



Governmental Support for Entrepreneurship in Spain: An Institutional Approach*

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Abstract

Institutions have acted as rules of the game influencing entrepreneurship. However, little is known about their complementary function as knowledge generators. Drawing on institutional economics, this paper explores the role of regional governments and universities in creating public support and knowledge conducive to entrepreneurship in Spain. Unbalanced panel data models are applied to 281 observations taken from GEM; Ministry of Economics, Industry, and Competitiveness; and INE in the 2004-2018 period. Findings suggest that formal institutions as R&D expenditure and staff in the public sector and universities positively predict entrepreneurship. In light of these results, theory and policies are discussed.

Keywords: Entrepreneurship, Formal institutions, Governmental policies, Public sector, Universities.

JEL Classification: J68, L26, O3, P48.

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1. Introduction

The importance of entrepreneurship for economic growth is undeniable (Acs *et al.*, 2012; Baumol and Strom, 2007; Urbano *et al.*, 2019), given its effects on the labor market, competitiveness, industry development, and social problems (Bruton *et al.*, 2021). As a result, governments have paid increasing attention to ways in which regional and national economies can become more entrepreneurial (Economidou *et al.*, 2018). However, such decisions have created debates regarding the role of governments in the entrepreneurial process and what types of entrepreneurial activities should be incentivized.

Arshed *et al.* (2014) and Shane (2009) advocate for entrepreneurial activities with innovation or technological components, as other motives (e. g., necessity reasons) might adversely affect long-term employment. Instead, Welter *et al.* (2017) are in favor of incentivizing entrepreneurial diversity, yet tipping the balance in favor of one or the other requires action from governments and policymakers.

An accurate way to understand governments' decision-making process consists of analyzing institutional characteristics (North, 1990). Prior literature has shown that governments have "played the game" as regulators (Bjørnskov and Foss, 2016; Djankov *et al.*, 2002). Extant research has also identified that universities form the bridge between the public sector, industry, given their roles in research, teaching, and knowledge transfer (Etzkowitz, 2014). However, a recent stream of research has shown that governments can go beyond the rules, regulations, and intrinsic nature of universities by creating and spreading knowledge from the public sector itself (Audretsch and Link, 2019). Although little evidence exists for innovation (cf. Audretsch *et al.*, 2019; Link, 2021), less attention has been paid when it comes to entrepreneurship as a process of turning knowledge of the public domain into new ventures.

Conscious about this research gap, we explore the role of regional governments and universities in creating public support and knowledge conducive to entrepreneurship in Spain. We depart from the institutional economics framework (North, 1990, 2005) to dive into formal institutions, such as R&D expenditure, R&D staff, and researchers in public administration and universities. Although these elements are not rules or regulations per se, these belong to the institutional environment and depart from approved royal laws and decrees (Martinez and Bares, 2018). Our analysis uses Spain as a case study, which is a country with important regional differences not only in terms of economic activity (including innovation and entrepreneurship), but also in cultural aspects such as language (Acs *et al.*, 2015; Hintzmann, 2015). We explore a sample of 281 observations (in 17 autonomous communities and two autonomous cities) throughout a period ranging from 2004 to 2018. By employing unbalanced panel data, we find that two out of three variables of interest (i. e., R&D expenditure and R&D staff in public administration and universities) positively explain an increase in the level of entrepreneurship.

Our findings inform theoretical and policy discussions. On the one hand, our results reinforce the idea of viewing formal institutions not only as a regulatory framework but

also as a way to create knowledge. Consistent with Audretsch and Link (2019), who expand the knowledge spillover theory of entrepreneurship (Acs *et al.*, 2009) to the public sector, we add evidence about the importance of explicitly considering institutions within the analysis of knowledge generation. On the other hand, we also offer insights into the analysis of entrepreneurial universities (Wong *et al.*, 2007), in which direct and indirect expenditure in R&D of public administration become complementary mechanisms to expand the knowledge needed in the entrepreneurial process. Finally, we offer discussions about the importance of creating public research hubs and science parks that not only incentivize innovation and entrepreneurship, but also coordinate initiatives and efforts from public and private entities.

After this brief introduction, Section 2 presents the main theoretical foundations. Section 3 explains the methodology, in which the data collection and the econometric approach are described. Section 4 is devoted to analyzing the results in light of theory and suggested hypotheses. Finally, Section 5 discusses the main contributions and future research lines.

