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Intellectual Capital and Firms' Financial Performance: A European Empirical Study

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Abstract

The current study seeks to analyse the impact of the intellectual capital (IC) on the financial performance measured by Return on Assets in the European context for the period 2004-2015. This study uses data of non-financial listed firms of 8 European countries for the period between 2004 and 2015. Considering that financial crisis had different impact on European countries, we divided the eight countries in two groups: (1) group 1 – Greece, Portugal, Spain and Italy; and (2) group 2 – Germany, France, Finland and United Kingdom (UK). The estimation method used is the GMM system (1998) estimator, as a dynamic panel estimator, which allows to do longitudinal studies and to analyse the effect of lagged explanatory variables on firms' financial performance. The results indicate that IC efficiency in the current period has a positive impact on financial performance. The three components of VAIC^{TM} Model - capital employed efficiency, human capital efficiency and structural capital efficiency in the current period have a positive impact on financial performance, with the exception for structural capital efficiency which for the first group of countries has a negative impact on financial performance. Finally, results suggest that the financial crisis negatively affects financial performance on both groups of countries. The current study contributes to the current literature, analysing the impact of IC on firms' financial performance in two

groups of European countries which suffered the consequences of the 2008 crisis differently.

Keywords: European listed Firms, Financial Performance, Intellectual Capital, Value Added Intellectual Coefficient model

1. Introduction

In a knowledge-based economy, intellectual capital (IC) is considered a key resource in the firm's value creation, competitiveness and growth. One of the main priorities in the Europe 2020 strategy is the smart growth (Veugelers et al., 2015), i.e., economic growth based on innovation and knowledge. Knowledge is recognized as a valuable resource for firms' growth and innovation (Lev, 2004). Innovations and human factor – IC – can be seen as one of the main drivers of countries and firms' future growth as well as individuals' development (European Commission, 2013). IC investments, often referred as intangible assets, allows firms to gain competitive advantage over their competitors, as it is a scarce resource and it is difficult to imitate.

In recession periods, like that one following the recent global financial crisis, firms tend to have scarce financial resources (Hall, Moncada-Patern ò-Castello, Montresor, & Vezzani, 2016). Financial crisis has negative effect on economic development, which may contribute to firms reducing their investments. According to the Quarterly Report on the Euro Area (2013), several European Union (EU) countries reduced their investment in 2009. The beginning of the financial crisis in the end of 2007 and the difficult to access credit by firms may have worsen firms' financial performance due to the prediction of lower demand, which enforced firms to look to new sources to gain competitive advantages. Therefore, in order to promote innovation, European Union (EU) made efforts to fund innovation through projects such as Horizon 2020 strategy (Veugelers et al., 2015).

IC investments, often referred as intangible assets, aim for future benefits, not having physical or financial form (Lev, 2004) and strongly contributing to value creation through employee's knowledge, organizational processes and innovation and relationships (Serenko & Bontis, 2004; Wang, Wang, & Liang, 2014; Youndt, Subramaniam, & Snell, 2004). In the context of the new economy, IC is recognized as a key factor for the survival and performance of the firm (Nimtrakoon, 2015). Several authors (Bontis, 1998; Nimtrakoon, 2015; Sveiby, 1997) suggest that IC can be decomposed in three components: human capital (HC); structural capital (SC); relational capital (RC). The human capital refers to the knowledge and competence of human resources of the firms, and it is considered as one of the most important sources of innovation (Stewart, 1997); the structural capital includes internal elements of the firms, such as patents, software, trademarks, copyrights (Bontis, Keow, & Richardson, 2000; Sydler, Haefliger, & Pruksa, 2014); the relational capital refers to the creation and maintenance of relationships with external stakeholders, such as customers, suppliers, partners, investors and creditors (Stewart, 1997; Sydler et al., 2014).

Several methods have been developed in order to valuate IC, such as Skandia IC Report Method (Edvinsson & Malone, 1997) and Value Added Intellectual Coefficient model (VAIC™) (Pulic, 1998, 2000). VAIC™ has been widely adopted by academics and

practitioners (Nimtrakoon, 2015), as it allows to monitor and measure the value added based on the efficiency of firm's IC (Ståhle, Ståhle, & Aho, 2011). Furthermore, VAIC™ allows to measure the individual components of IC: physical and financial capital (CEE), human capital (HCE), and structural capital (SCE) (Firer & Williams, 2003; Pulic, 1998, 2000).

