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The impact of financing decisions of intellectual capital on firms' financial performance and on the gap between firm's book value and market value

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Dedication

To my family and to you for always believing in me.

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The journey towards the conclusion of my Doctoral thesis was marked by the people I meet and the people that always supported me. I am grateful to all of you that contributed to the success of this journey. A new journey is just about to start. From my point of view, this is just the beginning of my contribution to science.

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Abstract

With the rise of innovation-driven era, knowledge has become the most important feature in the firm's value creating process. Academics and practitioners have been devoting their attention to the study of intellectual capital (IC) for the last two decades. IC is an emerging and fast-evolving concept and the fact that IC is a multidisciplinary and interdisciplinary concept makes the study of this complex phenomenon challenging. In this thesis, we address several research topics, some of which still are unexplored, regarding the impact of IC on firm's financial performance, growth opportunities and financing decisions. This investigation comprises sixth empirical studies focusing on Western European countries.

The first empirical paper compiled in this Doctoral thesis is entitled "A European Empirical Study of the Relationship Between Firms' Intellectual Capital, Financial Performance and Market Value". The purpose of this paper is two-fold: (1) to analyse the relationship between firms' IC, financial performance and market value; and (2) to analyse the relationship between ownership concentration and IC performance. Results reveal that IC is an important resource for firms' value creation and human capital is found to be a key factor of firms' wealth. Also, results indicate that ownership concentration and owners' management involvement constrain firms' IC performance.

The second empirical paper is entitled "Financial Performance and Intellectual Capital: An Empirical Analysis in the Context of the Euronext Market Countries". This paper seeks to analyse the impact of IC on financial performance, using the Value Added Intellectual Coefficient (VAIC™) method, in the European context. Results suggest that IC investments have a positive impact on firms' financial performance in the short and long run. The human capital component is of greater importance in enhancing firms' financial performance in both previous and current periods. Also, the results reveal that firms investing in R&D have greater financial performance, while the recent financial crisis produced a negative effect on financial performance in 2008 and 2009.

The third empirical paper is entitled "Intellectual Capital and Financial Performance Considering the Crisis Period: A European Empirical Study". The objective of this paper is to analyse the impact of the IC on the financial performance measured by Return on Assets in the European context for the period 2004-2015 as well as the global financial crisis effect on firms' financial performance. Results indicate that IC efficiency of the current period has a positive impact on the financial performance. The three components of VAIC™ Model – capital employed efficiency (CEE), human capital efficiency (HCE) and structural capital efficiency (SCE) of the current period have a positive impact on financial performance, except for SCE of that for the

first group of countries has a negative impact on financial performance. Also, findings suggest that the financial crisis negatively affects financial performance on both groups of countries.

The fourth empirical paper is entitled "Intellectual Capital, Growth Opportunities and Financial Performance in European Firms: Dynamic Panel Data Analysis". The purpose of this paper is three-fold: (1) to analyse the impact of IC and growth opportunities on firms' financial performance; (2) to analyse the moderating effect of IC on the relationship between growth opportunities and financial performance; and (3) to analyse the impact of IC on growth opportunities. Findings reveal that IC efficiency of the current period has a positive impact on firm's financial performance of high-tech, medium-tech and low-tech European firms and results indicate the non-linearity of the relationship between growth opportunities and firm's financial performance. Findings suggest that the positive relationship between growth opportunities and firm's financial performance is enhanced with the efficient use of firms' IC. Finally, results indicate that the efficient use of IC in the current period has a greater impact on growth opportunities in high-tech firms.

The fifth empirical paper is entitled "Intellectual Capital and High-tech Firms' Financing Choices in the European Context: A Panel Data Analysis" and aims to analyse the impact of IC on high-tech firms' financing choices. Results suggest that IC investments in high-tech firms have a negative impact on debt, but a positive effect on internal finance and equity issues. High-tech firms seem to rely on equity issues to finance their activities once internal finance is exhausted, avoiding debt to finance innovative projects. High-tech firms face considerable transactions costs, given the moderated adjustment of the long-term debt ratio towards the target ratio. Low ownership concentration brings a higher diversification of financing sources. Finally, the financial crisis had a negative effect on internal finance and a positive effect on long-term debt for high-tech firms.

Finally, the sixth empirical paper entitled "Intellectual Capital and Firms' Financing Decisions in the European Context: A Panel Data Analysis" analyses the impact of IC on firms' financing decisions, specifically if intensive IC firms follow the predictions of the main finance theories, i.e., trade-off theory (TOT) and pecking order theory (POT) in their capital structure decisions. Our findings show that IC components, such as human capital and structural capital negatively impact on firm's book leverage in both samples of firms, while the relational capital positively impacts on book leverage in high IC efficiency firms. However, results show that the interaction between the IC components, reduce the negative impact of the human capital and structural capital on book leverage. Regarding the remaining determinants of capital structure, the findings indicate a positive effect of collaterals on book leverage, which suggests the presence of information asymmetry problems as it is the case of high IC efficiency firms that face higher costs of capital and, thereby prefer internal financing due to the lower costs. The negative relationship between profitability and book leverage suggests that both types of firms prefer to resort firstly to internal financing. The negative effect of growth opportunities on book

leverage represents potential risk and, therefore, firms reduce their debt levels. The speed of adjustment of debt level towards the target debt ratio is greater in high IC efficiency firms than in low IC efficiency firms.

Keywords

Intellectual Capital; Financial Performance; Growth Opportunities; Financing Decisions; Ownership Concentration.

Resumo Alargado

Com a ascensão de uma era baseada na inovação, o conhecimento tornou-se o recurso mais importante para o processo de criação de valor das empresas. Nas ultimas duas décadas, o estudo do capital intelectual (IC) tem recebido a atenção por parte da academia e profissionais de diversas áreas. O IC é um conceito multidisciplinar e interdisciplinar, emergente e em rápido desenvolvimento, o que torna desafiante o estudo deste complexo fenómeno. Nesta tese de doutoramento são analisados vários tópicos, alguns ainda carecem de futura investigação, relacionados com o impacto do IC na performance financeira, nas oportunidades de crescimento e nas decisões de financiamento das empresas. Assim, esta investigação é constituída por seis estudos empíricos com foco nos países da Europa do Oeste.

O primeiro artigo cientifico desta tese de doutoramento tem como título "A European Empirical Study of the Relationship Between Firms' Intellectual Capital, Financial Performance and Market Value". O propósito deste artigo cientifico é (1) analisar a relação entre IC, performance financeira e o valor de mercado das empresas, e (2) analisar a relação entre a concentração de capital e a performance do IC. Os resultados revelam que o IC é um recurso importante para a criação de valor das empresas, sendo que o capital humano é considerado o fator chave da sustentabilidade das empresas. Os resultados também indicam que a concentração de capital e o envolvimento dos acionistas maioritários na gestão das empresas restringem a performance do IC.