2. Theoretical framework and hypotheses

When it comes to the analysis of the role the public sector plays in different activities, institutional economics may provide important insights into different decisions governments make to affect the economy and society. North (1990, 2005) suggests that main regulations and laws are derived from short-term decisions local and national governments approve. Drawing on this theory, it is expected that “the rules of game” intervene in markets to guarantee proper functioning (North, 2005). Although these rules of the game are derived from constant interrelations between formal (e.g., regulations, norms, constitution, etc.) and informal institutions (e.g., culture, habits, codes, etc.), the exploration of governments as agents playing in the market requires a deep focus on the former rather than the latter (Williamson, 2000). In this regard, formal institutions become the main ground upon which we build our analysis of public support (through investment and knowledge generation) affecting entrepreneurship.

Indeed, entrepreneurship has gained a lot of insights from the institutional economics framework, as the analysis of the environment surrounding entrepreneurs has created additional perspectives useful for the policy debate about entrepreneurship and innovation (Bruton *et al.*, 2010; Welter, 2011). Bjørnskov and Foss (2016) and Urbano *et al.* (2019) have shown that this framework has served to create a strong connection between entrepreneurship and economic growth. Given the importance of entrepreneurship for the development of markets and industries (Huggins and Thompson, 2015), policymakers have paid more attention to different strategies that incentive both the quantity and quality of entrepreneurship (Arshed *et al.*, 2014; Shane, 2009). In line with the seminal work by Baumol (1990), incentives are the key to motivate people to identify opportunities and turn them into productive entrepreneurial projects. Although governments could be assumed as regulators affecting firm entry (Djankov *et al.*, 2002; van Stel *et al.*, 2007), this paper goes beyond the traditional vision and subscribes to the emerging trend, in which the public sector can become an entrepreneurial

agent (Audretsch and Link, 2019; Demircioglu and Chowdhury, 2021; Link, 2021), whose main activity consists of investing in knowledge.

In the spirit of Audretsch and Link (2019) and Link (2021), we are interested in understanding how direct and indirect public expenditure in R&D and knowledge as formal institutions urge entrepreneurship in Spain. Martínez and Bares (2018) explain that the Spanish public sector plays a big role in supporting innovation and entrepreneurship through public organizations and universities, which are mostly state-owned. Whilst amalgamating the public sector and universities into one variable requires an assumption, especially given private universities' sparsity, Liñán *et al.* (2013) clarify that state-owned organizations and universities follow same rules, as all of them derive from royal decrees. In fact, in the UK, the public sector (including universities) is allowed to receive private funding, whereas this is not possible in Spain. Hence, the source of funding may define a particular context with important limitations for entrepreneurial intentions and actions (Liñán *et al.*, 2013).

Two approaches can help us understand the mechanisms behind the relationship between public support, knowledge, and entrepreneurship. For the first approach, there is a vast literature about the importance of direct transfer to incentive innovative and entrepreneurial behavior within organizations (Link and van Hasselt, 2020; Urbano *et al.*, 2020). Exploring this idea in the public sector might deviate the attention from the institutional perspective as direct transfer or investment can be also seen as resources. Although this is true, Williamson (2000) explains that government resources respond to a public administration structure, which is part of formal institutions. Rules are defined to plan the next public investments, which can involve expenditure in R&D (Kourouklis, 2021). Grimaldi and Fernandez (2017) explain that the connection between universities and industry also depends on those investments public universities receive to move innovative projects forward. The existence of this public resource helps the creation of projects within the public sector and universities that seek to solve social problems and challenges (Hayter and Link, 2020). However, the result of funded projects does not reach markets immediately. Huggins and Thompson (2015) suggest entrepreneurs serve as intermediaries to connect innovations with markets and ultimately economic growth. In this regard, Urbano *et al.* (2017) have provided evidence on how public universities have invested in different activities and curricula oriented toward the development of entrepreneurial skills. As a result, more student employer entrepreneurs were found in Spain. On this basis, we suggest the following hypothesis.

Hypothesis 1: The R&D expenditure in public administration and universities has a positive effect on the entrepreneurship rates in Spain.

