Industrial Cooperation, Knowledge Sources and the Role of Public Sector in Manufacturing Firms: Case of Spain and Portugal

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Abstract

Public Funding for firms has been argued as a catalyst for firms' cooperative and knowledge generative activities in contemporary knowledge-based economies. As innovation potential is widely poised as regional competitive ability, firms' cooperation with partners have been revered as a preliminary activity to establishing networks whilst sharing diverse knowledge from partners involved to initiate or even mediate innovation. Using data from Community Innovation Survey (2012-2014) and SEM analysis on Spanish and Portuguese manufacturing firms, the paper assesses the relevance of public funds on cooperation tendencies of firms, knowledge sourcing from partners and eventually, the moderator role played by cooperation in appropriating public funds for knowledge acquisition. It was found that public funding significantly influences cooperation in Spain than in Portugal whilst cooperation was much more influential in sourcing for knowledge from partners in Portugal than in Spain. Results also revealed a slightly higher moderator ability of cooperation in Spain than in Portugal. Country-specific recommendations were further created.

Keywords: Public funds, Cooperation, Knowledge, Spain, Portugal.

JEL classification: O32, O38, O52

1 Introduction

The early 20th century witnessed the strong adoption of public support and interference in private economic activities of macro and micro regions. Emergence of the new growth theory also further entrenched government's interest in supporting and actively engaging in regional growth efforts by actively supporting firms via subsidies and grants. Adoption of the open innovation model not only limited firms to the assistance of governments but also incited an interactive and knowledge sharing collaborations which opened up firms up to new margins of innovation now strongly endorsed as a model for contemporary regional growth.

Literature on cooperation of firms with universities and research centers have been endorsed by most researchers [3], clients [14], [19], and suppliers [2],[12] and have proven to be viable partners for knowledge generation and acquisition. In Spain, cooperation measures has been realized by entrepreneurs as having one of the lowest cooperation intensity in the Union, decreasing rapidly from 2012 forward whilst Portugal, from the viewpoint of Universities and businesses was adjudged to have a weak cooperation as well [28].

Majority of research have also endorsed the overwhelming relevance of cooperation by firms [7],[33],[30] knowledge sourced for innovatory needs [7],[29],[33]. Despite the contrary propositions that public funds are mere interferences in the economy and stifles businesses by crowding out funds [1], the researcher believes that funds invested for research are equally beneficial as privately invested funds and supports the notion cooperation as both an antecedent and a transformer of resources invested for research collaboration and knowledge generated.

Owing to the new-found public support for innovation centric activities [4],[23], the below par cooperation levels in Southern European countries [28], the need for cooperation in creating intellectual capital for expediting regional knowledge growth and competitive advantage [22] and also the continuing contemporary public financial interest in supporting knowledge sharing, the research aims to assess the relevance of public funding on cooperation, on knowledge

acquired and the moderator role cooperation plays in transforming public funds into knowledge acquired by firms for innovation needs.

The first section of the paper will give an introductory review of the topic focused, the second part will discuss the literature on the concept of funding, cooperation and knowledge, the third part will explain the methodology used and the data sources, followed by analysis of the results and finally conclusion.

2 Literature Review

The New growth theory has incited international and national support for knowledge sharing and co-operative interactions with firms, academic institutions and industrial partners and even non- governmental organisations (NGO's). Owing to the regional value created and its innovation potential, supranational, national and local authorities in recent times, increasingly inject public funds into firms' operational and cooperative interactions with other firms, academic institutions, research institutes, suppliers etc. with the eventual objective of firm growth, innovation and subsequent regional development [22].

The circular triple helix model buttresses this adopted responsibility of the government as a financier via establishment of funding programs and subsidies to support industrial collaborative research with Universities, other firms and other relevant partners in the industrial and market sphere [13]. Such financial support expended to regional players is fundamentally oriented at inter-firm R&D collaborations, firms and academic collaboration as well as other external partners. Strategic alliances created by firms in lieu of this resource acquisition has its tenets on accessing new resources, acquiring access to new technology to innovate or to penetrate new and uncharted markets [25].

Spike in publicly funded collaborations in industries in recent times have been alluded to additional funds for innovation required within the industrial sphere owing to the adjudged inefficient use of the public funds invested for cooperative research among other partners in the industrial sphere [17]. Previous research also found that federal R&D stimulates total private R&D intensity [6] whilst, it had been thought that private R&D investment devoted to research falls as the firm receives more public R&D funds. It was however, argued to have been caused by crowding out but it was rebutted that such funds were only an aspect of the entire company budget [1] and hence could not be argued that federal funds significantly diminished expenditure of private firms.