O segundo estudo empírico intitulado "Financial Performance and Intellectual Capital: An Empirical Analysis in the Context of the Euronext Market Countries" e tem como objetivo analisar o impacto do IC na performance financeira das empresas pertencentes ao mercado bolsista Euronext. Os resultados sugerem que os investimentos em IC têm um impacto positivo na performance financeira quer a curto quer a médio-longo prazo. A componente capital humano apresenta o maior impacto no aumento da performance financeira quer no período corrente quer no período anterior. Os resultados também revelam que as empresas que mais investem em investigação e desenvolvimento apresentam melhor performance financeira. A recente crise financeira apresenta um efeito negativo na performance financeira das empresas nos anos de 2008 e 2009.

O terceiro estudo empírico tem como título "Intellectual Capital and Financial Performance Considering the Crisis Period: A European Empirical Study". Os seus objetivos são (1) analisar o impacto do IC na performance financeira no contexto Europeu e (2) o efeito da crise financeira na performance financeira das empresas. Os resultados indicam que a eficiência do IC no período corrente apresenta um impacto positivo na performance financeira. As três componentes do VAIC™, i.e., CEE, HCE e SCE, apresentam um impacto positivo na performance

financeira do período corrente. Os resultados também sugerem que a crise financeira afeta negativamente a performance financeira das empresas.

O quarto estudo empírico intitulado "Intellectual Capital, Growth Opportunities and Financial Performance in European Firms: Dynamic Panel Data Analysis", tem como objetivos: (1) analisar o impacto do IC e oportunidades de crescimento na performance financeira das empresas; (2) analisar o efeito moderador do IC na relação entre oportunidades de crescimento e performance financeira das empresas; e (3) analisar o impacto do IC nas oportunidades de crescimento. Os resultados sugerem que a eficiência do IC no período corrente tem um impacto positivo na performance financeira das empresas europeias high-tech, medium-tech e low-tech, bem como a não linearidade das oportunidades de crescimento na performance financeira das empresas. Os resultados também sugerem que a relação positiva entre oportunidades de crescimento e performance financeira aumenta com o uso eficiente do IC por parte das empresas. Finalmente, os resultados também sugerem que o uso eficiente do IC no período corrente tem maior impacto nas empresas high-tech.

O quinto estudo empírico é intitulado "Intellectual Capital and High-tech Firms' Financing Choices in the European Context: A Panel Data Analysis" e prentede analisar o impacto do IC nas escolhas de financiamento das empresas *high-tech*. Os resultados sugerem que os investimentos em IC nas empresas *high-tech* têm um efeito negativo no endividamento e um efeito positivo no recurso ao financiamento interno e à emissão de ações. Aparentemente, as empresas *high-tech* recorrem à emissão de ações para financiar as suas atividades quando o financiamento interno se esgota evitando o recurso ao endividamento para financiar as suas atividades inovadoras. As empresas *high-tech* apresentam custos de transação consideráveis dado que apresentam um ajustamento moderado do seu endividamento de médio/longo prazo em direção o rácio ótimo de endividamento. Uma baixa concentração da propriedade de capital estimula uma maior diversificação das fontes de financiamento das empresas *high-tech*. Finalmente, a crise financeira apresenta um efeito negativo no recurso ao financiamento interno e um efeito positivo no recurso ao endividamento de médio/longo prazo.

Finalmente, o sexto e último estudo empírico desta tese de doutoramento intitulado "Intellectual Capital and Firms' Financing Decisions in the European Context: A Panel Data Analysis" e tem como objetivo analisar o impacto do IC nas decisões de financiemaneto das empresas, mais especificamente, se as empresas intensivas em IC seguem as previsões das principais teorias financeiras, i.e., trade-off theory (TOT) and pecking order theory (POT), nas decisões da sua estrutura de capital. Os resultados sugerem que duas as componentes do IC, i.e., capital humano e capital estrutural, têm um impacto negativo no endividamento de ambas as amostras estudadas, enquanto que a outra componente do IC, i.e., capital relacional, impacta positivamente o endividamento das empresas com maior eficiência no uso do IC. Contudo, os resultados sugerem que as interações entre as componentes do IC reduzem o impacto negativo do capital humano e estrutural no endividamento. Relativamente aos

restantes determinantes da estrutura de capital das empresas, os resultados indicam um positivo efeito dos colaterais no endividamento, sugerindo a presença de problemas de assimetria de informação no grupo de empresas com maior eficiência do IC que apresentam um custo do capital superior e, consequentemente, preferem o financiamento interno. A relação negativa entre a rendibilidade e o endividamento sugere que ambos os grupos de empresas preferem recorrer ao financiamento interno como primeira opção para financiar as suas atividades. O efeito negativo das oportunidades de crescimento no endividamento, representam um risco potencial, e assim, as empresas tendem a reduzir os seus níveis de endividamento. Finalmente, os resultados também sugerem que a velocidade de ajustamento em direção ao rácio ótimo de endividamento, é maior nas empresas com maior eficiência do IC.

Palavras-chave

Capital Intelectual; *Performance* Financeira; Oportunidades de Crescimento; Decisões de Financiamento; Concentração da Propriedade do Capital.

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CHAPTER 1

Introduction

1. Motivation and Rationale

Two decades have passed and the study of intellectual capital (IC) is still in its embryonic stages (Kristandl and Bontis, 2007). IC is an emerging and fast-evolving concept (Ilyin, 2014; Mehralian, Rasekh, Akhavan, and Sadeh, 2012) that has been reaching the attention of researchers and practitioners. The fact that IC is a multidisciplinary and interdisciplinary concept (Bontis, 1999; Marr and Chatzkel, 2004; Morariu, 2014) makes the study of this complex phenomenon challenging.