As mentioned, direct investment in R&D activities becomes a potential mechanism that explains the relationship between the public sector and entrepreneurship. However, and related to the second approach, knowledge transfer (as an indirect investment) may also offer a connection between local governments, universities, and entrepreneurs (Audretsch and Link, 2019). Analyses of entrepreneurial universities are conclusive regarding the role higher education plays in encouraging entrepreneurship and the development of an entrepreneur-

ial culture (Pinheiro and Stensaker, 2014). Kirby (2006) has discussed the importance of developing certain capabilities within universities. Strategies such as academic seminars, workshops with venture capitalists and reputable entrepreneurs, and the creation of institutes and research centers, are useful to develop an innovative and entrepreneurial mindset within universities. This requires important endeavors in collecting funds to support these activities, and especially to increase and maintain a solid group of people involved in R&D activities (Link and Wright, 2015). This is similar in the public sector, although less research exists as compared to literature about entrepreneurial universities (Link, 2021). Key activities from local governments may consist of creating public organizations which are fully orchestrated by the public sector, and which are devoted to the development of products, services, and processes that offer solutions for the communities of which they are a part (Del Rey and López-García, 2020). Morisson (2019) explored a public organization in Colombia that is completely focused on innovation. This underlined the importance of investing in human capital as the main core of this organization. Similarly, Civera *et al.* (2021) show that the knowledge created due to indirect investment in R&D incentivizes people in Spain to become entrepreneurs with high growth potential. Thus, we posit that:

Hypothesis 2: The number of public administration and university staff involved in R&D exerts a positive influence on entrepreneurship rates in Spain.

In line with the previous hypothesis, there is also a complimentary activity that staff involved in knowledge generation constantly develops. While R&D activities entail the development of prototypes, these should be supported by theoretical analyses and advances. Thus, researchers devoted to exploring new theories, extant literature, and results in other regions or countries become crucial to the creation of solid teams. Similar to R&D staff, researchers also create connections with industry and society through products such as academic articles, patents, among others (Olcay and Bulu, 2017; Wong *et al.*, 2007). This is apparent when observing universities, as research is part of their main activities (Etzkowitz, 2017). Nonetheless, evidence of this idea when observing public organizations remains scarce. Link and Scott (2020) provide evidence about the importance of having researchers in federal research laboratories, who create academic publications. These documents have two main functions. First, knowledge is disseminated to the rest of the academic community that builds prototypes or other innovative products upon that evidence. Second, academic publications derived from research activities become the return to public-sector R&D (Link and Scott, 2020). Audretsch *et al.* (2019) also provide evidence about the role of innovation research centers in increasing a research team that produces academic articles. The key aspect here is the creation of knowledge that can be absorbed by entrepreneurs. Although the idea of knowledge spillover was focused on private companies (Acs *et al.*, 2009), Audretsch and Link (2019) expanded the analysis to the knowledge spillover theory of entrepreneurship in the public sector. In this regard, the origin of ideas that are transformed into products entrepreneurs commercialize comes from what researchers in public organizations such as research centers and universities perform. Therefore, a third hypothesis is suggested below.

Hypothesis 3: The number of researchers in public administration and universities exerts a positive influence on entrepreneurship rates in Spain.

3. Methodology

To assess our hypotheses, we have combined information from Global Entrepreneurship Monitor (GEM), Ministry of Economics, Industry, and Competitiveness, and INE (Instituto Nacional de Estadística). The GEM project is a complete dataset devoted to the exploration of entrepreneurship worldwide, its antecedents, and consequences (Bosma, 2013). Including more than 100 countries (both developed and developing), this dataset allows cross-national comparisons on the level of national entrepreneurship rates, as well as estimations of the role entrepreneurship plays in national economic growth. According to Acs *et al.* (2008), studies derived from GEM information have served to formulate and evaluate different public policies supporting innovation and entrepreneurship.

The existence of GEM national teams has enabled the collection of subnational data for some countries. This is the case for Spain, which includes 26 teams covering all autonomous communities and cities (Peña-Legazkue *et al.*, 2020). Since we have focused on a Spanish case, complementary data come from official sources such as the Ministry of Economics, Industry, and Competitiveness, as well as INE, which provide details about the economy, population, and public sector across the 17 autonomous communities and two autonomous cities (Ceuta and Melilla) over the last 20 years. Hence, our sample comprises 281 observations for the 2004–2018 period. It is worth clarifying that although Ceuta and Melilla do not have their own university, the Universidad de Granada has presence there with the two campuses. In addition, the available dataset enables us to distinguish information about these cities and the rest of the communities alike.

3.1. Dependent variable

In this article, total early-stage entrepreneurial activity (TEA) is utilized as the dependent variable in different models. According to Bosma (2013), TEA is the best-known indicator of the GEM project, and is defined as the percentage of the adult population engaged in the process of setting up a new business or owning an established young business (up to 42 months). This variable also captures the motivational drivers of individuals engaging in entrepreneurship. In this regard, TEA considers both those driven by opportunity recognition and those who are pulled into entrepreneurial activities due to necessity. This variable has been extensively used in prior research analyzing institutions as antecedents of entrepreneurship and economic development (Amorós *et al.*, 2020; Aparicio *et al.*, 2016; Bosma *et al.*, 2018).