Reliably, such funds expended are ridden on for cooperation by firms with other firms [24] and Universities. Research in the public sector have revealed the significance of public support on the tendency of companies undertaking R&D cooperation with public research organisations all of which are aimed at eliminating market failures, [22]. Despite the wide acclaim that public funds supports firm research, some authors denounce the relevance of public funds to research and development activities of firms as it is believed to be strongly dictated by firms internally generate funds rather than public investment further entrenching the contrary [4] which could be chiefly aligned with perceived bureaucracy at the National and supranational level as well as implementation and transparency inefficiencies.

Cooperation with industrial partners incites sharing of knowledge from all participants effectively perpetrating the lasting effects of knowledge spill-overs from academic sector the industry and its partners. Regional growth in a knowledge-based economy, in contemporary times, have been hinged on the how easy knowledge is acquired, shared and used for innovatory purposes [2] to harness entrepreneurial opportunities and acquire greater recognition for leveraging. [23] undertook a case study research to assess how funding agencies assisted in generating knowledge that spans various disciplines. In their cases studied, they concluded funding needs to be flexible, to allow programmes the time and space to evolve and realise their full interdisciplinary potential. This funding also needs to include investment in liaison roles and less visible processes.

Czarnitzki et al. [9] applied a matching estimator in a multiple treatment setting, analyse the effects of R&D collaboration and public R&D funding on R&D per sales and patent acquired for Germany and Finland and found that collaboration has positive effects. [8] entrenched the connection between funds and knowledge of firms on a study of how sources of funds and diversity of knowledge affected firms' new product development. They found that internally generated funds emboldened the impact of R&D sources with more diversity of knowledge on the sale of new products, while external funds strengthened the effect of R&D sources with more control of knowledge on the sale of new products.

Literatures on strategy have also revealed that cooperation and knowledge acquired from external agents are relevant resources of the firm in the current competitive environment, especially for innovatory reasons [11]. As it has been touted as "open innovation model", firms have been encouraged to establish networks and relationships with other agents of the innovation system such as customers, research institutes, Universities and others to complement their resources and internal capacities with outside ideas [21], [10].

Sánchez-González et al. [27] assessed cooperation with customers and how it affected firms' innovation tendencies. Using knowledge generated to represent innovation, they found that firms cooperating with customers induced firm to increase investments oriented towards expanding the technological knowledge base within the firm's technological domain effectively reducing their technological investments. Consequently, they found that this cooperation had directs effects on firms' economic returns engineered from the sales of new products new for the market endowing firms with continued competitive edge. This was concurred by [15], [32].

Based on the above discussed literature, which endorses both the relevance of public funding to cooperation of firms [17] even as there are some rejections [4], the author is of the notion that funding for industries does support and eases the expenditure set aside for innovation by firms even as cooperation is believed to generate knowledge for firms quest for a strong competitive advantage and innovation. On this note it is hypothesised that "Public funds invested are significant indicators for stimulating cooperation with industrial partners-competitors and suppliers"-H1.

Having known the theoretical support and rejection for public funds on cooperation and cooperation on knowledge [27], which has been represented as knowledge by some authors, some results of cooperation in research on knowledge have been held as quite uncertain [18]. The open innovation model equally stresses the significant effect of collaboration with other partners of the firm on the knowledge generated and innovation tendencies of firms [22] hence, second hypothesis [H2] is created such that "Firms' cooperation with other industrial partners-competitors and suppliers- is significant to knowledge acquired for innovation"-H2.

Upon the creation of the previous hypothesis, and the literature on impact of collaboration on knowledge sourcing [27], [18], essence of knowledge acquired], it is further hypothesised that "Public funding of firms significantly affects the sourcing of knowledge for innovatory needs"- H3 whilst "Cooperation as a variable is a significant moderator to knowledge sourced upon investment of public funds"-H4. The goal of the paper, however, is to reveal the essence of public influence on cooperation and knowledge sourcing and establish the moderator role played by co-operation in effectively utilising public funds for acquisition of knowledge by firms.