By extending the research of IC to European countries, this study seeks to analyse the impact of the intellectual capital on the financial performance measured by Return on Assets in the European context for the period 2004-2015.

To reach our main objective, we use a sample of non-financial listed firms consisting of 8 European countries for the period between 2004 and 2015. Considering the different level of the impact of financial crisis on different countries, eight countries were divided in two groups: (1) group 1 formed by countries more affected by the financial crisis, i.e., Greece, Portugal, Spain and Italy; and (2) group 2 formed by the countries less affected by the financial crisis, i.e., Germany, France, Finland and United Kingdom (UK). We use econometric modelling techniques, specifically, we resort to GMM system (1998) estimator to analyse a dynamic panel data.

The current paper is structured as follows. In Section 2, we present the literature review and hypothesis formulation; In section 3, we describe the methodology; Section 4 presents the results; In section 5, we discuss the results; and finally, section 6 we present the conclusion and implications.

2. Intellectual Capital and Firm's Financial Performance

The importance of IC for firms' growth and wealth is well recognized among researchers. In fact, the interest of researchers on IC research is notorious (Serenko & Bontis, 2013). According to Lev (2004), intangible assets are claims of future benefits, which do not have physical or financial form. Kaplan and Norton (2004) argue that intangible assets are a key driver for firms' future value creation. Also, IC provides innovative capacity to the firms (Chen, Cheng, & Hwang, 2005; Lev & Sougiannis, 1996). This innovative capacity allows firms invest in their core competences, which are not easy imitable by competitors (Prahalad & Hamel, 1990; Seyoum, 2004). Various studies show the positive contribute of IC to firms' financial performance and market value (Ballester, Garcia-Ayuso, & Livnat, 2003; Bontis, 1998; Chan, Lakonishok, & Sougiannis, 2001; Chen et al., 2005; Denicolai, Ramusino, & Sotti, 2015; Nimtrakoon, 2015; Tseng, Lan, Lu, & Chen, 2013; ul Rehman, Ilyas, & ur Rehman, 2011; Xing, 2014). Moreover, the intangible assets have been pointed out as an explanation for the disparity between firms' book value and market value (Lev, 2004).

Although the absence of a generalized definition of IC, several authors (Nahapiet & Ghoshal, 1998; Wang et al., 2014; Youndt et al., 2004) suggest that IC can be defined as the sum all knowledge and knowing capabilities that allows firms to gain and/or maintain a sustainable competitive advantage. Edvinsson and Malone (1997, p. 44) define IC as "the possession of knowledge, applied experience, organizational technology, customer relationships and professional skills that provide the firm with a competitive edge in the market". Stewart (1997, p. 67) defined IC as "packaged useful knowledge".

The components of IC decomposition are widely accepted among researchers (Edvinsson & Malone, 1997; Sveiby, 1997; Sydler et al., 2014), i.e., human capital (HC), structural (or organizational) capital (SC), and relational (or customer) capital (RC) (Bontis, Janosevic, & Dzenopoljac, 2015; Nimtrakoon, 2015; ul Rehman et al., 2011; Wang et al., 2014). Moreover, HC refers to the sum of employee's knowledge, competence, innovativeness, commitment and wisdom (Bontis, 1998; Johnson, 1999; Morris, 2015). This is the individual's knowledge that doesn't belong to firms and that employees take with them when they leave the organization. SC comprises the firms most valuable strategic assets, such as, organizational capabilities, culture, processes, patents, copyrights, trademarks, databases, and so on (Denicolai et al., 2015; Janosevic & Dzenopoljac, 2012; Johnson, 1999). The RC is the knowledge obtained through the establishment of relationships with external stakeholders (Johnson, 1999; Kweh, Lu, & Wang, 2014; Yu, Wang, & Chang, 2015). Therefore, IC comprises employee's knowledge, organizational processes, innovation capabilities, research and development projects, brand and relationships (Johnson, 1999; Serenko & Bontis, 2004; Wang et al., 2014; Youndt et al., 2004).