With the rise of the innovation-driven era, knowledge has become the most important feature in the firm's value creating process (Bontis, Dragonetti, Jacobsen, and Roos, 1999; Cabrita and Bontis, 2008; Drucker, 1993; Gho, 2005; Joshi, Cahill, Sidhu, and Kansal, 2013; Stewart, 1997; Sveiby, 1997). The shift from a manufacturing-based or traditional economy towards a knowledge-based economy, i.e., production based on tangible assets, such as land, machinery and capital, to intangible assets such as knowledge, skills and creativity (Clarke, Seng, and Whiting, 2011; Gho, 2005; Haji, 2016; Labra and Sánchez, 2013), brought to light the importance of IC as a new source of competitive advantage (Bontis, 1998; Bontis, Janosevic, and Dzenopoljac, 2015; Dzenopoljac, Janosevic, and Bontis, 2016; Itami, 1987; Roos and Roos, 1997; St-Pierre and Audet, 2011) since it is difficult to replicate or to use it as efficiently (FitzPatrick, Davey, Muller, and Davey, 2013; Zéghal and Maaloul, 2010). Furthermore, IC affects a firm's growth opportunities (Liu and Wong, 2011), enhances the firm's innovativeness (Bontis, 1999; Bontis *et al.*, 2015; Chi, Lieu, Hung, and Cheng, 2016; Curado, 2008; Lev, 2001; Yu, Wang, and Chang, 2015) and is a source of firm value (Bontis *et al.*, 1999; Bontis *et al.*, 2015; Dzenopoljac *et al.*, 2016; Edvinsson, 1997; El-Bannany, 2015; Hall, 1992; Hsu and Fang, 2009; Mavridis, 2005; Stewart, 1997; Yalama and Coskun, 2007), firm earnings (Harrison and Sullivan, 2000; Liu and Wong, 2011; Maaloul, Ben Amar, and Zeghal, 2016; Roos and Roos, 1997; Rylander, Jacobsen, and Roos, 2000; Zavertiaeva, 2016) and firm wealth (Edvinsson, 1997; Firer and Williams, 2003; Guerrini, Romano, and Leardini, 2014; Martinez and Garcia-Meca, 2005; Read, 1996; Riahi-Belkaoui, 2003; Stewart, 1997; Yang and Lin, 2009).

As part of the shift to a knowledge-based economy, several authors have focused their research on the importance of disclosure of IC in financial statements (e.g., Arvidsson, 2011; Curado, Henriques, and Bontis, 2011; FitzPatrick *et al.*, 2013; Ibadin and Oladipupo, 2015; Orens, Aerts, and Lybaert, 2009; Petty and Guthrie, 2000). This is due to the fact that traditional accounting

methods fail to disclose IC (Arvidsson, 2011; Ibadin and Oladipupo, 2015; Nazari and Herremans, 2007; Nimtrakoon, 2015), and thus, the hidden value omitted from financial statements is pointed out as the explanation for the difference between a firm's market and book value (Edvinsson, 1997; Firer and Williams, 2003; Gho, 2005; Haji, 2016; Lev, 2001; Pulic, 1998; Salamudin, Bakar, Ibrahim, and Hassan, 2010; Sveiby, 1997). Moreover, several studies concluded that the voluntary disclosure of IC enhances the firm's market value (Abdolmohammadi, 2005; Haji, 2016; Orens *et al.*, 2009), reduces the cost of capital (Arvidsson, 2011; Orens *et al.*, 2009; Zavertiaeva, 2016) and information asymmetry (Abdolmohammadi, 2005; Arvidsson, 2011; Zavertiaeva, 2016), thereby enhancing the efficient allocation of resources in the stock market. Additionally, IC disclosure also mitigates agency problems (Arvidsson, 2011).

As a response to the need for IC measurement and valuation, a significant number of measurement models have evolved from different disciplines (Andriessen, 2004; Bontis, 2001; Bontis *et al.*, 1999; Janosevic and Dzenopoljac, 2012; Nazari and Herremans, 2007; Sveiby, 2001). However, there is no single best model because each one has its pros and cons (Lu, Wang, Tung, and Lin, 2010; Sydler, Haefliger, and Pruksa, 2014) according to the objectives of IC measurement (Nazari and Herremans, 2007; Sveiby, 2001; Sydler *et al.*, 2014). For this study, it is not our purpose to develop an IC measurement model. Therefore, this study uses VAIC™ (Pulic, 1998, 2000) to measure IC performance, which is widely accepted by academics and practitioners as a good indicator of IC efficiency (Bontis *et al.*, 2015).

2. Research Objectives

IC is a key resource for firms' value creation process and to create sustainable competitive advantages (Holland, 2006; OECD, 2013). The European Union (EU) acknowledges that innovations and the human factor – IC – are the main drivers of countries and firms' future growth as well as individuals' development (Holland, 2006; OECD, 2013). Despite the recognition that IC strongly contributes to firms' value creation through employees' knowledge, organizational processes, innovation and relationships (Serenko and Bontis, 2004; Wang, Wang, and Liang, 2014; Youndt, Subramaniam, and Snell, 2004), the innovation environment in the EU remains weak (Cincera, Ravet, and Veugelers, 2015). Access to external finance and the recent financial crisis have accentuated the scarcity of financial resources, mainly for funding investment in intangible assets, such as IC (Cincera *et al.*, 2015; Hall, Moncada-Paternò-Castello, Montresor, and Vezzani, 2016).

Previous studies investigated the impact of IC on firms' financial performance and market value across different countries and industries. Although most studies show a positive and significant effect of IC on firms' financial performance, some produce contradictory results, which may be attributed to countries' or industry specificities (e.g., Bontis, 1998; Denicolai, Ramusino,

and Sotti, 2015; Morariu, 2014; Nimtrakoon, 2015; Tseng, Lan, Lu, and Chen, 2013; ul Rehman, Ilyas, and ur Rehman, 2011). Empirical evidence of the impact of IC on firms' market value also shows contradictory results (e.g., Ballester, Garcia-Ayuso, and Livnat, 2003; Chan, Lakonishok, and Sougiannis, 2001; Chen, Cheng, and Hwang, 2005; Nimtrakoon, 2015; Ramirez and Hachiya, 2012; Xing, 2014).

Several studies suggest that ownership concentration might have a positive impact on firm performance and firm value (Denis and McConnell, 2003; Shleifer and Vishny, 1986). However, agency problems might be noticed among firms with ownership concentration. On one hand, the lack of willingness to share control may block the entrance of qualified and well-trained managers (Greco, Ferramosca, and Allegrini, 2014; Miller and Le Breton-Miller, 2006; Westhead and Howorth, 2006). On the other hand, agency problems might be solved in firms managed by their owners (McVey and Draho, 2005; Miller and Le Breton-Miller, 2006) due to the absence of divergent interests between owners and managers (Lemmon and Lins, 2003). In this connection, Saleh, Rahman, and Hassan (2009) and Greco *et al.* (2014) studied the impact of ownership concentration and IC and the results were contradictory.