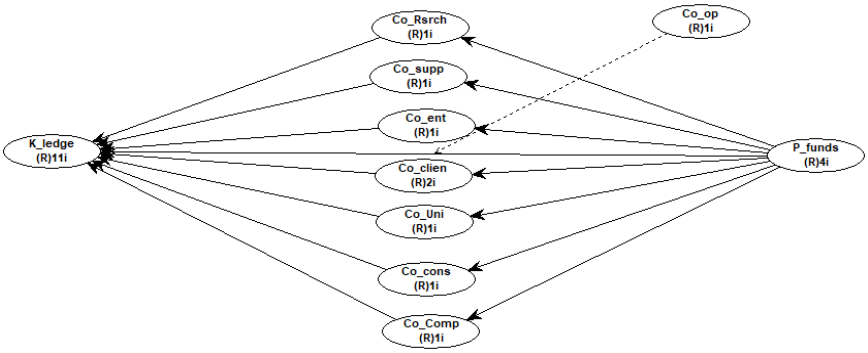
3 Data and Methodology

Data from Community Innovation Survey (2012-2014) was resorted to for this analysis. CIS data represents a survey designed to reveal information on the sectoral innovation activities by the enterprises involved, activities undertaken, the funding sources and the inherent location of such firms. This questionnaire was utilised for the purpose of the research as used by [30] and [11]. The data focused on 15,777 local, national and EU headquartered manufacturing firms in both Spain and Portugal with a real Gross Domestic Product per capita (PPP) of €24500 and €11,800 respectively as of 2017 as reported by the European Commission. Research and Development intensity has largely been shown to affect cooperation in contemporary times

These countries were selected because of their reported below-par cooperation intensity levels in with Universities and industries [28] and innovation performance in recent years despite their glowing potential reported by [30] and European Commission as of 2017. It is even imperative because of the strong need for cooperation and research and development intensity required in generating intellectual capital to expedite regional growth.

Despite the argued philosophical bias and supposedly weak external validity preached by critics, to reveal the moderator role, the study resorted to the use of Structural Equation Modelling (SEM) analysis to develop a model to analyse, test and confirm the above-stated hypothesis. This model was selected due to its assumptions of free distribution, its analytical capability of revealing moderating and mediatory roles and its compound of analytical tools that suited this analysis [20] as well as its capacity to general compute models in a multiple regression.

Figure 1: SEM structure for both Portugal and Spain



Source: Authors' own formation.

Table 1: Reliability and internal consistency tests [first part]

	P_Funds		Knowledge		Co_ent		Co_Supp		Co_Client		Co_Com	
	Spa	**Por**	**Spa**	**Por**	**Spa**	**Por**	**Spa**	**Por**	**Spa**	**Por**	**Spa**	**Por**
Composite Reliability	0.8	0.6	1	0.9	1	1	1	1	0.8	0.7	1	1
Cronbach alpha	0.6	0.2	0.9	0.9	1	1	1	1	0.5	0.4	1	1
Average Variance extracted [AVE]	0.5	0.3	0.6	0.4	1	1	1	1	0.7	0.6	1	1
Full Collinearity VIF	3.1	1.2	1.6	1.2	1	1	1.6	1	1.4	1.2	1.3	1.2

Source: Author's own.

Table 2: Reliability and internal consistency tests [second part]

	Co_Rsrch		Co_Uni		Co_op		Co_Cons		Co_op*P	
	Spa	**Por**	**Spa**	**Por**	**Spa**	**Por**	**Spa**	**Por**	**Spa**	**Por**
Composite Reliability	1	1	1	1	1	1	1	1	0.8	0.6
Cronbach alpha	1	1	1	1	1	1	1	1	0.6	0.2
Average variance extracted [AVE]	1	1	1	1	1	1	1	1	0.5	0.3
Full Collinearity VIF	1.9	1.3	1.6	1.2	2.8	1.2	1.5	1.2	3.1	1.2

Variables used: P_funds: Local, National, European Union funds and Funding from EU's 7th Framework Programme for RTD; Co_ent- Cooperation with other enterprises within enterprise group; Co_Supp- Cooperation with Suppliers of equipment; Co-Clie- Cooperation with clients or customers from the private sector and the public sector; Co_comp- Cooperation with competitors or other enterprises; Co_cons- Cooperation with consultants and commercial labs; Co_Uni- Cooperation with Universities; Co_Rsrch- Cooperation with Government, public or private research institutes; Co_op- Co-operation arrangements or innovation activities. Knowledge- knowledge sourced from within the enterprise or enterprise group, suppliers of equipment, materials, components, or software, clients or customers from the private sector, clients or customers from the public sector, competitors or other enterprises in your industry, consultants and commercial labs, universities or other higher education institutions, government, public or private research institutes, conferences, trade fairs, exhibitions, scientific journals and trade/technical publications, professional and industry associations. Spa- Spain, Port- Portugal.

4 Results and Analysis

To establish the fitness, reliability and the internal consistency of the model and the, validation analysis was carried out composing of discriminant validity, composite reliability and Cronbach alpha for the test of construct validity. To measure error and composite weights, the construct reliability uses the Cronbach's alpha coefficient for estimation. A Cronbach's alpha with the value of equal to or greater than 0.7 is acceptable [16]. Convergent validity, the extent to which the measurement items together explain the construct they represent in the structural model [16] is assessed with Average Variance Extracted (AVE) and composite reliability (CR) using a minimum loading of 0.50 and maximum of 0.70 respectively [16, 20]. The model however, satisfied all these conditions.

