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# **Development Expenditures as Source of Revenue and Market Valuation: Evidence from the Iberian Cluster**

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## **Abstract:**

Over the last decades, companies have been aligning its strategy with focus on research and development activities, towards future economic benefits. These innovative activities are, in many cases, associated to changes by introducing new methods, ideas, processes, products, and learning practices. Innovation also translates the ability to produce and transform knowledge, contributing to potential economic returns. The current research aims to identify whether development expenditures (application of research findings or other knowledge), recognized in the firms' annual statement of financial position, have a significant impact on Iberian firms' revenues and on market valuation. Based on the 68 Iberian non-financial listed companies, with active development projects over the period 2010-2015, an econometric framework was regressed. Portugal and Spain are significantly aligned on the impact of development expenditures on predicting firm's revenue and firm's market valuation. This intangible asset, when managed together with other intangible resources, can generate higher value-added inflows, if compared with its isolated effects. Research didn't evidence any significant time effects neither activity sector effects.

**Keywords:** innovation; European strategy 2020; research and development; development expenditures; intangibles; intellectual capital; Iberian cluster, Portugal; Spain

**Biography:**

Professor of Accounting and Finance at *Instituto Universitário de Lisboa* (ISCTE-IUL) and researcher at *Business Research Unit* (BRU-IUL). Undergraduate in Business Administration, he obtained a Master's Degree in Statistics and Information Management and a PhD in Management, specializing in Accounting (University of Coimbra, Portugal). His research is in the fields of financial accounting, corporate governance, auditing, business and performance, and research methodologies. Member of scientific and editorial boards in conferences and international journals.

This paper is a revised and expanded version of a paper entitled 'Development Expenditures towards firm's turnover and firm' market valuation: evidence from Portugal and Spain' presented at the 9th International Conference on entrepreneurship, Innovation and Regional Development (ICEIRD), National University of Political Studies and Public Administration ((SNSPA), Bucharest, Romania, 23-34 June 2016.

**1. Theoretical background and objectives**

The last two decades have been driven by a new techno-economic paradigm (Freeman and Louçã, 2001). The old “*Fordist*” style has been replaced by an “*Information and Communication Technology*” (ICT) networking style, driven by information-intensive mechanisms, by computer-added designs, by concurrent engineering, strongly customized, supported by flexible production systems, embedded in distributed intelligence procedures, based on multi-skilling, and supported by government information, coordination and regulation. Countries and firms became a very heavy spender on Research and Development (R&D) and on continuous education and training – its focus has increasingly based on innovation. It embodies an action or process of innovating. It is associated to changes, with a certain level of novelty, by introducing new methods, new ideas, or new products. Innovation translates the ability to produce knowledge, it contributes to potential inflows, and it is widely recognized as one of the primary driving forces of growth and profitability. Over the last decades, researchers tried to identify the sources that drive individuals and groups to innovate and contribute to value creation and sustainable development across firms and nations (Deschryvere, 2014; Fontana et al., 2012; Chen et al., 2011; Malerba, 2005; Breshi et al.,

2000; Malerba and Orsenigo, 1995, 1996; Pavitt, 1984; Jewkes et al., 1958). In these different approaches towards the identification of innovation drivers, Schumpeterian patterns have been stated as the most robust findings across the literature. Thus, innovative activities differ across industries along several dimensions, in particular the knowledge intensity embedded in those activities, the type of actors and institutions involved in innovative activities and policies, and the economic effects of innovations (Malerba, 2005). Those patterns are structured around four dimensions: 1. Concentration and asymmetries among innovating firms in each particular sector; 2. Size of the innovating firms; 3. Changes over time in the hierarchy of innovators; and 4. Relevance of the entry of new innovators. Fontana et al. (2012) explore the most recent literature about Schumpeterian patterns of innovation and contribute to identify the sources of breakthrough inventions by extracting new outcomes on the base of the mentioned old patterns. Broadly, a turbulent environment rather than a more stable is conducive to a higher probability of the occurrence of breakthrough inventions and creation national and regional ecosystems, understood as the way firms and agencies capture the complex synergies among a variety of collective efforts involved in bringing innovation to market. Thus, at a national level, an innovation ecosystem is made up of a network of local innovation ecosystems, built on: 1. Competencies with attention to regional strengths; 2. The identification of research strategies; 3. Regional environment; 4. Forming regional partnerships; and 5. Funding the machinery, which consists of facilities, people and organizations (NAS, 2007).

From a financial point of view, R&D disbursements are probably the most known and used proxy to measure the innovation intensity across entities and nations. According to *International Accounting Standard 38* (IASB, 2004), “*Research*” relates to the original and planned investigation undertaken with the prospect of gaining new scientific or technical knowledge and understanding while “*Development*” is the application of research findings or other knowledge to a plan or design for the production of new or substantially improved materials, devices, products, processes, systems, or services prior to commencement of commercial production or use (Chaudhry et al., 2016). From an accounting perspective, costs incurred in the research phase are expensed immediately, affecting the current profit and loss, while costs incurred in the development phase are capitalized (IASB, 2004), recognized as intangible assets in the financial statement of financial position. Thus, R&D expenditures could lead entities (public and private) to growth, to increased returns, and subsequently into financial and strategic achievements. These expenditures, based on knowledge applications,