In spite of the importance of IC in firms' value creation, firms that strongly embodies intangible assets in their activities see the degrees of sunkness of their investments increase (Lev & Zambon, 2003). This fact makes difficult to identify and measure the value IC and, therefore, financial statements fail in report IC value (Lev, 2004; Nimtrakoon, 2015). Several authors provided an overview of IC valuation models (Bontis, 2001; Sveiby, 1997; Sydler et al., 2014). One of the most adopted methods to valuate IC, among researchers, is the Value Added Intellectual Coefficient model (VAIC™) (Pulic, 1998, 2000). Several advantages are pointed to the VAIC™, such as, a simple method to determine the value added based on the efficiency of firm's IC (Ståhle et al., 2011), the data used in the VAIC™ model is available in the financial statements and it allows comparative studies (Nimtrakoon, 2015; Tan, Plowman, & Hancock, 2007). Furthermore, VAIC™ allows to measure the contribution by individual components to firms' value added: physical and financial capital, human capital, and structural capital (Firer & Williams, 2003; Pulic, 1998, 2000).

Despite various studies that show a positive and significant effect of IC on firms' financial performance (FP), using VAIC™ as a IC measure of the efficiency of IC, there are contradictory results, which may be attributed to countries or industry specificities (Bontis, 1998; Chen et al., 2005; Denicolai et al., 2015; Nimtrakoon, 2015; Tseng et al., 2013; ul Rehman et al., 2011). Results from Riahi-Belkaoui (2003) indicate positive relationship between IC and FP. Chen et al. (2005) analysed the impact of IC on firms' FP on Taiwanese listed firms. Results show a positive and significant relationship between IC and firms' FP. In other study, Tan et al. (2007) analysed the effect of IC on firms' FP across different industries. Their findings show that the positive relationship between IC and FP vary across industries. Results from Janosevic and Dzenopoljac (2012) study revealed that IC has a positive impact on return on equity and a strong impact on employee productivity, but not on return on assets. Rahman (2012) studied 100 United Kingdom listed firms and conclude that that higher value of IC increases firms' FP. Tseng et al. (2013) used a sample of Taiwanese IT listed firms and the results indicate a significant positive association between IC and FP. Differing from

previous studies, Morariu (2014) used a sample of Romanian firms to analyse the association between IC and firms' FP. Results show a significant negative relationship between IC and firms' FP. Using a sample of listed firms from ASEAN countries, the results of Nimtrakoon (2015) study, reveals that the effect of IC on firms' FP is significant and positive for in all countries.

Several studies found a positive association between VAIC components and FP. For example, ul Rehman et al. (2011) found a positive and significant impact of HC on FP. Wang et al. (2014) also found a positive and significant correlation between HC and FP. Tseng et al. (2013) used operating profit per employee as an indicator for HC component and verified a positive impact of HC on firms' FP. Morris (2015) analysed the impact of HC across different industries and the results show a positive and significant association between HC and FP. In the study conducted by Nimtrakoon (2015) in five selected ASEAN countries, i.e., Indonesia, Malaysia, Philippines, Singapore and Thailand, and results show a positive and significant correlation between HC and FP. Concerning the SC component of IC, ul Rehman et al. (2011) study shows a positive and significant impact on FP. In Wang et al. (2014) study, authors have verified a positive and significant correlation between SC and FP. Results of Zéghal and Maaloul (2010) reveal a positive relationship between SC and FP. Guo, Shiah-Hou, and Chien (2012) examined the influence of patents and research and development (R&D) expenses on accounting performance. Although results show a non-significant relationship between patents and FP, the authors found a negative and significant effect of R&D on FP. Also, when testing the influence of compensation of CEOs or Vice presidents (human capital), the authors found a positive and significant correlation between salary and bonus for CEOs and FP. Results from Nimtrakoon (2015) study revealed a positive and significant correlation between SC and FP for Malaysia and negative and significant correlation between SC and FP for Philippines.

In accordance with the studies mentioned above, we propose the following hypotheses:

H1. Intellectual Capital has a positive impact on firms' financial performance

H1a. Physical Capital Efficiency has a positive impact on firms' financial performance

H1b. Human Capital Efficiency has a positive impact on firms' financial performance

H1c. Structural Capital Efficiency has a positive impact on firms' financial performance

3. Data, Variables and Method

3.1 Database

We use data set of 25080 observations on 1052 non-financial listed firms, for the period between 2004 and 2015, across 8 European countries divided in two groups: (1) group 1 – Greece, Portugal, Spain and Italy; and (2) group 2 – Germany, France, Finland and United Kingdom (UK). Our data set was gathered from DATASTREAM database by Thomson Reuters as it provides current and historical economic and financial data for all listed firms on the major world stock exchanges. All financial firms were excluded from our data set. The sample has an unbalanced panel structure, where the number of years vary between 3 to 12.