IC provides firms with innovative capacity (Chen *et al.*, 2005; Lev and Sougiannis, 1996). This innovative capacity is recognised as a source of value creation and firm growth. IC affects the dynamics of a firm's growth opportunities due to the capacity to produce technological innovations (Liu and Wong, 2011) through investment in research and development (R&D) activities (Chauvin and Hirschey, 1993; Chen *et al.*, 2005; Lev and Sougiannis, 1996). These investments imply resorting to some firm resources that do not have a physical or financial form (Lev, 2004), such as human capital. Firms in advanced technology sectors need to invest in their human capital as they are part of firms' core competencies. In this way, firms can upgrade their technology skills and innovativeness, which is not easy to imitate by their competitors, and are therefore able to develop new products and/or services (Prahalad and Hamel, 1990; Seyoum, 2004). To finance innovative activities, firms with high levels of intangible assets prefer to use internal funds (Carpenter and Petersen, 2002; Hall and Lerner, 2010; Magri, 2014; Myers, 1984; Myers and Majluf, 1984). The use of internal finance is especially important in high-IC firms due to the fact that (1) investment in IC presents a lack of collateral (Hall and Lerner, 2010; Magri, 2014), and (2) the high risk of high-IC firms due to the uncertainty of their innovative activities (Amit, Glosten, and Muller, 1990; Carpenter and Petersen, 2002), which prevents them from accessing credit on favourable terms (Carpenter and Petersen, 2002; Jensen and Meckling, 1976; Magri, 2014). Studies on the relationship between IC, growth opportunities and financing decisions are scarce. Liu and Wong (2011) found a positive relationship between IC and leverage, especially for high-IC firms since they deliver promising growth opportunities to the market.

Based on the above-mentioned literature, this study has the following specific objectives: (1) to analyse the impact of IC on firms' financial performance; (2) to analyse the impact of IC on

firms' financial performance considering the financial crisis period; (3) to analyse the impact of IC on firms' market value; (4) to analyse the impact of ownership concentration and owner management involvement on IC performance; (5) to analyse the moderating effect of IC on the relationship between growth opportunities and financial performance; (6) to analyse the impact of IC on growth opportunities; and (7) to test the relationship between IC and firms' financing decisions.

3. Contributions

This study presents several contributions to the literature on IC. First, to our knowledge this is the first study exploring a large sample of non-financial listed firms across countries in Western Europe for the period between 2004 and 2015. Therefore, 12 years of analysis allowed us to make a longitudinal study. Furthermore, the sample was explored in several ways. It was studied as a full sample and subsamples were created according to firms' research and development intensity; firms' IC efficiency; and also, countries according to the degree to which they were affected by the recent financial crisis. Second, the use of econometric modelling techniques, i.e., dynamic panel data and specifically the Generalized Method of Moments – GMM system (1998), allowed us to test the effect of lagged explanatory variables, namely, IC and IC components, on firms' financial performance and market value. This is a major contribution to the IC literature since the outputs of IC need time to reach fruition and we can expand our knowledge of the impact of IC on firms' financial performance and market value. Third, this study explores corporate governance variables and their impact on IC performance. According to the results, we argue that ownership concentration and owner management involvement constrains IC performance. This brings to light the importance of management for IC performance. Fourth, by exploring the financial literature, this study connects IC to firms' growth opportunities and financing decisions. The IC literature lacks knowledge of how IC affects firms' growth opportunities and financing decisions. We argue that IC has a greater impact on firms' growth opportunities, especially in high-tech firms. We also advocate that IC contributes negatively to firms resorting to debt, which may suggest that firms tend to rely on internal financing to fund their innovative activities. Finally, we anticipate the results of this study will be of interest to academics and firms' stakeholders, specifically managers, shareholders, investors and government agencies.

4. Publications and Conferences Presentation

The content of Chapter 3 was published as a research paper:

Sardo, F. and Serrasqueiro, Z. (2017). A European Empirical Study of the Relationship Between Firms' Intellectual Capital, Financial Performance and Market Value. *Journal of Intellectual Capital*, 18(4), pp.771-788. Doi: https://dx.doi.org/10.1108/JIC-10-2016-0105.

Chapter 4 is published as a book chapter:

Sardo, F., and Serrasqueiro, Z. (2017). *Financial Performance and Intellectual Capital: An Empirical Analysis in the Context of the Euronext Market Countries*. In A. Tavidze (Ed.), Progress in Economics Research (Vol. 37, pp. 103-117). New York: Nova Science Publishers, Inc.

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Additionally, Chapter 6 was published as a research paper:

Sardo, F. and Serrasqueiro, Z. (forthcoming 2018). Intellectual Capital, Growth Opportunities, and Financial Performance in European Firms: Dynamic Panel Data Analysis. *Journal of Intellectual Capital*, 19(5).

The material of Chapter 7 was submitted to the International Journal of Managerial Finance as paper entitled “Intellectual Capital and High-Tech Firms’ Financing Choices in the European Context: A Panel Data Analysis”, where it is under the peer-review process.

The content of Chapter 8 was submitted to the Management Science as paper entitled “Intellectual Capital and Firms’ Financing Decisions in the European Context: A Panel Data Analysis”, where it is under the peer-review process.

5. Structure of the Thesis

The remainder of this Ph.D. thesis is organized in seven chapters.

Chapter 2 provides a theoretical background to IC, which includes the IC concept and IC dimensions, i.e., human capital, structural capital and relational capital. This chapter also presents several proxies for IC and IC dimension measurement.

Chapter 3 corresponds to the first empirical paper included in this Ph.D. thesis, entitled “A European Empirical Study of the Relationship Between Firms' Intellectual Capital, Financial Performance and Market Value”. The purpose of this paper is two-fold: (1) to analyse the relationship between firms' intellectual capital (IC), financial performance and market value; and (2) to analyse the relationship between ownership concentration and IC performance. Based on a sample of non-financial listed firms belonging to 14 countries in Western Europe, for the period between 2004 and 2015, and resorting to GMM system (1998), a dynamic panel data estimator, results reveal that IC is an important resource for firms' value creation and human capital is found to be a key factor of firms' wealth. The results also indicate that ownership concentration and owner management involvement constrain firms' IC performance.

Chapter 4 includes the second empirical paper entitled “Financial Performance and Intellectual Capital: An Empirical Analysis in the Context of the Euronext Market Countries”. This paper seeks to analyse the impact of intellectual capital on financial performance, using the Value Added Intellectual Coefficient (VAIC™) method, in the European context. Based on a sample of non-financial listed firms in Euronext stock market countries (Belgium, France, the Netherlands and Portugal) for the period between 2005 and 2015, we explore the impact of IC on firms’ financial performance, using dynamic panel estimators, specifically the GMM system (1998) dynamic estimator. Results suggest that IC investments have a positive impact on firms’ financial performance in the short and long run. The human capital component is of greater importance in enhancing firms’ financial performance in both previous and current periods. Also, the results reveal that firms investing in R&D have greater financial performance, while the recent financial crisis produced a negative effect on financial performance in 2008 and 2009.