are the basis of innovation, driving companies to potential economic benefits (Tahinakis and Samarinas, 2013). According to Chen et al. (2011), most nations have gradually devoted more efforts to R&D and have tried to create a favorable innovation environment by enforcing intellectual property rights to promote innovations. However, literature does not provide unanimous evidence about the relationship between innovation and firm's revenues (Lopes and Ferraz, 2016; Tudor et al., 2014; Deschryvere, 2014; Tanfous, 2013; Lopes, 2011; Chan et al., 2003; Lev and Sougiannis, 1996). In this scope, Deschrvere (2014) found that large firms that are continuous innovators have significant positive two-way associations between R&D growth and sales growth; however, in small continuous product innovators that association is clearly stronger than for large ones. Furthermore, relating the occasional process and product innovators, he found a positive and significant association between sales growth and subsequent R&D growth. Concerning the effectiveness of R&D intensity, Lopes (2011) did not achieve a significant correlation between those expenditures and turnover. However, companies and countries should monitor and report their innovation cycles in order to increase their turnovers. This result seems consistent with evidences achieved by Chan et al. (2003) relating to the stock market valuation derived from those expenditures, not supporting a direct relationship between R&D expenditures and future returns. Different evidences were obtained by Lev and Sougiannis (1996) relating insider gains. These gains in R&D inside intensive companies are significantly higher than insider gains obtained in firms not strongly engaged in innovation expenditures. Although the complex relationships between R&D and subsequent economic benefits, if efficiently and productively used, R&D can serve as a major source of competitive advantage and predicted returns (Chen et al, 2011). According to Akinwale et al. (2011), it is not enough to increase the expenditures on R&D and innovation when countries have weak institutions and networks, and poor coordination systems. Building a creative high performance R&D culture is required (Skerlavaj et al., 2013; Stock et al., 2013; Newman, 2009; Ambos and Schlegelmilch, 2008). This creative culture combines customer focus, risk tolerance, entrepreneurship, alignment with strategies, innovation, virtual organization and networking, and efficient execution. Thus, building a creative winning R&D culture is embedded on values, expertise, short and long term orientation, and effective policies.

The age of ICT has definitely marking the new ways to transform knowledge. The business to business use of the internet is probably turned out to be the most important source of productivity gains (Freeman and Louçã, 2001). Over the last decade, the efforts on R&D in

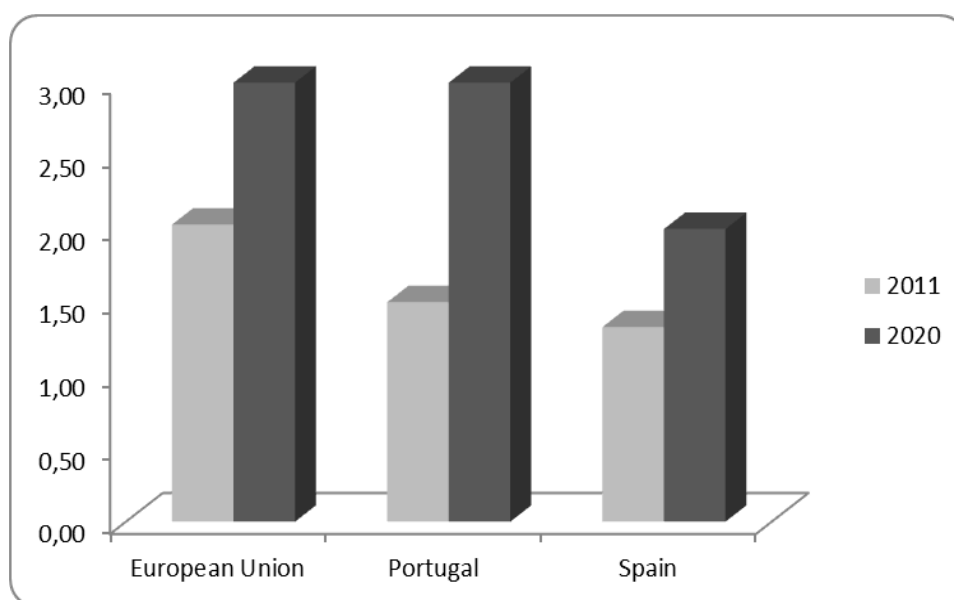
all funding sources (business enterprise sector; government sector; higher education sector; and private non-profit sector) have increased across European and Non-European countries. These efforts have been settled as a key policy component of the EU strategy 2020 for economic growth (Eurostat, 2016a), despite the intrinsic multicultural differences (Hofstede, Hofstede and Minkov, 2010). Broadly, European Union sets a 3% objective for R&D intensity and most Member States (e.g. Denmark, Germany, Slovenia, Estonia, France, Belgium, and Portugal) have adopted, at a national level commitment, that intensity target. Nordic countries (Finland and Sweden), pursuing its historic and progressive effort over time, set its target on R&D above 3%. Non-European countries, such as United States, Japan, South Korea and China, have settled a R&D intensity target of 3%, 4%, 5%, and 2.5%, respectively, despite in some cases without a defined deadline. Although the desired convergence on European strategy, challenges across European countries on R&D do not require the same intensity effort. Some of them already reached their national targets, others are still on track, and others did not settle ambitious efforts, both in the public and private funding sources. Hence, R&D expenditures are influenced by several economic and social factors, including the funding policies implemented by Member States. According to Eurostat (2016a, 2016b), the policy failures are categorised as follows: 1. Insufficient or inadequate public funding of the science base and higher education system; 2. Inefficient public incentives to stimulate business R&D; 3. Poor match between supply and demand side measures; and 4. The need to identify and address the bottlenecks that restrict the growth of firms in innovative sectors. Although the impact of macroeconomic trends at the firm's level, organizations include in their innovation strategies important R&D efforts towards the achievement of systematic and sustainable profitability and performance standards (Tahinakis and Samarinas, 2013; Lopes, 2011; Freeman and Louçã, 2001; Lev and Sougiannis, 1996).

This research aims to add complimentary evidences to previous researches (Lopes and Ferraz, 2016; Lopes et al., 2016a; Tudor et al., 2014; Tahinakis and Samarinas, 2013; Tanfous, 2013; Akinwale et al., 2011; Lopes, 2011; Chan et al., 2003; Lev and Sougiannis, 1996) and to identify whether the intangible resource “*Development Expenditures*”, recognized in the annual accounts, has, in the Iberian countries (Portugal and Spain), a significant and positive impact on regional firms' economic returns and market valuation. Furthermore, it also aims to provide an integrated overview about the convergence and alignment of those countries, included in the Iberian cluster, with the EU strategy 2020 on R&D efforts.