Following suggestions of Guariglia (2008), Bond, Elston, Mairesse, and Mulkay (2003) and Cummins, Hasset, and Oliner (2006), we mitigate potential survivor bias by allowing firm's entry and exit. We trimmed the data at one percent tails in order to control the potential effects of outliers, which may derive from particular events, such as large mergers, errors in coding or firm's extraordinary shocks.

3.2 Estimation Method and Variables Measurement

The variables names and IDs of the variables used in this study can be seen in Table 1.

Table 1. Variable names and IDs

Variables Names	Variables IDs
Dependent variables	
Financial Performance	ROA
Independent Variables	
Value Added Intellectual Coefficient	VAIC
Physical and Financial Capital	CEE
Human Capital Efficiency	HCE
Structural Capital Efficiency	SCE
Total Leverage	Tlev
Research and Development Intensity	RDintensity
Firm's Age	Age
Firm's Size	Size
Dummy Crisis	$D_{08;09}$

Due to the dynamic character of the main research variables in study, we use dynamic panel data econometrics, which allows the use of time series data taking into account the heterogeneity in adjustment dynamics between different types of firms. Therefore, we will use the Generalized Method of Moments (GMM), which is a dynamic estimator proposed by Blundell and Bond (1998) that allows us to control endogeneity problem and avoids significant bias in estimates (Wooldridge, 2007). The efficiency of this estimator lies in the possibility to control the correlation errors over time and the heteroscedasticity across firms. The results from GMM system (1998) estimator can only be valid under the following conditions: (1) validity of the restrictions created by use of the instruments; and (2) should not exist second-order autocorrelation. To test the first condition, i.e., the validity of the restrictions created by the used instruments, we use the Hansen test where the null hypothesis is the validity of the restrictions created by the used instruments. For the second condition, we test the existence of second-order autocorrelation, where the null hypothesis indicate that there is not second-order autocorrelation. In the case of not rejecting the null hypothesis for Hansen and second-order autocorrelation tests, we conclude that GMM system (1998) estimator is valid and robust. Through the use of high number of instruments, the GMM system (1998) estimator lead to dramatically improvements in efficiency compared with the first difference GMM estimator (Arellano & Bover, 1995; Blundell & Bond, 1998). Arellano and Bond (1991), Windmeijer (2005) and Roodman (2006) showed the reliability of the

one-step estimator GMM, asymptotic more efficient than the two-step estimator due to the downward biased standard errors. In order to overcome this problem, Windmeijer (2005) developed the small sample corrector, which provides more accurate inference on the two-step procedure specially for GMM system (1998) estimator (Roodman, 2009). Therefore, we used two-step procedure with the correction proposed by Windmeijer (2005).

Our estimation models are presented as follows:

Equation (1):

$$ROA_{i,t} = \propto_0 + \beta_1 ROA_{i,t\text{-}1} + \beta_2 VAIC_{i,t} + \beta_3 VAIC_{i,t\text{-}1} + \beta_4 Tlev_{i,t} + \beta_5 RDintensity_{i,t} + \beta_6 AGE_{i,t} + \beta_7 SIZE_{i,t} + \varphi_1 D_{08;09} + \varphi_s D_s + \varphi_t d_t + \eta_i + \varepsilon_{i,t}$$

Equation (2):

$$ROA_{i,t} = \propto_0 + \beta_1 ROA_{i,t\text{-}1} + \beta_2 CEE_{i,t} + \beta_3 HCE_{i,t} + \beta_4 SCE_{i,t} + \beta_5 CEE_{i,t\text{-}1} + \beta_6 HCE_{i,t\text{-}1} + \beta_7 SCE_{i,t\text{-}1} + \beta_8 Tlev_{i,t} + \beta_9 RDintensity_{i,t} + \beta_{10} AGE_{i,t} + \beta_{11} SIZE_{i,t} + \varphi_1 D_{08;09} + \varphi_s D_s + \varphi_t d_t + \eta_i + \varepsilon_{i,t}$$