3.2. Independent variables

To capture the participation of the public sector in innovation and entrepreneurship, we have used three variables common in analyses of innovation and technological change (Urbano *et al.*, 2020; Pinto *et al.*, 2019). First, innovation has been approached through R&D expenditure. In this case, we have captured the investment value (in thousands of constant

Euros) that both public administration and universities have spent across autonomous communities and cities over the chosen period of analysis. Researchers, such as Burke *et al.* (2021), Link (2021), and Ruiqi *et al.* (2017), have also used this variable to observe policies and strategies related to innovation. In this regard, we have covered the tangible investment that is related to the direct expenditure.

Second, we have captured the role of governments and universities making indirect investments in R&D through staff involved in these activities within public administrations and universities. Thus, the variable counts the number of employees focused on R&D in the public sector of autonomous communities. This variable has drawn attention from scholars interested in analyzing human capital aspects of innovation and entrepreneurship (cf. Acs *et al.*, 2009; Löffsten and Lindelöf, 2005).

Third, we have also considered those involved in R&D working as researchers. In this case, we account for the number of employees with this category in public administration and universities. In this case, we also observe a human capital aspect of innovation, which has become a policy indirectly supporting innovative activities related to knowledge. Other authors have also captured this component as a proxy of innovation in countries and regions (e.g., Audretsch *et al.*, 2019; Link and Scott, 2020). All these variables are taken from the Ministry of Economics, Industry, and Competitiveness, particularly from the Spanish system of science, technology, and innovation indicators.

Table 1
DESCRIPTION OF VARIABLES

Variables	Description	Source
<i>Dependent variable</i>		
TEA	Total early-stage entrepreneurial activity. Percentage of adults aged 18-64 setting up a business or owning–managing a young firm (up to 3.5 years old)	GEM 2004-2018
<i>Independent variables (Governmental support)</i>		
R&D expenditure in Public Administration and Universities	The total expenditure of R&D by public administration and universities in autonomous community (in thousands of constant Euros)	Ministry of Economics, Industry and Competitiveness 2004-2018
R&D staff in Public Administration and Universities	Number of staff involved in R&D in public administration and universities by autonomous community	Ministry of Economics, Industry and Competitiveness 2004-2018
Researchers in Public Administration and Universities	Number of researchers in public administration and universities by autonomous community	Ministry of Economics, Industry and Competitiveness 2004-2018

(Continued)

Variables	Description	Source
<i>Control variables</i>		
Education	Percentage of population with tertiary education by the autonomous community.	INE 2004-2018
Firms	Number of firms within the autonomous community	INE 2004-2018
Unemployment rate	Unemployment rate by autonomous community	INE 2004-2018
GDP per capita	The total value of the gross domestic product (GDP) per capita. Data in 2010 constant euros.	INE 2004-2018
Population	Number of inhabitants by autonomous community	INE 2004-2018

3.3. Control variables

Although the main focus is on understanding entrepreneurship from pro-innovation government initiatives, other factors may also influence entrepreneurship. Extant works have shown the importance of considering socioeconomic factors in determining the differences in entrepreneurial activity across regions and countries (Arenius and Minniti, 2005; González-Pernía and Peña-Legazkue, 2015). Direct and indirect investments made by local governments and universities differ systematically between developed and lagged regions (Caldera and Debande, 2010). Thus, the influence of those initiatives related to R&D and knowledge on entrepreneurship must be analyzed within the framework of the level of development. For this reason, we account for education as the percentage of those individuals with a university degree in autonomous communities. In terms of market competition, we have included the number of firms that exist in autonomous communities. Concerning socio-economic characteristics, we have included the unemployment rate, number of inhabitants (i. e. population), and the level of GDP per capita in Spanish autonomous communities. Thanks to socio-economic characteristics, we are able to control for those regions with high levels of R&D expenditure and staff, which are at the same time high in GDP. These variables are taken from INE. In Table 1, the variables used in this research are described.

3.4. Models

The effects of policy support on entrepreneurship are analyzed at the regional level, using Ordinary Least Squares (OLS) in unbalanced panel data regression for the period ranging from 2004 through 2018. For this purpose, the following model is estimated:

$$TEA_{it} = \alpha + \beta_1 PS_{it} + \beta_2 CV_{it} + \mu_i \quad (1)$$

where TEA_{it} is the vector containing the entrepreneurship variable; PS_{it} is the vector expressing the policy support measured through the expenditure in R&D, staff involved in R&D, and researchers in local public administration and universities; CV_{it} is the vector of control variables that represents the socioeconomic factors related to education, incumbent firms, unemployment, GDP per capita, and population of the region (autonomous community) i in time t ; and μ_i is the error term.