## 2. Overview of R&D policies in Iberian countries

At a macroeconomic level, and relating the Iberian geographic cluster, Portugal is integrated in the Member States group which needs to substantially raise their rate of increase in R&D intensity in order to comply with its target, and whose required efforts exceeds the EU average. As illustrated by graph 1, the national target (2%) of Spain is below the EU strategy 2020 target. Thus, this country is not aligned with EU target, needing additional efforts in order to raise its own national target. Over the period 2000-2011, Portugal observed a negative average annual growth on R&D intensity (-0.2%) while Spain observed an increase of 3.6%. In order to achieve the targeted rate, set for both countries, an increase of 8% and 4.6%, respectively for Portugal and Spain, is required for the period 2011-2020.

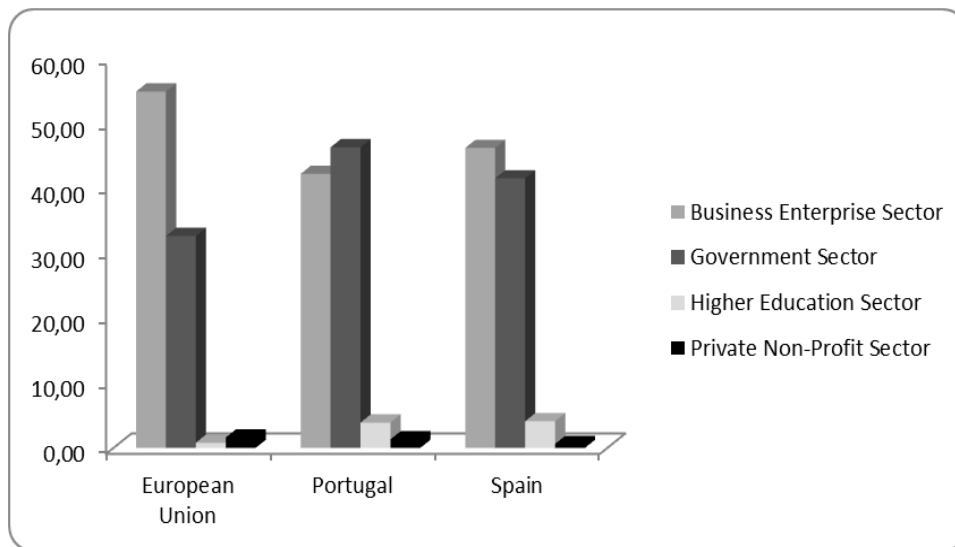
**Graph1 – R&D intensity as a % of GDP (2011/2020)**



Source: Eurostat (2016a)

In European Union, 55.0% of R&D expenditures are funded by business enterprise sector and 32.7% are funded by government sector. Higher education sector and private non-profit sector, as sources of R&D funding, still evidence a marginal impact (0.8% and 1.6%, respectively). As illustrated by graph 2, Portugal and Spain observe opposite trends: in Portugal, government sector is responsible for funding 46.4% of R&D projects while in Spain 46.3% of similar projects are funded by business enterprise sector.

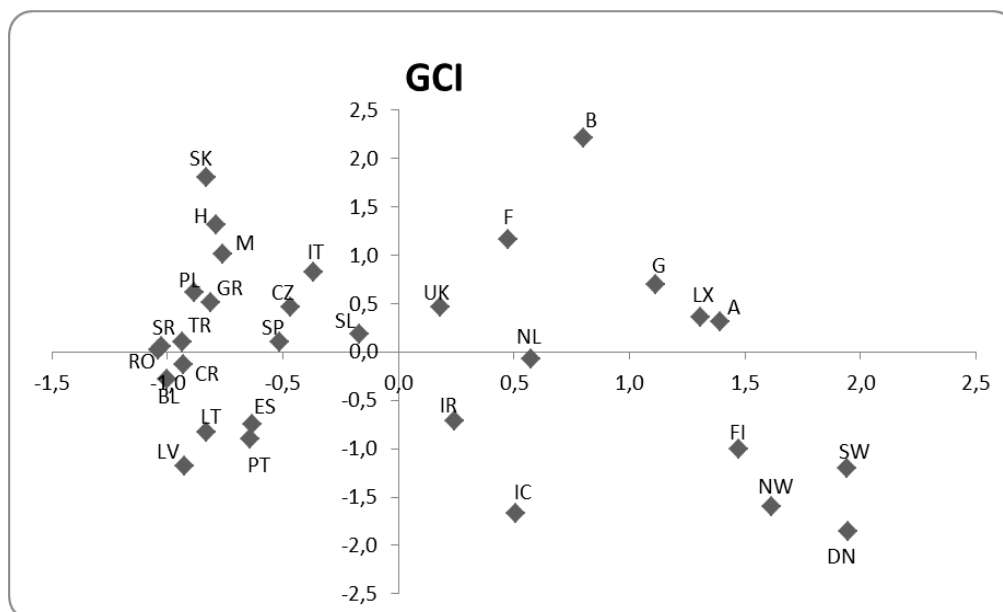
**Graph2 – R&D by funding source (2013)**



Source: Eurostat (2016b)

Crossing the *Global Cultural Index* (GCI), based on the six cultural dimensions defined and used by Hofstede et al. (2010), and the R&D intensity, measured as a percentage of GDP (Eurostat, 2016a), an overview of European countries can be provided in the graph 3 below. We can find signs of convergence between both countries. Thus, we consider that those countries are aligned by the same requirement efforts, integrating the same geographical and strategic cluster.