Where: η_i are non-observable individual effects; and $\varepsilon_{i,t}$ is the error; d_t correspond the year dummies; and D_s industry sector dummies. The dependent variables used in this study were measured as follows: $ROA_{i,t}$ is the Return on Assets, given by the ratio of net profits in the current period to total assets in the current period. Next, we present the independent variables measures: $ROA_{i,t-1}$ is the Return on Assets, given by the ratio of net profits in the previous period to total assets in the previous period; $VAIC_{i,t}$ is the value added intellectual coefficient in the current period (VAIC™) corresponding to sum of HCE plus SCE plus CEE, where: $HCE_{i,t}$ is the human capital efficiency, given by value added (VA) / human capital (HC); $SCE_{i,t}$ structural capital efficiency, given by structural capital (SC) / value added (VA); and $CEE_{i,t}$ is the capital employed efficiency, given by value added (VA) / capital employed (CE). $VAIC_{i,t-1}$ is the value added intellectual coefficient in the previous period; $HCE_{i,t-1}$ is the human capital efficiency in the previous period; $SCE_{i,t-1}$ is the structural capital efficiency in the previous period; and $CEE_{i,t-1}$ is the Capital employed efficiency in the previous period. Where: VA is given by the difference of total sales and total expenses excluding employee costs; CE is given by the difference of total assets and intangible assets; HC is given by total employee expenditures; and SC is given by the difference of VA and HC. Finally, the measurement of control variables are as follows: $RDintensity_{i,t}$ is the intensity of firms' R&D activities, given by the ratio of R&D expenses in the current period to total revenues in the current period; $Tlev_{i,t}$ is the leverage in the current period, given by the ratio of book value of total debt in the current period to total assets in the current period; $SIZE_{i,t}$ is the size of the previous period, given by the natural logarithm of total assets in the current period; $AGE_{i,t}$ is firm age in the previous period, given by the natural logarithm of the number of years of existence of the firm in the current period; and $D_{08;09}$ is a dummy representing the global financial crisis for the years of 2008 and 2009. It assumes the value 1 if the year is equal to 2008 or 2009, and the value 0 for the remaining years in study.

4. Empirical Results

4.1 Descriptive Statistics and Correlation Matrix

The descriptive statistics for the whole sample can be seen in Table 2. It summarizes the descriptive statistics of dependent and independent variables.

Table 2. Descriptive statistics of global sample

Country		$ROA_{i,t}$	$VAIC_{i,t}$	$CEE_{i,t}$	$HCE_{i,t}$	$SCE_{i,t}$
Finland	Observations	1205	1308	1308	1308	1308
	Mean	.027	1.8	.66	1.2	.38
	Median	.042	1.8	.53	1.1	.27
	S.D.	.14	.99	.48	.53	.56
France	Observations	4415	4932	4932	4932	4932
	Mean	-.0033	1.7	.55	1.2	.44
	Median	.03	1.7	.43	1.1	.29
	S.D.	.22	1.1	.47	.9	.68
Germany	Observations	3660	4224	4224	4224	4224
	Mean	-.0072	1.5	.57	1.1	.49
	Median	.036	1.5	.5	1	.36
	S.D.	.25	1.1	.42	.79	.77
Greece	Observations	564	588	588	588	588
	Mean	.037	1.6	.48	1.4	.58
	Median	.03	1.1	.24	1	.6
	S.D.	.09	1.1	.42	.88	.63
Italy	Observations	2133	2340	2340	2340	2340
	Mean	-.012	1.6	.38	1.2	.38
	Median	.016	1.5	.27	1.1	.32
	S.D.	.19	1.3	.36	.97	.83
Portugal	Observations	474	492	492	492	492
	Mean	.0041	1.6	.35	1.4	.28
	Median	.018	1.5	.19	1.1	.29
	S.D.	.15	1.3	.34	.98	.82
Spain	Observations	622	708	708	708	708
	Mean	.032	1.8	.43	1.4	.37
	Median	.035	1.7	.28	1.2	.32
	S.D.	.12	1.1	.38	.77	.59
UK	Observations	3613	4068	4068	4068	4068
	Mean	.063	2.2	.61	1.6	.48
	Median	.057	2.2	.53	1.4	.38
	S.D.	.13	1.1	.45	.85	.44
Total	Observations	22390	25080	25080	25080	25080
	Mean	.011	1.7	.57	1.2	.47
	Median	.036	1.7	.47	1.1	.35
	S.D.	.21	1.1	.48	.87	.68

According to Table 1, it can be noticed that firms from UK, Finland, Germany presents the higher median scores of ROA. Whereas firms from Italy, Portugal, Greece presents the lower median scores of ROA. Concerning the efficiency of firms' IC, UK, Finland and France presents the higher median scores, while, Greece, Italy and Portugal have the lower median scores of firms' IC efficiency. Regarding firms' CEE, UK, Finland and Germany have the higher median scores, whereas, Portugal, Greece and Italy present the lower median score of CEE. The countries with higher median scores of firms' HCE are UK and Spain. The other countries present similar median scores of HCE. Regarding SCE, the countries with higher median scores of firms' SCE are Greece and UK. Whereas, the countries with lower median scores of firms' SCE are Finland, Portugal and France.