Given the availability of data from 2004 to 2018, we estimated random- and fixed-effects models and we used the Hausman specification test to verify the choice of the fixed- or random-effects model. The test suggested the use of the fixed-effects specification for TEA ($X^2(3) = 42.84$, $\text{Prob} > X^2 = 0.000$), which rejects the null hypothesis that the difference in coefficients is not systematic. This result is consistent with Beenstock and Felsenstein (2007) and Nerlove and Balestra (1996), who suggest that given the existing regional differences within countries, fixed effects are more accurate than random effects. In addition, as heteroskedasticity is a potential issue, we estimate linear regressions with robust variance estimates, which are based on a variable list of equation-level scores and a covariance matrix. Similar to Acs *et al.* (2012), Aparicio *et al.* (2018), Bosma *et al.* (2018), we use the natural logarithm in both sides of Equation 1 to linearize the function. This log-log approach enables a direct interpretation of coefficients in terms of the percentage change in the independent variable implying a change in the dependent variable expressed in the respective coefficient (Wooldridge, 2012). Additionally, by using log-log models we can account for different formats of variables, especially because our independent variables are expressed in absolute terms, whereas some controls are available in relative terms.

4. Results

Table 2 provides the means, standard deviations, and pairwise correlation coefficients for all the variables we assessed in Equation 1. On the one hand, it is possible to observe that the average level of entrepreneurial across Spanish autonomous communities is 5.59%, which is consistent with the GEM 2017-2018 national report (Peña-Legazkue *et al.*, 2018). On the other hand, the correlation matrix shows potential associations between the three variables used to capture policy support and entrepreneurship, which meet our expectations. However, Table 2 also shows a high correlation between the three independent variables. Hence, we need to disregard potential collinearity issues. A diagnostic test of multicollinearity was conducted through the variance inflation factors (VIFs) of all variables in the analyses for each model. After computing the test, we have found that variables are not problematic, since the obtained VIF was 3.07, a value substantially below 10, which is a suggested threshold (Hsieh *et al.*, 2003).

In Table 3, the results of the OLS regression with robust variance estimates are shown. Following Aparicio *et al.* (2021a), Carree and Thurik (2008), and Carree *et al.* (2002, 2007), we have accounted for business cycle effects such as crisis (González-Pernía *et al.*, 2018)

by including time fixed effects. Thus, models 1-3 replicate the correlation approach between the three independent variables (R&D expenditure, staff involved in R&D, and researchers). Model 4 only considers control variables, as these account for unobservable characteristics. Models 5-7 bring together both independent and control variables, which allow us to test the suggested hypotheses in the presence of other factors included in the error term, as well as the potential time variations stemming from external shocks. Thanks to this approach, we can show the importance of each variable for entrepreneurship individually, which may be informative for policymakers given the budget constraints, and hence potential opportunity costs of investing in either R&D activities, staff in R&D or researchers. All the models are highly significant ($p < 0.001$), which means that the explanatory variables jointly explain the variance of entrepreneurship rates.

Table 2
DESCRIPTIVE STATISTICS AND CORRELATION MATRIX

Variable	Mean	Std. Dev.	Min.	Max.	1	2
1 TEA	5.597	3.995	1.300	64.000	1	
2 R&D expenditure in Public Administration and Universities	361184.800	442282.000	1136.500	1754902.000	0.075	1
3 R&D staff in Public Administration and Universities	6926.922	7996.304	16.500	31259.000	0.088	0.990
4 Researchers in Public Administration and Universities	4845.412	5261.506	16.500	19916.000	0.093	0.983
5 Education	31.230	7.107	18.000	49.700	-0.049	0.325
6 Firms	171999.700	174904.900	3590.000	626020.000	0.132	0.945
7 Unemployment rate	16.753	7.611	4.280	37.170	-0.143	0.117
8 GDP per capita	22253.270	4494.029	13159.540	35040.580	0.045	0.405
9 Population	2446.264	2401.790	64.700	8406.400	0.127	0.905
Variable	3	4	5	6	7	8
3 R&D staff in Public Administration and Universities	1					
4 Researchers in Public Administration and Universities	0.997	1				
5 Education	0.318	0.324	1			
6 Firms	0.952	0.955	0.180	1		
7 Unemployment rate	0.092	0.066	-0.276	0.009	1	
8 GDP per capita	0.400	0.413	0.781	0.275	-0.478	1
9 Population	0.909	0.909	0.123	0.983	0.079	0.166

Note: Values in bold mean significant correlations at $p < 0.01$.