Chapter 5 corresponds to the third empirical paper entitled "Intellectual Capital and Financial Performance Considering the Crisis Period: A European Empirical Study". The objective of this paper is to analyse the impact of intellectual capital (IC) on financial performance measured by Return on Assets in the European context for the period 2004-2015 as well as the effect of the global financial crisis on firms' financial performance. In order to differentiate the financial crisis impact on financial performance in 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 the United Kingdom (UK). The estimation method used in this study is the GMM system (1998) estimator. Results indicate that IC efficiency in the current period has a positive impact on financial performance. The three components of the VAIC™ Model - CEE, HCE and SCE in the current period have a positive impact on financial performance, except for SCE for the first group of countries, which has a negative impact on financial performance. The findings also suggest that the financial crisis negatively affects financial performance in both groups of countries.

Chapter 6 corresponds to the fourth empirical paper entitled "Intellectual Capital, Growth Opportunities and Financial Performance in European Firms: Dynamic Panel Data Analysis". The purpose of this paper is three-fold: (1) to analyse the impact of IC and growth opportunities on firms' financial performance; (2) to analyse the moderating effect of IC on the relationship between growth opportunities and financial performance; and (3) to analyse the impact of IC on growth opportunities. The sample of non-financial listed firms, consisting of 14 European countries for the period between 2004 and 2015, was divided into subsamples according to the intensity of research and development activities. The estimation method used is the GMM system (1998) estimator. The results reveal that IC efficiency in the current period has a positive impact on the financial performance of high-tech, medium-tech and low-tech European firms and indicate the non-linearity of the relationship between growth opportunities and firm's' financial performance. The findings suggest that the positive relationship between growth opportunities and firms' financial performance is enhanced by the efficient use of firms' IC. Finally, the results indicate that the efficient use of IC in the current period has a greater impact on growth opportunities in high-tech firms.

Chapter 7 includes the fifth empirical paper entitled "Intellectual Capital and High-tech Firms' Financing Choices in the European Context: A Panel Data Analysis". This paper aims to analyse the impact of intellectual capital (IC) on firms' financing choices. This study uses a sample of high-tech listed firms across 14 Western European countries for the period between 2004 and 2015. The data set was gathered from the DATASTREAM database by Thomson Reuters. The data set has an unbalanced panel structure, where the number of years' firms presented in the research sample varies between 3 and 12. The estimation method used is the GMM system (1998) estimator, a dynamic panel estimator. Results suggest that IC investments in high-tech firms have a negative impact on debt, but a positive effect on internal finance and equity

issues. High-tech firms seem to rely on equity issues to finance their activities once internal finance is exhausted, avoiding debt to finance innovative projects. High-tech firms face considerable transactions costs, given the moderated adjustment of the long-term debt ratio towards the target ratio. Low ownership concentration brings a higher diversification of financing sources. The financial crisis had a negative effect on internal finance and a positive effect on long-term debt for high-tech firms.

Chapter 8 contains the sixth empirical paper entitled "Intellectual Capital and Firms' Financing Decisions in the European Context: A Panel Data Analysis". The aim of this paper is to analyse the impact of IC on firms' financing decisions, specifically if intensive IC firms follow the predictions of the main finance theories, i.e., TOT and POT in their capital structure decisions. Based on a sample of 1400 non-financial listed firms across 14 countries in Western Europe for the period between 2004 and 2015, we created two subsamples containing High IC Efficiency Firms and Low IC Efficiency firms. Our findings show that IC components, such as human capital and structural capital negatively impacts on firm's book leverage in both samples of firms, while the relational capital positively impacts book leverage in high IC efficiency firms. However, results show that the interaction between the IC components, reduce the negative impact of the human capital and structural capital on book leverage. Regarding the remaining determinants of capital structure, the findings indicate a positive effect of collaterals on book leverage, which suggests the presence of information asymmetry problems as it is the case of high IC efficiency firms that face higher costs of capital and, thereby prefer internal financing due to the lower costs. The negative relationship between profitability and book leverage suggests that both types of firms prefer to resort firstly to internal financing. The negative effect of growth opportunities on book leverage represents potential risk and, therefore, firms reduce their debt levels. The speed of adjustment of debt level towards the target debt ratio is greater in high IC efficiency firms than in low IC efficiency firms.

Finally, in Chapter 9, we conclude this Ph.D. thesis by summarizing the main findings, indicating the practical implications and limitations of this research and suggesting future lines of research.

References

Abdolmohammadi, M. J. (2005). Intellectual capital disclosure and market capitalization. *Journal of Intellectual Capital, 6*(3), 397-416.

Amit, R., Glosten, L., and Muller, E. (1990). Entrepreneurial Ability, Venture Investments, and Risk Sharing. *Management Science, 36*(10), 1233-1246.

Andriessen, D. (2004). *Making sense of Intellectual capital: Designing a Method for the Valuation of Intangibles*. Boston: Butterworth-Heinemann.

Arvidsson, S. (2011). Disclosure of non-financial information in the annual report: A management-team perspective. *Journal of Intellectual Capital, 12*(2), 277-300.

Ballester, M., Garcia-Ayuso, M., and Livnat, J. (2003). The economic value of the R&D intangible asset. *European Accounting Review, 12*(4), 605-633.

Bontis, N. (1998). Intellectual capital: an exploratory study that develops measures and models. *Management Decision, 36*(2), 63-76.

Bontis, N. (1999). Managing organizational knowledge by diagnosing intellectual capital: Framing and advancing the state of the field. *International Journal of Technology Management, 18*(5-8), 433–462.

Bontis, N. (2001). Assessing knowledge assets: A review of the models used to measure intellectual capital. *International Journal of Management Reviews, 3*(1), 41-60.

Bontis, N., Dragonetti, N. C., Jacobsen, K., and Roos, G. (1999). The knowledge toolbox: a review of the tools available to measure and to manage intangible resources. *European Management Journal, 17*(4), 391-402.

Bontis, N., Janosevic, S., and Dzenopoljac, V. (2015). Intellectual capital in Serbia's hotel industry. *International Journal of Contemporary Hospitality Management, 27*(6), 1365-1384.

Cabrita, M. d. R., and Bontis, N. (2008). Intellectual capital and business performance in the Portuguese banking industry. *International Journal of Technology Management, 43*(1-3), 212-237.

Carpenter, R. E., and Petersen, B. C. (2002). Capital Market Imperfections, High-Tech Investment, and New Equity Financing. *The Economic Journal, 112*(477), 54-72.