**Graph 3 – Culture and R&D across Europe**



Source: Adapted from Hofstede et al. (2010) and Eurostat (2016a)



At a microeconomic level (firms' level), this research is based on Development Expenditures, capitalized and disclosed in the firm's statement of financial position (balance sheet), of the non-financial Iberian listed firms (Portugal 24; Spain 44). Our sample integrates all the 68 Iberian firms with active development projects over the period 2010-2015. Those firms were categorized according the “*Standard Industries Classification*” (SIC): *Energy* (production and alternative energies) at 10.3%; *Basic materials* (forestry, paper; metals, mining) at 13.2%; *Industrials* (construction, materials; aerospace and defense; electronic and electrical equipment; transportation) at 20.6%; *Consumer goods* (automobiles, parts; beverages, food producers; household goods; residential construction; leisure goods; tobacco) at 17.6%; *Consumer services* (food/drug retailers; media; travel; leisure) at 20.6%; *Telecommunications* (fixed-line, mobile) at 4.4%; *Utilities* (gas, water, electricity, multi-utilities) at 2.9%; and *Technology* (software/ computer services, technology hardware/equipment) at 10.3%. Data relates to the period 2011-2015 for the dependent variables and to the economic period 2010-2014 for the independent variables. Data was extracted from the *Datastream* database, and from the annual financial reporting, yearly disseminated to stakeholders as required by the financial markets regulators and taxation authorities.

As previously described, this research, in the scope of business R&D intensity policy, has the main objective to identify whether development expenditures (recognized as intangibles in the statement of financial position) funded by business enterprise sector have a significant impact (isolated or aggregated effects) on Portuguese and Spanish firms' economic revenue (measured through firm's Turnover) and on market valuation (measured through firm's Market Value). Thus, we formulate two econometric models with the following core specifications:

**Model 1** (*Isolated effect of Development Expenditures*)

$$Y_{it} = \beta_0 + \beta_1 DEVEXP_{i(t-1)} + \beta_2 OTHINT_{i(t-1)} + \beta_3 BOARD_{i(t-1)} + \beta_4 LEV_{i(t-1)} + \beta_5 SIZE_{i(t-1)} + \beta_6 COUNT_{i(t-1)} + \beta_7 Sector\ Effects_{i(t-1)} + \beta_8 Time\ Effects_{i(t-1)} + \varepsilon_{it}$$

( $i = 1, \dots, n$  ;  $t = 1, \dots, m$ )

**Model 2** (*Conjoint effect of Development Expenditures*)

$$Y_{it} = \beta_0 + \beta_1 (DEVEXP * OTHINT)_{i(t-1)} + \beta_2 BOARD_{i(t-1)} + \beta_3 LEV_{i(t-1)} + \beta_4 SIZE_{i(t-1)} + \beta_5 COUNT_{i(t-1)} + \beta_6 Sector\ Effects_{i(t-1)} + \beta_7 Time\ Effects_{i(t-1)} + \varepsilon_{it}$$

( $i = 1, \dots, n$  ;  $t = 1, \dots, m$ )

Where:

- $Y_{it}$  is the logarithm of firm's turnover ( $TURN$ ) at the end of economic year  $t$ , and average firm's market value ( $MVALUE$ ) per common share over the economic year  $t$ .
- $DEVEXP_{i(t-1)}$  is the logarithm of total development expenditures (e.g. patents; software projects, technical design, etc.) capitalized by firm  $i$  in economic year  $t-1$ .
- $OTHINT_{i(t-1)}$  is the logarithm of total other intangible assets (goodwill; brands and trademarks; licenses; alliances; etc.) recognized by firm  $i$  in economic year  $t-1$ .
- $BOARD_{i(t-1)}$  represents the number of members of the board of directors of firms in economic year  $t-1$ .
- $LEV_{i(t-1)}$  is the debts to assets ratio (financial leverage) of firm  $i$  in year  $t-1$ .
- $SIZE_{i(t-1)}$  is the logarithm of total assets, evidenced by firm  $i$  at the end of economic year  $t-1$ .
- $COUNT_{i(t-1)}$  expresses the country and stock exchange: Portugal – PSI; Spain – IBEX.
- $Sector\ Effects_{i(t-1)}$  is a dummy variable for each activity sector, according “*Standard Industries Classification*”.
- $Time\ Effects_{i(t-1)}$  is a dummy variable for each year over the period 2010-2015.
- $\varepsilon_{it}$  is the residual of firm  $i$  in period  $t$  or  $t-1$ .

Hence, model 1 captures the isolated effect of development expenses and other intangibles on firm's turnover and on firm's market value while model 2 captures the effect of those resources through an aggregated approach with other intangible assets such as brands, licenses, trademarks, among others. This research can consolidate the previous outcomes provided by Lopes and Ferraz (2016), Lopes et al. (2016b), Miller and Choi (2010) and Lev and Sougiannis (2003, 1996).

$MVALUE$ , as a dependent variable, is used in this scope as an embodiment of all intellectual drivers (e.g. firm's reputation; stakeholders' satisfaction; strategic alliances; etc.) whose capitalization in the statement of financial position is not supported by financial and accounting rules, and complimentary information is not disclosed in the management reporting notes (Tahinakis and Samarinas, 2013; Akinwale et al., 2011; Chan et al., 2003; Lev and Sougiannis, 1996). However, market value can also be understood as a source of future returns, by inducing stakeholders into future shares acquisitions and other financial behaviors. Thus, we formulate the model 3, in which  $MVALUE$  is used as a predictor of firm's future revenue.