Table 3
ESTIMATING ENTREPRENEURSHIP THROUGH PUBLIC SUPPORT

Equation 1	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Ln TEA	Ln TEA	Ln TEA	Ln TEA	Ln TEA	Ln TEA	Ln TEA
<i>Independent variables (Governmental support)</i>							
Ln R&D expenditure in Public Administration and Universities	0.054*** (0.016)				0.159** (0.068)		
Ln R&D staff in Public Administration and Universities		0.052*** (0.016)				0.093* (0.049)	
Ln Researchers in Public Administration and Universities			0.055*** (0.017)				0.065 (0.047)
<i>Control variables</i>							
Ln Education				-1.036*** (0.230)	-1.196*** (0.246)	-1.124*** (0.249)	-1.087*** (0.248)
Ln number of firms				-0.416 (0.285)	-0.651** (0.330)	-0.734** (0.339)	-0.690** (0.337)
Ln unemployment rate				-0.283* (0.146)	-0.192 (0.136)	-0.148 (0.135)	-0.156 (0.133)
Ln GDP per capita				0.700*** (0.214)	0.848*** (0.252)	0.942*** (0.257)	0.910*** (0.257)
Ln population				0.549* (0.306)	0.593 (0.364)	0.752** (0.349)	0.745** (0.344)
Constant	1.015*** (0.203)	1.236*** (0.139)	1.234*** (0.141)	-0.219 (1.757)	-0.844 (1.785)	-1.224 (1.839)	-1.230 (1.874)
R ²	0.032	0.033	0.033	0.407	0.420	0.420	0.417
Observations	220	219	219	260	220	219	219
Year fixed-effects	No	No	No	Yes	Yes	Yes	Yes
AIC	188,632	188,496	188,508	127,545	109,986	110,571	111,628
BIC	195,418	195,274	195,286	191,637	174,465	174,964	176,020

* p<0.1, ** p<0.05, *** p<0.01.

Regarding the hypothesis testing, we have suggested in hypothesis 1 that the R&D expenditure in public administration and universities has a positive effect on entrepreneurship rates in Spain. Effectively, we found a positive effect of R&D expenditure on the total early-stage entrepreneurial activity in our sample ($\beta_1=0.159$, $p<0.05$). Hence, we follow the statement presented by Huggins and Thompson (2015), which defines a positive relationship between innovation and entrepreneurship. However, we utilized a different variable to understand budgeting aspects of public administration and universities, such as a homogenous measure in all Spanish autonomous communities and cities, which is consistent with extant

literature (Audretsch and Link, 2019; Link, 2021; Ziesemer, 2021). This result could indicate that public efforts in investing in R&D are important to engage more people in entrepreneurship (Amorós *et al.*, 2019b). In fact, for each region in our sample, if the investment in R&D increases by 1% through time, the TEA increases by 0.159%, *ceteris paribus*.

Hypothesis 2 posited that the number of public administration and university staff involved in R&D exerts a positive influence on entrepreneurship rates in Spain. Here, those employees analyzed in relation to R&D activities have a significant influence on entrepreneurship ($\beta_1=0.093$, $p<0.1$). This result could mean that human capital factors related to innovation are accurate to explain the relationship between the staff of the public sector involved in R&D and TEA. Also, it is possible to assume that the election of an entrepreneurial career could be a step forward for those who have worked in innovation activities and wanted to commercialize new products and services. In this sense, our results are consistent with Urbano *et al.* (2020), who found a significant relationship between R&D staff and firm growth. In our case, for each autonomous community in Spain between 2004 and 2018, a 1% increase in R&D staff in local public administration and universities leads to an increase of 0.093% in TEA across time, *ceteris paribus*.

Similar to hypothesis 2, the third hypothesis suggested that the number of researchers in public administration and universities exerts a positive influence on entrepreneurship in Spain. Although the direction of this relationship was expected, results do not show a statistically significant association ($\beta_1=0.065$, $p>0.1$). As mentioned, the number of researchers embraces different characteristics related to knowledge in each region in terms of the innovation process. According to Urbano *et al.* (2020), this type of intrapreneurial activity influenced by human capital tends to impact positively on firm growth. In contrast, our results suggest that for each region in our sample, if researchers in public administration and universities increased by 1% through time, the TEA might not increase as expected, *ceteris paribus*. However, the results from model 3 (Table 3) still suggest that both public support schemes observed through the number of researchers and entrepreneurship are positively correlated. While we must reject the hypothesis, extant evidence emphasizes the importance of encouraging entrepreneurial universities via academic staff encompassing researchers, lecturers, and practitioners (Wong *et al.*, 2007). According to Pinheiro and Stensaker (2014) and Etzkowitz (2017), it is likely that universities equipped with this qualified human capital create innovative products, such as patents that need entrepreneurship as a vehicle bridging universities, industry, and society.