Chan, L. K. C., Lakonishok, J., and Sougiannis, T. (2001). The stock market valuation of research and development expenditures. *The Journal of Finance, 56*(6), 2431-2456.

Chauvin, K. W., and Hirschey, M. (1993). Advertising, R&D expenditures and the market value of the firm. *Financial Management, 22*(4), 128-140.

Chen, M., Cheng, S., and Hwang, Y. (2005). An empirical investigation of the relationship between intellectual capital and firms' market value and financial performance. *Journal of Intellectual Capital, 6*(2), 159-176.

Chi, C. W., Lieu, P. T., Hung, K., and Cheng, H. W. (2016). Do industry or firm effects drive performance in Taiwanese knowledge-intensive industries? *Asia Pacific Management Review, 21*(3), 170-179.

Cincera, M., Ravet, J., and Veugelers, R. (2015). The sensitivity of R&D investments to cash flows: comparing young and old EU and US leading innovators. *Economics of Innovation and New Technology, 25*(3), 1-17.

Clarke, M., Seng, D., and Whiting, R. H. (2011). Intellectual capital and firm performance in Australia. *Journal of Intellectual Capital, 12*(4), 505-530.

Curado, C. (2008). Perceptions of knowledge management and intellectual capital in the banking industry. *Journal of Knowledge Management, 12*(3), 141–155.

Curado, C., Henriques, L., and Bontis, N. (2011). Intellectual capital disclosure payback. *Management Decision, 49*(7-8), 1080-1098.

Denicolai, S., Ramusino, E. C., and Sotti, F. (2015). The impact of intangibles on firm growth. *Technology Analysis & Strategic Management, 27*(2), 219-236.

Denis, D. K., and McConnell, J. J. (2003). International corporate governance. *Journal of Financial and Quantitative Analysis, 38*(1), 1-36.

Drucker, P. (1993). *Post-Capitalist Society*. Oxford: Butterworth-Heinemann.

Dzenopoljac, V., Janosevic, S., and Bontis, N. (2016). Intellectual capital and financial performance in the Serbian ICT industry. *Journal of Intellectual Capital, 17*(2), 373-396.

Edvinsson, L. (1997). Developing intellectual capital at Skandia. *Long Range Planning, 30*(3), 320-331.

El-Bannany, M. (2015). Explanatory study about the intellectual capital performance of banks in Egypt. *International Journal of Learning and Intellectual Capital, 12*(3), 270-286.

Firer, S., and Williams, M. (2003). Intellectual capital and traditional measures of corporate performance. *Journal of Intellectual Capital, 4*(3), 348-360.

FitzPatrick, M., Davey, J., Muller, L., and Davey, H. (2013). Value-creating assets in tourism management: Applying marketing's service-dominant logic in the hotel industry. *Tourism Management, 36*, 86-98.

Gho, P. C. (2005). Intellectual capital performance of commercial banks in Malaysia. *Journal of Intellectual Capital, 6*(3), 385-396.

Greco, G., Ferramosca, S., and Allegrini, M. (2014). Exploring intellectual capital in family firms. An empirical investigation. *International Journal of Learning and Intellectual Capital, 11*(2), 91-106.

Guerrini, A., Romano, G., and Leardini, C. (2014). Does intellectual capital efficiency affect financial performance the case of Italian listed firms. *International Journal of Learning and Intellectual Capital, 11*(2), 127-148.

Haji, A. A. (2016). Trend of hidden values and use of intellectual capital information Evidence from Malaysia. *Accounting Research Journal, 29*(1), 81-105.

Hall, B. H., and Lerner, J. (2010). The Financing of R&D and Innovation. In B. H. Hall and N. Rosenberg (Eds.), *Handbook of the Economics of Innovation*. North Holland: Elsevier.

Hall, B. H., Moncada-Paternò-Castello, P., Montresor, S., and Vezzani, A. (2016). Financing constraints, R&D investments and innovative performances: new empirical evidence at the firm level for Europe. *Economics of Innovation and New Technology, 25*(3), 183-196.

Hall, R. (1992). The strategic analysis of intangible resources. *Strategic Management Journal,, 13*(2), 135–144.

Harrison, S., and Sullivan, P. H. (2000). Profiting from intellectual capital – learning from leading companies. *Journal of Intellectual Capital, 1*(1), 33-46.

Holland, J. (2006). Fund management, intellectual capital, intangibles and private disclosure. *Managerial Finance, 32*(4), 281.

Hsu, H. Y., and Fang, W. (2009). Intellectual capital and new product development performance: The mediating role of organizational learning capability. *Technological Forecasting and Social Change, 76*(5), 664-677.

Ibadin, P. O., and Oladipupo, O. A. (2015). Determinants of Intangible Assets Disclosure in Quoted Companies in Nigeria. *Asian Journal of Accounting and Governance, 6*, 13-25.

Ilyin, D. S. (2014). The Impact Of Intellectual Capital On Companies` Performance: Evidence From Emerging Markets. *Korporativnye finansy*(4), 46-66.

Itami, H. (1987). *Mobilizing Invisible Assets*. Cambridge, MA: Harvard University Press.

Janosevic, S., and Dzenopoljac, V. (2012). Impact of intellectual capital on financial performance of Serbian companies. *Actual Problems of Economics,133*(7), 554-564.

Jensen, M., and Meckling, W. (1976). Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. *Journal of Financial Economics, 3*, 305-360.

Joshi, M., Cahill, D., Sidhu, J., and Kansal, M. (2013). Intellectual capital and financial performance: An evaluation of the Australian financial sector. *Journal of Intellectual Capital, 14*(2), 264-285.

Kristandl, G., and Bontis, N. (2007). Constructing a definition for intangibles using the resource based view of the firm. *Management Decision, 45*(9), 1510-1524.

Labra, R., and Sánchez, M. P. (2013). National intellectual capital assessment models: A literature review. *Journal of Intellectual Capital, 14*(4), 582-607.

Lemmon, M. L., and Lins, K. V. (2003). Ownership Structure, Corporate Governance and Firm Value: Evidence from the East Asian Financial Crisis. *The Journal of Finance, 58*(4), 1445-1468.

Lev, B. (2001). *Intangibles: Management, Measurement, and Reporting*. Washington D.C.: Brookings Institution Press.

Lev, B. (2004). Sharpening the intangibles edge. *Harvard Business Review, 82*(6), 109-116.

Lev, B., and Sougiannis, T. (1996). The capitalization, amortization, and value-relevance of R&D. *Journal of Accounting and Economics, 21*(1), 107-138.

Liu, Q., and Wong, K. P. (2011). Intellectual Capital and Financing Decisions: Evidence from the US Patent Data. *Management Science, 57*(10), 1861-1878.