### **Model 3**

$$TURN_{it} = \beta_0 + \beta_1(DEVEXP*OTHINT)_{i(t-1)} + \beta_2BOARD_{i(t-1)} + \beta_3MVALUE_{i(t-1)} + \beta_4LEV_{i(t-1)} + \beta_5SIZE_{i(t-1)} + \beta_6COUNT_{i(t-1)} + \beta_7Sector\ Effects_{i(t-1)} + \beta_8Time\ Effects_{i(t-1)} + \varepsilon_{it}$$

( $i = 1, \dots, n$  ;  $t = 1, \dots, m$ )

Variables were simultaneously introduced in the models in order to identify whether development expenses and other intangible assets can act as predictors of economic returns and firm's valuation (rejection of  $H_0: \beta_1=\beta_2=\dots=\beta_7=0$ ;  $p<\alpha$ ). Thus, based on the literature theoretical background, we formulate the following four hypotheses:

- H<sub>1</sub>: Development expenditures have a positive impact on Iberian firm's turnover.
- H<sub>2</sub>: Development expenditures have a positive impact on Iberian firm's market valuation.
- H<sub>3</sub>: Development expenditures and other intangibles have a positive aggregated impact on Iberian firm's turnover.
- H<sub>4</sub>: The impact of development expenses on firm's economic returns and on firm's market valuation is convergent within Portugal and Spain.

The phenomenon under analysis is complex and has multivariate causes and effects. Although the lack of literature on the linkage proposed for analysis, R&D (IASB, 2004), as an intermediate stage of conclusive innovation, has the power to embody a set of skills, abilities, knowledge, expertise, and strategic decisions, towards the dynamic transformation of tacit knowledge into explicit knowledge (e.g. patents, software, alliances, rights, trademarks, technical design, etc.). Thus, our assumption is that only proactive and dynamic organizations, strongly oriented to efficient knowledge transformation mechanisms, can support strong R&D expenditures efforts (Skerlavaj et al., 2013; Stock et al., 2013; Newman, 2009; Ambos and Schlegelmilch, 2008; Lev and Sougiannis, 2003, 1996).

The means, standard deviations, and other descriptive measures, for the sample as a whole on the various measures of interest are shown in Table 1. The simple correlations (Pearson's coefficients) between the variables of interest are shown in Table 2.

**Table 1: Descriptive measures**

Variable	N	Min.	Max.	Mean	Std. Deviation	Skewness	Kurtosis
<i>TURN</i>	340	15.7495	25.1566	21.7340	2.03118	0.243	-0.425
<i>MVALUE</i>	340	0.0045	102.5400	13.6590	18.0882	2.844	7.262
<i>DEVEXP</i>	340	10.2751	24.3591	17.6071	3.2755	0.173	-0.798
<i>OTHINT</i>	340	10.4573	24.6145	18.9812	2.7682	-0.435	0.432
<i>BOARD</i>	340	3	30	11	4.492	1.156	3.516
<i>LEV</i>	340	0.0756	1.4512	0.7481	0.2347	-0.263	0.947
<i>SIZE</i>	340	15.8190	25.5891	21.3468	2.1947	0.213	-0.453

**Table 2: Pearson's correlation coefficients**

VAR.	<i>TURN</i>	<i>MVALUE</i>	<i>DEVEXP</i>	<i>OTHINT</i>	<i>BOARD</i>	<i>LEV</i>	<i>SIZE</i>	<i>COUNT</i>
<i>TURN</i>	1							
<i>MVALUE</i>	0.228	1						
	0.065*							
<i>DEVEXP</i>	0.673***	-0.045	1					
	0.000	0.815						
<i>OTHINT</i>	0.815***	-0.089	0.648***	1				
	0.000	0.365	0.000					
<i>BOARD</i>	0.603***	-0.134	0.342***	0.532***	1			
	0.000	0.256	0.000	0.000				
<i>LEV</i>	0.201	-0.267	0.214	0.072	0.039	1		
	0.114	0.254	0.417	0.419	0.810			
<i>SIZE</i>	0.912***	0.276**	0.587***	0.643***	0.581***	0.118	1	
	0.000	0.021	0.000	0.000	0.000	0.327		
<i>COUNT</i>	0.193	0.287**	-0.034	-0.028	-0.012	-0.081	0.132	1
	0.116	0.013	0.797	0.786	0.919	0.467	0.244	

\*\*\*  $p < 0.01$ ; \*\*  $p < 0.05$ ; \*  $p < 0.1$

Based on the bivariate analysis, *TURN* is significantly correlated with *DEVEXP* ( $r=0.673$ ;  $p<0.001$ ), *OTHINT* ( $r=0.815$ ;  $p<0.001$ ), *BOARD* ( $r=0.603$ ;  $p<0.001$ ), and *SIZE* ( $r=0.912$ ;  $p<0.001$ ). These evidences, corroborating the achievements provided by Lopes and Ferraz (2016), Lopes et al. (2016a, 2016b), Miller and Choi (2010), and Lev and Sougiannis (2003, 1996), are aligned with the assumptions of *International Accounting Standard 38*

(IASB, 2004) that intangible assets are associated to expected future benefits, flowing for the owner, over a certain useful life period. However, we didn't find any significant correlation between MVALUE, and DEVEXP ( $r=-0.045$ ;  $p=0.815$ ) and OTHINT ( $r=-0.089$ ;  $p=0.365$ ). Thus, customers seem to incorporate more easily the power of intangibles through turnover, as the most direct performance measure, instead of adjusting it on firm's market value (strongly driven by multiple factors, including irrational technical behaviours and decisions, instead of using a more fundamental approach). The unexpected negative signal supports the need for additional developments about the information asymmetry between intangible resources recognition and measurement basis, and shareholders' perceptions. This result is consistent with outcomes provided by Chan et al. (2003), in respect to stock market valuation derived from R&D expenditures. Those results do not support a direct relationship between development expenditures and firm's market valuation. The regression model towards the prediction of TURN and MVALUE (with and without time effects and activity sector effects) are evidenced in the table 3 and table 4 below.