Finally, the analysis of control variables suggests that regions with a large portion of highly educated people may incentivize individuals to look for a job, so as to avoid the risks associated with entrepreneurship. This is consistent with Berril *et al.* (2020) and van Stel and van der Zwan (2020). Furthermore, overcrowded markets (i. e. highly populated regions and many incumbent firms) bring opportunities in terms of available niches, which can become potential customers with purchase capacity (i. e. high GDP per capita). This is consistent with the existing literature (Carree *et al.*, 2002, 2008; Gries and Naudé, 2010; Hessels *et al.*, 2008; Wennekens *et al.*, 2005, among others). However, these markets can also impose barriers for new entrepreneurs. Hence, tough competition may bring extra costs that entrepreneurs might

not be willing to accept (Bailey and Thomas, 2017). This is revealed through the negative and statistically significance of the number of firms and education on TEA.

5. Discussion and conclusions

In this paper, we explored the role of local governments and universities in creating public support and knowledge conducive to entrepreneurship in Spain. Institutional economics (North, 1990) set the basis to analyze a sample of 281 observations during the 2004-2018 period. By employing unbalanced panel data models, we found that public support has positively affected entrepreneurship via R&D expenditure and staff involved in R&D activities, which are institutional resources coming from public administration and universities.

Our results are consistent with literature exploring the effects of R&D investment in innovation and entrepreneurship (Amorós *et al.*, 2019b; Pinto *et al.*, 2020; Urbano *et al.*, 2020), which is different from region to region or country to country (Blanco *et al.*, 2020; Ziesemer, 2021). These findings also bring evidence to the debate about the chicken-and-egg problem between innovation and entrepreneurship (Huggins and Thompson, 2015). Accordingly, entrepreneurship becomes the vehicle that transfers innovation efforts and initiatives to the market and ultimately, society. Although we do not assess economic growth models, we show that higher R&D investments are not only translated into more innovation, but also into greater entrepreneurship. In our case, we found that regional governments and universities investing in R&D play a role as entrepreneurs in the public sector, going beyond the traditional view of regulators (Djankov *et al.*, 2002).

Complementary to investments, indirect expenditure in R&D through specialized staff performing innovation activities also encourages entrepreneurship. This is consistent with the idea of knowledge spillover (Acs *et al.*, 2009), in which the remaining knowledge across firms in a particular region is turned into entrepreneurial projects that become new ventures with new products and services. Audretsch and Link (2019) brought this idea to the analysis of the public sector as an additional source of knowledge spillover. Drawing on this seminal work, Link (2021) and Link and Scott (2021) explored particular products such as patents and academic publications as antecedents of creativity and knowledge diffusion, which are elements needed for entrepreneurship. We add evidence to the literature by showing the importance of increasing and maintaining personnel involved in R&D, who can enter entrepreneurship and incentive the development of products and services that can be commercialized in the near future by entrepreneurs. Hence, this evidence may expand the theoretical and public policy perspectives, which consider the role of (local) governments in the entrepreneurship process.

5.1. Contributions to theory

Given the theoretical foundation of our research, our findings might be useful to further comprehend the effect of institutions on entrepreneurial activity. The main conceptual structure adopted in entrepreneurship research was focused on the literal role of “rules of

the game” (North, 1990), which differ across countries explaining the main differences in productive activities (North, 2005).

Welter (2011) suggests that the context comprises historical, temporal, institutional, spatial, and social elements. An important question may be raised when considering regional governments as entrepreneurial entities. Who does the public sector interact with society to implement formal institutions in favor of entrepreneurship? Traditional literature has found that reducing taxes and regulations can be beneficial for entrepreneurs and SMEs (Aparicio *et al.*, 2016; Belitski *et al.*, 2016; van Stel *et al.*, 2007). However, a recent stream of entrepreneurship is advancing our understanding of the quality of both institutions and entrepreneurship (Webb *et al.*, 2020). This quality might imply more active participation of regional governments, not only through public policies but also through investments in innovation and research centers. These, alongside universities, can better manage public resources to support influential projects that support the development of industries and places (Audretsch and Lehmann, 2017).