Table 3 reports the statistics descriptive based on sub-samples of group 1 and group 2.

Table 3. Descriptive statistics by sub-samples

Variables	Total - Group 1 (n = 344 firms)			Total - Group 2 (n = 708 firms)		
	Observations	Mean	S.D.	Observations	Mean	S.D.
$ROA_{i,t}$	3793	.0043	.16	12893	.032	.12
$VAIC_{i,t}$	4128	1.6	1.2	14532	1.8	1.1
$CEE_{i,t}$	4128	.4	.37	14532	.43	.38
$HCE_{i,t}$	4128	1.3	.93	14532	1.4	.77
$SCE_{i,t}$	4128	.39	.77	14532	.37	.59

According to Table 2, group 2 presents the higher mean values for ROA, VAIC, CEE and HCE, while group 1 only presents higher mean score of SCE.

The correlation and magnitude of the variables in study were analysed with Pearson correlation coefficient and can be seen in Table 4.

Table 4. Correlation matrix

Variables	$ROA_{i,t}$	$ROA_{i,t-1}$	$VAIC_{i,t}$	$VAIC_{i,t-1}$	$CEE_{i,t}$	$HCE_{i,t}$	$SCE_{i,t}$	$CEE_{i,t-1}$	$HCE_{i,t-1}$	$SCE_{i,t-1}$
$ROA_{i,t}$	1.0000									
$ROA_{i,t-1}$	0.5423**	1.0000								
$VAIC_{i,t}$	0.3036**	0.2565**	1.0000							
$VAIC_{i,t-1}$	0.2538**	0.2955**	0.6320**	1.0000						
$CEE_{i,t}$	0.1917**	0.1300**	0.0757**	0.0481**	1.0000					
$HCE_{i,t}$	0.3370**	0.2881**	0.6949**	0.5483**	0.0176	1.0000				
$SCE_{i,t}$	-0.0887**	-0.0808**	0.2111**	-0.0347**	0.1059**	-0.0866**	1.0000			
$CEE_{i,t-1}$	0.1435**	0.1935**	0.0662**	0.0687**	0.8361**	-0.0043	0.0862**	1.0000		
$HCE_{i,t-1}$	0.2794**	0.3322**	0.5439**	0.7002**	-0.0167	0.7222**	-0.0545**	0.0189	1.0000	
$SCE_{i,t-1}$	-0.0976**	-0.0931**	-0.0478**	0.2130**	0.0762**	-0.0628**	0.4381**	0.1024**	-0.0893**	1.0000
Note: ** Statistical significance at 1%; * Statistical significance at 5%										

The correlation matrix shows significant associations between most pairs of variables. According to Aivazian, Ge, and Qiu (2005) and Gujarati and Porter (2010), the problems of endogeneity between independent variables are relevant for correlation coefficients above 30%. Therefore, we found five correlations above 30% among independent variables, which are ROA from previous period with VAIC from current and previous period, between CEE

from current period and CEE from previous period, between HCE from current period and HCE from previous period and between HCE from current period and HCE from previous period. Therefore, to overcome the problem of endogeneity, we applied GMM system (1998) dynamic estimator as we can use of instrumental variables to reduce the endogeneity problem. Also, we found high persistency in the correlation of dependent variable, ROA between current and previous periods, due to the high correlation coefficients. This being so, we follow Blundell and Bond (1998) suggestion and in our study, we applied GMM system (1998) dynamic estimator, which is more appropriate to use in this study than GMM (1991) estimator.

Next we present GMM system (1998) results. According to the results of the Hansen test and second-order autocorrelation test we cannot reject the null hypothesis in either test for all estimations in this study. Therefore, we do not reject the validity of the restrictions of the instruments used and we do not reject the hypothesis of existence of second-order autocorrelation for the estimated models. This being so, the results of GMM system (1998) dynamic estimator are robust and, therefore, the empirical results are open to interpretation.

4.2 Intellectual Capital and Firm's Financial Performance

The results of estimations can be seen in Table 5.