**Table 3: Regression model equations - TURN (Model 1)**

<i>TURN</i>									
	$\beta$	<i>t</i>	<i>Sig.</i>	VIF		$\beta$	<i>t</i>	<i>Sig.</i>	VIF
<i>Intercept</i>	2.156	2.118	0.024**			3.819	1.914	0.044**	
<i>DEVEXP</i>	0.113	1.075	0.276	1.717		0.404	1.075	0.340	1.920
<i>OTHINT</i>	0.167	2.429	0.003***	2.248		0.542	2.765	0.014***	2.543
<i>BOARD</i>	0.043	0.791	0.387	1.610		0.089	0.994	0.413	1.876
<i>LEV</i>	0.746	1.834	0.081*	1.167		0.819	2.234	0.056*	1.342
<i>SIZE</i>	0.519	6.914	0.000***	1.409		0.635	7.810	0.000***	1.114
<i>COUNT</i>	0.289	1.432	0.135	1.023		0.119	1.212	0.245	1.423
<i>SEC</i>		Yes					No		
<i>Time Effects</i>		Yes					No		
<i>Adj.R</i> <sup>2</sup> = 0.734					<i>Adj.R</i> <sup>2</sup> = 0.694				
<i>F</i> = 37.104					<i>F</i> = 34.032				
<i>Sig.</i> 0.000***					<i>Sig.</i> 0.000***				
<i>DW</i> 1.913					<i>DW</i> 1.887				

\*\*\*  $p < 0.01$ ; \*\*  $p < 0.05$ ; \*  $p < 0.1$

**Table 4: Regression model equations - MVALUE (Model 1)**

<i>MVALUE</i>								
	$\beta$	<i>t</i>	<i>Sig.</i>	VIF	$\beta$	<i>t</i>	<i>Sig.</i>	VIF
<i>Intercept</i>	-7.213	-2.453	0.017**		-8.594	-2.525	0.014**	
<i>DEVEXP</i>	0.448	0.389	0.804	1.921	0.337	0.361	0.719	1.827
<i>OTHINT</i>	-2.125	-2.312	0.027**	2.115	-3.032	-2.433	0.018**	2.340
<i>BOARD</i>	-1.116	-1.907	0.025**	1.610	-1.377	-2.170	0.034**	1.610
<i>LEV</i>	-5.867	-1.413	0.089*	1.345	-6.940	-1.660	0.102	1.033
<i>SIZE</i>	6.768	4.143	0.000***	2.678	6.768	4.143	0.000***	2.309
<i>COUNT</i>	7.654	1.642	0.077*	1.713	8.761	1.727	0.089*	1.181
<i>Sector Effects</i>		Yes				No		
<i>Time Effects</i>		Yes				No		
		<i>Adj.R<sup>2</sup></i> =	0.312			<i>Adj.R<sup>2</sup></i> =	0.239	
		<i>F</i> =	5.209			<i>F</i> =	3.999	
		<i>Sig.</i>	0.000***			<i>Sig.</i>	0.000***	
		<i>DW</i>	1.432			<i>DW</i>	1.387	

\*\*\*  $p < 0.01$ ; \*\*  $p < 0.05$ ; \*  $p < 0.1$

Considering the effects of time (2010-2015) and the activity sector (eight typology classification), 73.4% of variance is explained when regressed against TURN while only 31.2% of variance is explained when regressed against MVALUE. In all cases, DEVEXP is not statistically significant ( $p > 0.1$ ), contradicting the evidences provided in the bilateral correlations analysis (table 2). Thus, although the positive expected signal, our hypotheses 1 and 2, are rejected, stating that development expenditures disbursed by firms cannot be used, on single effect, as a predictor of revenue and market value. As expected, other intangible resources can be used to predict TURN and MVALUE, however in the case of MVALUE, with an unexpected negative signal (Lopes and Ferraz, 2016; Lopes and Martins, 2016; Deschryvere, 2014; Tudor et al., 2014; Tanfous, 2013; Lopes, 2011; Chan et al., 2003; Lev and Sougiannis, 1996). This support the assumption that market value is driven by multiple factors, not supported by the fundamental analysis taken into account only by a certain type of shareholders. The size of the board of directors, as an embodiment of strategic expertise and strategic directions, is not statistically significant ( $p > 0.05$ ) in predicting TURN, however statistically significant in the prediction of MVALUE ( $p < 0.05$ ), despite its negative signal. These evidences confirm its indirect impact on turnover and its direct impact on

shareholder's perceptions (market approach) as signaled by Lopes et al. (2016a). As expected, the control variable SIZE is significant in both cases at 1% significance level.

**Table 5: Regression model equations – TURN (Model 2)**

<i>TURN</i>								
	$\beta$	<i>t</i>	<i>Sig.</i>	VIF	$\beta$	<i>t</i>	<i>Sig.</i>	VIF
<i>Intercept</i>	3.119	2.118	0.001***		4.967	3.273	0.002***	
<i>DEVEXP*OTHINT</i>	0.012	0.319	0.000***	1.734	0.005	0.263	0.000***	1.900
<i>BOARD</i>	0.034	0.710	0.564	2.212	0.026	0.800	0.427	1.597
<i>LEV</i>	0.703	1.543	0.087*	1.119	0.841	1.634	0.107	1.030
<i>SIZE</i>	0.734	8.509	0.000***	2.654	0.608	7.682	0.000***	2.125
<i>COUNT</i>	0.432	1.501	0.132	1.342	0.358	1.402	0.166	1.175
<i>Sector Effects</i>		Yes				No		
<i>Time Effects</i>		Yes				No		
		<i>Adj.R</i> <sup>2</sup> =	0.785			<i>Adj.R</i> <sup>2</sup> =	0.789	
		<i>F</i> =	40.819			<i>F</i> =	42.711	
		<i>Sig.</i>	0.000***			<i>Sig.</i>	0.000***	
		<i>DW</i>	1.911			<i>DW</i>	1.928	