Lu, W.-M., Wang, W.-K., Tung, W.-T., and Lin, F. (2010). Capability and efficiency of intellectual capital: The case of fabless companies in Taiwan. *Expert Systems with Applications, 37*(1), 546-555.

Maaloul, A., Ben Amar, W., and Zeghal, D. (2016). Voluntary disclosure of intangibles and analysts' earnings forecasts and recommendations. *Journal of Applied Accounting Research, 17*(4), 421-439.

Magri, S. (2014). Does issuing equity help R&D activity? Evidence from unlisted Italian high-tech manufacturing firms. *Economics of Innovation and New Technology, 23*(8), 825-854.

Marr, B., and Chatzkel, J. (2004). Intellectual capital at the crossroads: managing, measuring, and reporting of IC. *Journal of Intellectual Capital, 5*(2), 224-229.

Martinez, I., and Garcia-Meca, E. (2005). Assessing the quality of disclosure on intangibles in the Spanish capital market. *European Business Review, 17*(4), 305-313.

Mavridis, D. (2005). Intellectual capital performance drivers in the Greek banking sector. *Management Research News, 28*(5), 43-62.

McVey, H., and Draho, J. (2005). U.S. family-run companies – They may be better than you think. *Journal of Applied Corporate Finance, 17*(4), 134-143.

Mehralian, G., Rasekh, H. R., Akhavan, P., and Sadeh, M. R. (2012). The Impact of Intellectual Capital Efficiency on Market Value: An Empirical Study from Iranian Pharmaceutical Companies. *Iranian Journal of Pharmaceutical Research, 11*(1), 195-207.

Miller, D., and Le Breton-Miller, I. (2006). Family governance and firm performance: agency, stewardship, and capabilities. *Family Business Review, 19*(1), 73-87.

Morariu, C. M. (2014). Intellectual capital performance in the case of Romanian public companies. *Journal of Intellectual Capital, 15*(3), 392-410.

Myers, S. (1984). The Capital Structure Puzzle. *The Journal of Finance, 39*(3), 575-592.

Myers, S., and Majluf, N. (1984). Corporate Financing and Investment Decisions when Firms Have Information That Investors Do Not Have. *Journal of Financial Economics, 13*, 187-221.

Nazari, J. A., and Herremans, I. M. (2007). Extended VAIC model: Measuring intellectual capital components. *Journal of Intellectual Capital, 8*(4), 595-609.

Nimtrakoon, S. (2015). The relationship between intellectual capital, firms' market value and financial performance Empirical evidence from the ASEAN. *Journal of Intellectual Capital, 16*(3), 587-618.

OECD. (2013). Supporting Investment in Knowledge Capital, Growth and Innovation.

Orens, R., Aerts, W., and Lybaert, N. (2009). Intellectual capital disclosure, cost of finance and firm value. *Management Decision, 47*(10), 1536-1554.

Petty, R., and Guthrie, J. (2000). Intellectual capital literature review: Measurement, reporting and management. *Journal of Intellectual Capital, 1*(2), 155-176.

Prahalad, C. K., and Hamel, G. (1990). The core competence of the corporation. *Harvard Business Review, 68*, 79-91.

Pulic, A. (1998). *Measuring the Performance of intellectual potential in Knowledge Economy.* Paper presented at the 2nd McMaster World Congress on Measuring and Managing Intellectual Capital, 21-23 January 1998, Hamilton, Ontario.

Pulic, A. (2000). VAIC (TM) - an accounting tool for IC management. *International Journal of Technology Management, 20*(5-8), 702-714.

Ramirez, P. G., and Hachiya, T. (2012). Intangible assets and market value of Japanese industries and firms. *International Journal of Technology Management, 59*(1-2), 1-21.

Read, W. H. (1996). Managing the knowledge-based organization: Five principles every manager can use. *Technology Analysis & Strategic Management, 8*(3), 223-232.

Riahi-Belkaoui, A. (2003). Intellectual capital and firm performance of US multinational firms: a study of the resource-based and stakeholder views. *Journal of Intellectual Capital, 4*(2), 215-226.

Roos, G., and Roos, J. (1997). Measuring your company's intellectual performance. *Long Range Planning, 30*(3), 413-426+325.

Rylander, A., Jacobsen, K., and Roos, G. (2000). Towards improved information disclosure on intellectual capital. *International Journal of Technology Management, 20*(5-8), 715-741.

Salamudin, N., Bakar, R., Ibrahim, M. K., and Hassan, F. H. (2010). Intangible assets valuation in the Malaysian capital market. *Journal of Intellectual Capital, 11*(3), 391-405.

Saleh, N. M., Rahman, M. R. C. A., and Hassan, M. S. (2009). Ownership structure and intellectual capital performance in Malaysia. *Asian Academy of Management Journal of Accounting and Finance, 5*(1), 1-29.

Serenko, A., and Bontis, N. (2004). Meta-review of knowledge management and intellectual capital literature: Citation impact and research productivity rankings. *Knowledge and Process Management, 11*(3), 185–198.

Seyoum, B. (2004). The role of factor conditions in high-technology exports: An empirical examination. *The Journal of High Technology Management Research, 15*(1), 145-162.

Shleifer, A., and Vishny, R. W. (1986). Large shareholders and corporate control. *The Journal of Political Economy, 94*(3), 461-488.

St-Pierre, J., and Audet, J. (2011). Intangible assets and performance: Analysis on manufacturing SMEs. *Journal of Intellectual Capital, 12*(2), 202-223.

Stewart, T. A. (1997). *Intellectual capital: the new wealth of organizations*. New York, N.Y.: Doubleday & Co.

Sveiby, K. E. (1997). *The New Organizational Wealth: Managing and Measuring Knowledge-Based Assets*. New York: Berrett-Koehler.

Sveiby, K. E. (2001, updated 27 April 2010). Methods for measuring intangible assets. Retrieved from <http://www.sveiby.com/articles/IntangibleMethods.htm> Accessed November 2016.

Sydler, R., Haefliger, S., and Pruksa, R. (2014). Measuring intellectual capital with financial figures: Can we predict firm profitability? *European Management Journal, 32*(2), 244-259.

Tseng, K.-A., Lan, Y.-W., Lu, H.-C., and Chen, P.-Y. (2013). Mediation of strategy on intellectual capital and performance. *Management Decision, 51*(7), 1488-1509.

ul Rehman, W., Ilyas, M., and ur Rehman, H. (2011). Intellectual capital performance and its impact on financial returns of companies: An empirical study from insurance sector of Pakistan. *African Journal of Business Management, 5*(20), 8041-8049.

Wang, Z., Wang, N., and Liang, H. (2014). Knowledge sharing, intellectual capital and firm performance. *Management Decision, 52*(2), 230-258.