Table 5. GMM system (1998) estimation results of equation (1) and (2)

Variables	*Dependent variable*: $ROA_{i,t}$			
	gr1:(1)	gr1:(2)	gr2:(1)	gr2:(2)
$ROA_{i,t-1}$	0.29702***	0.29450***	0.28013***	0.25155***
	(0.01666)	(0.02814)	(0.00778)	(0.01430)
$VAIC_{i,t}$	0.03774***		0.02036***	
	(0.00784)		(0.00209)	
$VAIC_{i,t-1}$	0.03307***		-0.00108	
	(0.00657)		(0.00182)	
$CEE_{i,t}$		0.12275**		0.16152***
		(0.04445)		(0.01036)
$HCE_{i,t}$		0.05947**		0.01630**
		(0.02124)		(0.00605)
$SCE_{i,t}$		-0.16861***		0.03662***
		(0.03628)		(0.00591)
$CEE_{i,t-1}$		0.17424***		-0.12682***
		(0.03306)		(0.00513)
$HCE_{i,t-1}$		0.02740*		-0.02294***
		(0.01591)		(0.00531)
$SCE_{i,t-1}$		-0.02585		0.03321***
		(0.01633)		(0.00435)
$Tlev_{i,t}$	-0.69910***	-0.69329***	0.00675***	0.00918***
	(0.01536)	(0.02290)	(0.00029)	(0.00035)
$RDintensity_{i,t}$	0.00211***	0.00247***	0.00003**	0.00002***
	(0.00003)	(0.00004)	(0.00002)	(0.00000)
$Age_{i,t}$	-0.02101	-0.02912	-0.03033**	-0.00270
	(0.04137)	(0.04632)	(0.01441)	(0.02883)
$Size_{i,t}$	-0.02038***	-0.02002	0.02029**	0.03630**
	(0.00394)	(0.01473)	(0.00632)	(0.01344)
$D_{08;09}$	-0.02854**	-0.02951**	-0.01876**	-1.05962**

	(0.01368)	(0.01227)	(0.00675)	(0.42978)
Constant	0.59356**	0.69762*	-0.58287**	0.00000
	(0.26267)	(0.39014)	(0.23623)	(0.00000)
Observations	758	758	5120	4833
F	1260000***	1990000***	940.65***	3278***
Hansen (N(0,1))	39.88	31.20	79.55	59.31
m1 (N(0,1))	-2.01***	-3.19***	-4.40***	-4.39***
m2 (N(0,1))	-1.23	-1.19	1.82*	1.66*
Notes:				
Standard errors in parentheses				
*** p<0.01; ** p<0.05; * p<0.1				

The results of estimates for group 1 of countries are as follow:

Equation (1): Results show that ROA in the previous period, VAIC in the current and previous period, RDintensity in the current period have a significant positive impact on FP. Whereas, Tlev in the current period, SIZE in the current period and $D_{08;09}$ have a significant negative effect on FP.

Equation (2): Results indicate that ROA in previous period, CEE in the current and previous period, HCE in the current and previous period and RDintensity in the current period have a significant positive relationship with FP, while, SCE in the current period, Tlev in the current period and $D_{08;09}$ have a significant negative effect on FP.

The results for group 2 are presented as follow:

Equation (1): Results show that ROA in the previous period, VAIC in the current period, RDintensity, SIZE in the current period have a significant positive association with FP, while AGE in the current, Tlev in the current period and $D_{08;09}$ have a significant negative effect on FP.

Equation (2): Results indicate that ROA in the previous period, CEE in the current period, HCE in the current period, SCE in the current and previous period, RDintensity and SIZE in the current period have a significant positive effect on FP, while, CEE in the previous period, HCE in previous period, Tlev in the current period and $D_{08;09}$ have significant negative effect on FP.

5. Discussion of the Empirical Results

Results of equation (1) suggest that IC enhances firms' FP of both group 1 and group 2. In the first group, VAIC in the current and previous periods positively impacts on firms' FP. For the second group, results show that VAIC in the current period positively impacts on firms' FP. Therefore, IC has a positive impact on firms' financial performance. These results do not allow us to reject the hypothesis H1. Efficient use of firms' IC enhances their FP. These results are in line with previous studies (Chen et al., 2005; Janosevic & Dzenopoljac, 2012; Phusavat, Comepa, Sitko-Lutek, & Ooi, 2011; Riahi-Belkaoui, 2003; Tan et al., 2007). Additionally, RDintensity, with a positive impact on ROA, suggests that firms with higher investment in R&D have greater levels of performance. However, in accordance with the results, the magnitude of the impact of RDintensity on ROA shows a greater relative

importance in firms in group 1 countries compared with firms in group 2. Furthermore, results reveal persistence between FP in the previous and current periods in both groups.