\*\*\*  $p < 0.01$ ; \*\*  $p < 0.05$ ; \*  $p < 0.1$

This model is globally adherent (With time and activity sector effects:  $\text{Adj.R}^2=0.785$ ;  $F=40.819$ ;  $p<0.001$ /Without time and activity sector effects:  $\text{Adj.R}^2=0.789$ ;  $F=42.711$ ;  $p<0.001$ ), and the conjoint effect of DEVEXP and OTHINT is statistically significant ( $p<0.001$ ) as turnover's predictors. Based on these outcomes, development projects capitalized in financial statements have an aggregated effect (synergy effect) on performance, corroborating the evidence provided by Lopes and Ferraz (2016), Tudor et al. (2014), Tanfous (2013), and Lev and Sougiannis (2003, 1996). This evidence is also aligned with the findings achieved by Macerinskienė and Survilaitė (2011), which when parts of intellectual capital are managed together, business organisations can generate high value-added flows. This reflects the effect of the synergy between intangibles and their conjoint impact on the operational revenue of businesses. Thus, when parts of intellectual capital are managed together, its synergetic effects increase the performance and profitability of businesses. According other researches, incorporating a single typology of intangibles such as R&D or software developments, authors have found a significant relationship between those intangibles and firm's

performance level (Lev and Sougiannis, 2003, 1996). The same approach in predicting MVALUE is evidenced in the table 6 below.

**Table 6: Regression model equations – MVALUE (Model 2)**

<i>MVALUE</i>								
	$\beta$	<i>t</i>	<i>Sig.</i>	VIF	$\beta$	<i>t</i>	<i>Sig.</i>	VIF
<i>Intercept</i>	-8.320	-1.917	0.014**		-7.620	-2.837	0.006***	
<i>DEVEXP*OTHINT</i>	-0.039	-1.210	0.112	1.900	-0.044	-1.370	0.176	1.900
<i>BOARD</i>	-1.413	-2.345	0.007***	1.597	-1.398	-2.152	0.035**	1.597
<i>LEV</i>	-6.156	-2.234	0.114	1.030	-6.191	-1.546	0.127	1.030
<i>SIZE</i>	7.675	4.319	0.000***	2.125	5.675	3.524	0.001***	2.125
<i>COUNT</i>	6.128	1.934	0.045**	1.175	9.396	1.807	0.076*	1.175
<i>Sector Effects</i>		Yes				No		
<i>Time Effects</i>		Yes				No		
		<i>Adj.R</i> <sup>2</sup> =	0.198			<i>Adj.R</i> <sup>2</sup> =	0.226	
		<i>F</i> =	4.819			<i>F</i> =	3.917	
		<i>Sig.</i>	0.000***			<i>Sig.</i>	0.003***	
		<i>DW</i>	1.565			<i>DW</i>	1.428	

\*\*\*  $p < 0.01$ ; \*\*  $p < 0.05$ ; \*  $p < 0.1$

Relating the prediction of firm's market value, the robustness of the model is not significant ( $\text{Adj.R}^2=0.198$ ;  $F=4.819$ ;  $p<0.000$ , considering the model with time and activity sector effects and  $\text{Adj.R}^2=0.226$ ;  $F=3.917$ ;  $p=0.003$  without those effects). As already mentioned, MVALUE is driven by other factors, most of them beyond the financial and accounting approach embedded in this research.

In model 3, we aimed to identify the effect of firm's market price (MVALUE) on revenue (measured through TUR) generation, considering the conjoint effects of development expenditures and other intangible assets. This model is globally adherent ( $\text{Adj.R}^2=0.748$ ;  $F=36.145$ ;  $p<0.000$  considering time and activity sector effects and  $\text{Adj.R}^2=0.776$ ;  $F=37.764$ ;  $p<0.000$  otherwise). The key variables (DEVEXP and OTHINT) are statistically significant ( $p<0.01$ ) as turnover's predictors, confirming the positive synergy effect and the alignment provided by *International Accounting Standard 38* (IASB, 2004). Results summary of model 3 are evidenced in table 7.



**Table 7: Regression model equations (Model 3)**

<i>TURN</i>								
	$\beta$	<i>t</i>	<i>Sig.</i>	VIF	$\beta$	<i>t</i>	<i>Sig.</i>	VIF
<i>Intercept</i>	4.819	3.523	0.008***		5.524	3.422	0.009***	
<i>DEVEXP*OTHINT</i>	0.016	2.609	0.004***	2.287	0.006	3.525	0.008***	1.959
<i>BOARD</i>	0.126	1.432	0.407	1.603	0.034	1.040	0.303	1.718
<i>MVALUE</i>	0.012	0.056	0.397	2.645	0.006	0.011	0.316	1.365
<i>LEV</i>	0.813	1.675	0.056*	1.119	0.944	1.800	0.077*	1.070
<i>SIZE</i>	0.737	8.921	0.000***	1.934	0.572	6.588	0.000***	2.557
<i>COUNT</i>	0.342	1.209	0.325	1.484	0.299	1.139	0.259	1.238
<i>Sector Effects</i>		Yes				No		
<i>Time Effects</i>		Yes				No		
		<i>Adj.R</i> <sup>2</sup> =	0.748			<i>Adj.R</i> <sup>2</sup> =	0.776	
		<i>F</i> =	36.145			<i>F</i> =	37.764	
		<i>Sig.</i>	0.000***			<i>Sig.</i>	0.000***	
		<i>DW</i>	1.910			<i>DW</i>	1.943	

\*\*\*  $p < 0.01$ ; \*\*  $p < 0.05$ ; \*  $p < 0.1$

We can conclude, therefore, that intangibles recognised in financial statements have an aggregated effect on turnover, corroborating our hypothesis 3, and also supporting the evidences provided by Lopes and Ferraz (2016), Tanfous (2013), Tudor et al. (2014), and Lev and Sougiannis (2003, 1996). This outcome is also aligned with the findings of Macerinskiené and Survilaitė (2011), which when parts of intellectual capital are managed together, business organisations can generate high value-added flows.