Table 3: Estimates and test of Hypothesis

	Hypothesis	**Beta (P-value)**		**Result**		**Hypothesis**	**Beta (P-value)**		**Result**
		Spain	**Portugal**				**Spain**	**Portugal**	
H1a	**P_funds–Co_Supp**	0.23 (0.0)***	0.04 (0.0)***	**Accepted**	H2a	**Co_Sup-Knowledge**	0.10 (0.0)***	0.42 (0.0)***	**Accepted**
H1b	**P_funds-Co_comp**	0.18 (0.0)***	0.05 (0.0)***	**Accepted**	H2b	**Co_comp-knowledge**	0.04 (0.0)***	0.09 (0.0)***	**Accepted**
H3	**P_funds-Knowledge**	0.33 (0.0)***	0.20 (0.0)***	**Accepted**	H4	**P_funds–Co_op-Knowledge**	0.07 (0.0)***	0.05 (0.0)***	**Accepted**

Source: Authors' calculation.
*Legend: * Significant at p<0.10, **Significant at p< 0.05, ***Significant at p> 0.01*

From table 3, it could be observed that in both Spain and Portugal, public funding is recognised as a significant influencer of cooperation among all partners of firms in the industry. However, it could be observed that the degree to which public funds affects firm's cooperation with industrial partners (both with suppliers and competitors) was higher in Spain than in Portugal. This implies that Portugal relies more on public support in intensifying their cooperation centres initiatives with competitors and suppliers than required in Spain. This could be held as a preference for potential usage of business expenditure in cooperation initiatives or an over-reliance on public support by Portugal which could also be an indication of market failure[22]. This effectively accepts H1 concurring the work of [24].

Furthermore, the significance of cooperation of selected industrial partners on knowledge acquisition of firms was also found significant among all industrial partners considered-suppliers, research centres, Universities, consultants and laboratories, competitors and other firms within the same industry for both countries. This points out a very salient source of information generation in the Manufacturing sector inadvertently highlighting the pillars that could generate competitive advantage in an intellectual sense in Portugal and Spain even though is comparatively less potent in Spain. It is even more imperative as intellectual capital has been a significant driver of regional growth and global competitive strength in the knowledge economy This effectively accepted H2 in both Spain and Portugal concurring to findings of research with similar variables [14], [19].

In table 3, public funding was also found to significantly impact the sourcing of knowledge for innovatory needs in both Spain and Portugal thereon accepting the above stated H3. This research closely affirms the research of [26]. Furthermore, cooperation as a moderator of the relationship between public funding of firms and knowledge sourced by firms for innovation was found to be significant as well for both countries considered as well, however, the beta coefficient of 0.07 for Spain and 0.05 for Portugal evidenced a much effective role of cooperation in metamorphosing public funds for knowledge generation in Spain than in Portugal even though it very low in significance. These results also accepted H4 stated above and research direction of [5].

5 Conclusions

The study set out to reveal the impact of public funds on cooperation and knowledge, cooperation with industrial partners on knowledge generation and how cooperation moderated the transformation of such funds in to knowledge acquired by firms for innovatory purposes. H1 was accepted in both Spain and Portugal affirming the relevance of public funds in cooperation with industrial partners in the Manufacturing industry of both countries. However, the weights of the impact were higher in Portugal than in Spain. It is recommended that appropriate measures of transparency and control are duly endorsed to follow up on the usage vs results comparison of the funds provided to firms in Spain owing the direct relevance of funding.

H2 was also accepted confirming the significance of cooperation with industrial partners on knowledge acquired by firms for innovatory needs. Cooperation with industrial partners has much higher significance on knowledge acquisition in Portugal than in Spain. Owing to the overwhelming evidence of research of cooperation on knowledge generated for innovation, it is recommended that a deeper focused is placed on expediting and intensifying connections among firms via for example, public science and technology events, to appropriate the maximum returns of cooperation. H3 was accepted in both Spain and Portugal even as it was found more relevant in Spain that in Portugal. This entrenched the relevance of connection between public funding and knowledge acquired by firms for innovation. It is however recommended that firms engage active ex ante measures to control for the usage and proper assignment of funds to assigned knowledge generation sources. Ex post control measures is also recommended to be pursued to ensure an even more direct relevance and efficient use of funds for knowledge engaging activities. Lastly, H4 was also accepted as cooperation was assessed and found as a significant moderator of public funding and knowledge acquired by firms for generating product and process innovations in both countries. Firms in Portugal are recommended to attach higher importance to the taxpayers' fund and engage actively in cooperation and explore more platforms for engagement to intensify cooperation within industries to even higher effects whilst the Government and supranational bodies are equally admonished to eliminate red tapes to financing and even create wider platforms for access to finance whilst supplementing it with active ex post control measures and redirect funds in line with need and significance to the sectors in need. Further research could use a panel data to cover a wider range and also provide a gap period for input variables to transform into the selected output variables.

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