Regarding the results of equation (2), considering the components of VAIC, the results suggest that CEE, HCE and SCE in the current period have a positive impact on ROA, with the exception of SCE of the first group of countries, which has a negative impact on ROA. In relation to IC components in the previous period, results show that for the first group there is a positive impact of CEE and HCE on ROA and that SCE have a negative effect on ROA. Concerning the second group, only SCE in the previous period has a positive impact on ROA. Therefore, we cannot reject the previously formulated hypotheses H1a and H1b. However, we have to reject H1c due to the fact that SCE has a negative impact ROA in group 1. The results are broadly in line with previous studies (Bontis et al., 2015; Chen et al., 2005; Nimtrakoon, 2015; Ting & Lean, 2009; Tseng et al., 2013). European firms make efficient use of physical and financial capital, as this component, CEE, has a greater impact on firms' financial performance in both groups of countries. European firms may need to invest in employees' knowledge and competencies, which increases their capacity to innovate and develop new processes, products, and so on. The apparent lack of efficiency of firms' human capital limits the development of structural capital, which includes firms' internal elements, such as patents, software, trademarks, copyrights (Bontis et al., 2000; Sydler et al., 2014).

Concerning the impact of the global financial crisis 2008-2009 on FP, results show that the crisis had a negative effect on firm's financial performance in group 1 and group 2. The results may be a consequence of the reduction of demand as well as of investment, namely, in intangible assets. Leverage has a negative impact on firms' financial performance in group 1, while in group 2, leverage is seen to have a positive impact on firms' financial performance. This suggests that firms in group 1 may have greater difficulties in accessing credit, through facing unfavourable terms, given that group 1 is composed of the countries most affected by the global financial crisis, which had negative consequences for the amount and terms of credit.

6. Conclusion

The purpose of this study was to analyse the impact of intellectual capital (IC) on firms' financial performance (FP). To reach the paper's objective, this study was based on a sample composed by non-financial listed firms of eight European countries for the period between 2004 and 2015. Considering that financial crisis had different impact on European countries, eight countries were divided in two groups: (1) group 1 – Greece, Portugal, Spain and Italy; and (2) group 2 – Germany, France, Finland and United Kingdom (UK). As an econometric method, this study uses the dynamic estimator GMM system (1998).

Results suggest that IC enhances firms' FP on both groups of countries. In the first group, VAIC in the current and previous periods positively impacts on firms' FP. For the second group, the results show that VAIC in the current period positively impacts on firms' FP. Therefore, an efficient use of firms' IC enhances their FP.

When considering the components of VAIC, the results suggest that CEE, HCE and SCE in

the current period have a positive impact on FP, with the exception of SCE in the first group of countries, which has a negative impact on FP. In relation to VAIC components in the previous period, the results show that for the group 1 there is a positive impact of CEE and HCE on ROA and that SCE have a negative effect on FP. Concerning the group 2, only SCE of the previous period has a positive impact on FP. European firms make efficient use of physical and financial capital, as this component, CEE, has a greater impact on firms' financial performance in both groups of countries. European firms may need to invest on employees' knowledge and competencies, which increases their capacity to innovate and develop new processes, products, and so on. The apparent lack of efficiency of firms' human capital limits the development of structural capital, which includes firm's internal elements, such as patents, software, trademarks, copyrights.

The current study presents several contributions. This study explores the IC impact on FP of European listed firms, comparing firms from countries most affected by 2008 crisis with countries that apparently stood up to the global financial crisis better. Also, the study contributes to the literature of intellectual capital by using dynamic panel data analysis resorting to econometric models, which allowed us to use lagged variables.

On the practical side, we encourage managers to invest on employees' knowledge and competencies in order to increase firms' capacity to innovate and develop new processes. For police-makers, we suggest the creation and development of incentive programs in order to help firms finance IC.

The current study has the following limitations. The model VAIC does not measure the relational capital efficiency, therefore, we were unable to test the impact of relational capital on firms' financial performance. Also, not all countries in the same groups were affected in a similar way, making it difficult to individualize the results for each country. For future research, we suggest to extend the VAIC model by adding a Relational Capital Efficiency component in order to analyse its impact on firms' FP.

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