Relating the robustness of the models, we run the multicollinearity diagnosis, the residual analysis, and the heteroscedasticity tests. The Variance Inflation Factor (VIF) assesses the degree of multicollinearity in the models. In this scope, we found that none of the independent variables of the current research has a VIF value close to 10, concluding that the analysis does not observe a severe problem of multicollinearity. Towards the analysis of independence of residuals, we used the Durbin-Watson (DW) test. Based on DW statistic, we noted that a null hypothesis is not rejected, which means that residuals describe a normal distribution, confirming that those errors are not auto correlated. Relating heteroscedasticity, we used the test of White, not rejecting the null hypothesis ( $p > 0.05$ ). Thus, the evidences

provided by the current econometric model can serve as an important contribution to theory and practice.

Towards the analysis of the last hypothesis (H<sub>4</sub>: The impact of development expenses on firm's economic returns and on firm's market valuation is convergent within Portugal and Spain), we used a comparison of independent samples, using the dummy variable COUNT. Thus, null hypothesis states that the distribution between variables is the same across both countries (Portugal and Spain).

**Table 8: Comparison between Iberian countries**

Variable	Equality of Variances (F)	Sig.	Equality of Means (t)	df	Sig.	Mean Dif.
<i>TURN</i>	0.048	0.816	-1.619	338	0.145	-0.8223
<i>MVALUE</i>	15.191	0.000***	-2.463	338	0.013**	-11.7121
<i>DEVEXP</i>	0.413	0.489	0.319	338	0.817	0.2572
<i>OTHINT</i>	2.659	0.067*	0.119	338	0.653	0.1638
<i>BOARD</i>	6.167	0.038**	0.215	338	0.718	0.1494
<i>LEV</i>	1.437	0.309	0.518	338	0.302	0.0690
<i>SIZE</i>	0.389	0.614	-1.276	338	0.359	-0.5913

\*\*\* Null hypothesis rejected at 1% ( $p < 0.01$ ); \*\* Null hypothesis rejected at 5% ( $p < 0.05$ );

\* Null hypothesis rejected at 10% ( $p < 0.1$ )

Relating the equality of means, null hypothesis cannot be rejected for *TURN*, *DEVEXP*, *OTHINT*, *BOARD*, *LEV*, and *SIZE*, which confirms that observations do not differ across countries (H<sub>4</sub> is not rejected). We consider it an expected outcome because firms are integrated in a globalized market, are affected by macroeconomic externalities, such as the European Union common policies (European Strategy 2020) and the sovereign debts effects. This confirms the assumption that both countries are aligned by the same innovation efforts, beyond the integration in the same geographic cluster, those countries are driving the same economic and strategic cluster. In respect the equality of variances, the null hypothesis is rejected for *MVALUE*, *OTHINT*, and *BOARD*. These results can be supported on cultural issues (Hofstede et al., 2010), on scale effects, and on differences associated to the national corporate governance codes (Lopes et al., 2016a).

### 3. Concluding remarks and directions

Research and Development (R&D), as a key pillar in the micro and macro level innovation policies, are sources of value by fostering markets' development with new innovative products and services. Primarily embodied by individuals and groups, knowledge is transformed and embedded in the innovation cycles, driving companies and nations towards an increased labour productivity, towards the industrial competitiveness, towards the development of efficient resources, and towards the sustainable growth (Eurostat, 2016a). Based on the main objective of this research - to identify the financial impact of Development Expenditures (application of research findings or other knowledge) on firms' future revenues and market valuation - our analysis can provide some additional and corroborative insights to the literature, as follows:

- At a macroeconomic level, Iberian countries are not convergent in terms of R&D targets in the scope of European Union strategy 2020. Portugal needs to substantially raise their rate of increase to reach their target while Spain requires lower efforts, however with a national target below the 3% fixed in EU strategy 2020 on R&D intensity target. In Portugal, R&D is mainly funded by government sector while in Spain similar projects are mainly funded by business enterprise sector. Funds from higher education sector and private non-profit sector are still marginal, however in line with EU average trends.
- At a microeconomic level, the intangible *Development Expenditures* has a statistically positive and significant conjoint effect as a predictor of firm's revenue (measured by firms' Turnover). Intangibles recognised in the statement of financial position have an aggregated effect on firm's turnover. When managed together, firms can generate high value-added flows, reinforcing the synergy effects derived from immaterial resources. This research didn't find any significant effects derived from time (2010-2015) neither from the activity sector categorization. These outcomes are aligned with other evidences provided over the last decade, such as Lopes and Ferraz (2016), Tudor et al. (2014), Tanfous (2013), Macerinskienė and Survilaitė (2011), Lev and Sougiannis (2003, 1996).
- Although the global adherence of the econometric models, we achieved a weak result in predicting the firms' market value variances. In the scope of market valuation, other intangibles seem to be directly perceived by shareholders with a significant and direct impact on turnover, however unexpectedly negatively correlated. Investors

seem to privilege primarily the technical analysis of stocks rather than supporting their decisions on a fundamental analysis. Once again, no significant effects were obtained derived by time or activity sector categorization.

- In the scope of development expenditures, as the application of research efforts in developing new products, services and processes, Portugal and Spain are significantly convergent. This evidence is supported on culture, economic and social issues, and on European common directions, such as the European strategy 2020 and the Eurozone convergence commitments and requirements. However, the difference between corporate governance issues and rules can also support the divergences still evidenced in the firms' market valuation.

Finally, some limitations of the current research are acknowledged, principally its focus on only large listed companies. This research only provides an accounting perspective of the intangible asset “*Development Expenditures*” as a predictor of future revenues, as stated in the International Accounting Standard 38. It does not provide any analysis based on the innovation cycles (processes and steps) at a firm micro or macro level. However, as the current approach is replicable over time, it can also be conducted in the scope of other countries and regions, and structured on different and alternative metrics and approaches.

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