Perceiving regional governments as entrepreneurs can add a fresh perspective to the knowledge spillover theory of entrepreneurship (Acs *et al.*, 2009). The key question here is, who creates knowledge in these places and over what period of time? Firms are essential to creating a process based on R&D (Blanco *et al.*, 2020). However, public administration can move beyond expenditures budgeted for public procurement, for example (Uyarra *et al.*, 2020). Although public universities act as a mechanism through which governments incentive the creation of knowledge, we show that regional governments can also actively create knowledge useful for innovation and entrepreneurship (see, for example, Morisson, 2019). Although returns to this social investment might be acknowledged in the long run, the public characteristic of this knowledge can benefit everyone within the region. Thus, the knowledge spillover theory of the public sector might advance by landing tangible mechanisms such as R&D expenditure and staff to real challenges that encourage entrepreneurs to use existing knowledge and bring alternative solutions.

5.2. Contributions to the policy debate

The knowledge derived from governmental activities (excluding, at the moment, universities) can emerge from endeavors in creating research centers and laboratories (Link, 2021). Direct and indirect investment in R&D implies the maintenance of facilities, constant budget for expenses, material, etc., and specialized staff. At the same time, these efforts entail the orchestration of other actors’ initiatives that lead to public-private cooperation.

Morisson (2019) shows how a public research hub in Colombia can coordinate intentions and actions that produce innovative solutions for the social challenges the country has. Xie *et al.* (2018) also provide evidence about the role of public science parks in regional development. The main result in the Xie *et al.* (2018) study is the creation of a zone that attracts talent able to improve synergies in favor of the society. Hence, regional governments in Spain can become the seed of complex socialization processes that lead to higher knowledge and opportunities for potential entrepreneurs.

With regard to entrepreneurial universities, these are the natural mechanisms that create knowledge with a public budget. However, the idea of injecting constant investment to increase R&D activities and entrepreneurship not only result in more start-ups but also a population equipped with entrepreneurial culture (Pinheiro and Stensaker, 2014) and entrepreneurial potential (Aparicio *et al.*, 2021b). Public policies incentivizing academic production (e. g. patents, papers, etc.) may accelerate the creation of knowledge and, most importantly, the diffusion of new knowledge to students, who may become entrepreneurs or policymakers in the near future.

5.3. Limitations and future research

Despite the insights our research brings to theory, literature, and policy, we are aware of some limitations. Our analysis assumes that the information of universities in the main variables (R&D expenditure, R&D staff, and researchers) belong to public universities. Although the higher education system in Spain is mainly characterized by public universities, important private universities (particularly business schools) also exist. Future research might dive deeper into these indicators to disaggregate public and private universities. Also, additional works can include controls such as the number of public and private universities by the autonomous communities and cities. This can shed additional light on the role of universities as part of the public sector in encouraging entrepreneurship.

However, we have taken support from institutional economics, particularly formal institutions. Future research might embed the analysis of regional governments in entrepreneurial ecosystems (Content *et al.*, 2020). This can serve to underline governmental actions as an entrepreneurial entity that emerges and contributes (through knowledge) to the formation of high-added value new ventures, that spur regional and national economic development. As per Williamson (2000), multiple interactions between formal institutions might emerge, which brings other opportunities for additional research. For example, a combination of large R&D expenditure with relatively small staff could be useful for entrepreneurship as well.

Finally, we have relied on the total early-stage entrepreneurship activity from GEM as the main variable. However, a debate exists regarding the use of this proxy, especially because it might be too general to capture certain preferences behind the decision of entering entrepreneurship. In this regard, Amorós *et al.* (2019a) and Dencker *et al.* (2019) have argued in favor of further research about opportunity- and necessity-driven entrepreneurship. Although Spain has relatively low entry rates (Cabrer-Borrás and Belda, 2018), important differences exist across regions. Hence, future research might explore whether these differences originate from the public budget of lagged regions as compared to their developed counterparts.

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Resumen

Las instituciones suelen actuar como reglas de juego que influyen en el emprendimiento. Sin embargo, poco se sabe sobre su función complementaria como generadoras de conocimiento. Utilizando la teoría económica institucional, este artículo explora el rol de los gobiernos regionales en la creación de conocimiento y el apoyo gubernamental, los cuales conducen el emprendimiento en España. A partir de modelos de panel de datos no balanceados de 281 observaciones (período 2004-2018), los resultados

más relevantes sugieren que las instituciones formales tales como gasto en I+D y personal en universidades y sector público predicen positivamente el emprendimiento. El trabajo discute también las implicaciones teóricas y de política pública.

Palabras clave: emprendimiento, instituciones formales, políticas gubernamentales, sector público, universidades, España.

Clasificación JEL: J68, L26, O3, P48.