Westhead, P., and Howorth, C. (2006). Ownership and management issues associated with family performance and company objectives. *Family Business Review, 19*(4), 301-316.

Xing, H. (2014). The Effect of Advertising Expenditures on the Intangible Capital Aspect: Sample Firms of US Leading Advertisers. *International Business and Management, 9*(2), 124-129.

Yalama, A., and Coskun, M. (2007). Intellectual capital performance of quoted banks on the Istanbul stock exchange market. *Journal of Intellectual Capital, 8*(2), 256-271.

Yang, C.-C., and Lin, C. Y.-Y. (2009). Does intellectual capital mediate the relationship between HRM and organizational performance? Perspective of a healthcare industry in Taiwan. *International Journal of Human Resource Management, 20*(9), 1965-1984.

Youndt, M. A., Subramaniam, M., and Snell, S. A. (2004). Intellectual capital profiles: an examination of investments and returns. *Journal of Management Studies, 41*(2), 335-361.

Yu, H.-C., Wang, W.-Y., and Chang, C. (2015). The stock market valuation of intellectual capital in the IT industry. *Review of Quantitative Finance and Accounting, 45*(2), 279-304.

Zavertiaeva, M. (2016). Portfolio forming decisions: the role of intellectual capital. *Journal of Intellectual Capital, 17*(3), 439-456.

Zéghal, D., and Maaloul, A. (2010). Analysing value added as an indicator of intellectual capital and its consequences on company performance. *Journal of Intellectual Capital, 11*(1), 39-60.

CHAPTER 2

Intellectual Capital and Its Basic Concepts

1. Theoretical Background and SLR Approach

In this chapter, we address issues related to the basic concepts of IC. In order to develop our theoretical background to this Ph.D. thesis, we performed a systematic literature review (SLR).

The social science literature has been giving importance to SLRs, meta-analysis and bibliometric analysis, among others (Briner and Denyer, 2012; Crossan and Apaydin, 2010; Pittaway and Cope, 2007; Pittaway, Robertson, Munir, Denyer, and Neely, 2004; Rousseau, Manning, and Denyer, 2008; Saur-Amaral, Ferreira, and Conde, 2013; Walker, 2010). Previous IC reviews focused on measurement and reporting from an accounting perspective (Guthrie, Ricceri, and Dumay, 2012; Petty and Guthrie, 2000), IC measurement models (Bontis, 2001; Bontis, Dragonetti, Jacobsen, and Roos, 1999), citation impacts and research productivity rankings (Serenko and Bontis, 2004), IC as an academic discipline (Serenko and Bontis, 2013), utilization of IC research models (Dumay and Garanina, 2013) and recently Inkinen (2015) reviewed the impact of IC on firms' financial performance excluding papers that resort to an accounting approach. Therefore, our approach does not neglect the importance of accounting-based measurement models, such as VAIC™ (Pulic, 1998, 2000), which is widely accepted by academics and practitioners as a good indicator of IC efficiency (Bontis, Janosevic, and Dzenopoljac, 2015).

The systematic approach, which was developed in the field of medical sciences to improve the quality of the review process, caught the attention of Tranfield and Mouchel (2002) and Tranfield, Denyer, and Smart (2003). Tranfield and his colleagues propose the adaptation of SLR to the management field to overcome the low level of formality and unstructured processes used to plan literature reviews in social sciences, which may inhibit the capacity to explore and decide upon the key areas for research. Tranfield *et al*. (2003) suggested three-stage procedures that can be observed in Table 1.

Table 1 - Stages to Conduct a Systematic Literature Review

Stages	Methodology Stages Summary
1. Planning the review	It will be necessary to conduct scoping studies to assess the relevance and size of the literature and to delimit the IC area or topic.
The need for a review	May contain a conceptual discussion of the research problem, as management reviews are often regarded as a process of exploration, discovery and development.
Preparation of the review	Flexible approach - if there are changes made by the researchers, they must explicitly state them and explain why they did so.
Protocol review development	The protocol should not compromise the researcher's ability to be creative in the literature review process.
2. Conducting a review	Should be a comprehensive and unbiased search.
Identifying research	A systematic search begins with the identification of keywords and search terms, and the reviewer should decide and report in sufficient detail the search strings to ensure the replicability of the search.
Selection of studies	The inclusion and exclusion criteria specified in the review protocol should be applied rigorously and disagreement should be resolved between the reviewers.
Study quality assessment	The output of the search should be the full listing of considered core contribution articles and papers.
Data extraction	
Data synthesis	
3. Reporting and dissemination	A two-stage report might be produced: (1) descriptive analysis (relevant authors, journals, etc.) and (2) thematic analysis (key emerging themes and research questions).
Reporting and dissemination	
Evidence into practice	

Source: Adapted from Tranfield *et al.* (2003)

Following the suggestions made by Tranfield *et al.* (2003), we applied the three stages of an SLR. Firstly, we studied the relationship between IC and finance, then developed the review protocol. Secondly, we defined four search expressions which were applied in the ISI Web of Science™.

The search took place on 8th February 2017 at four different times (Search 1, Search 2, Search 3 and Search 4): Search 1 applied the search expression ""Intellectual Capital" AND Financial AND Performance" IN Topic. The search was carried out in the ISI Web of Science database, without a timespan filter. We then filtered the search by: document type = (Article) AND Research Areas = (Business Economics) AND Languages = (English). We obtained 111 results; Search 2 took ""Intellectual Capital" AND "Growth opportunities"" IN Topic as its search expression. We again used the ISI Web of Science database, without a timespan filter. We then filtered the search by: document type = (Article) AND Research Areas = (Business Economics) AND Languages = (English). We obtained 2 results; Search 3 applied the search expression ""Intellectual Capital" AND ((Market OR firm) AND value)" IN Topic and once again in the ISI Web of Science database, without a timespan filter. We then filtered the search by: document type = (Article) AND Research Areas = (Business Economics) AND Languages = (English). We obtained 210 results; Search 4 deployed the expression ""Intellectual Capital" AND (Leverage

OR Debt OR Financing OR "Capital Structure")" IN Topic to search the ISI Web of Science database, without a timespan filter. We then filtered the search by: document type = (Article) AND Research Areas = (Business Economics) AND Languages = (English). We obtained 94 results.

The inclusion and exclusion criteria were as follows. We selected all empirical studies which used quantitative methods and measured IC by resorting to balance sheet figures, i.e., financial indicators, or stock market data. Although some studies using financial indicators to measure IC have been criticized because of the inability to really capture the phenomenon of IC (Ståhle, Ståhle, and Aho, 2011), they are widely used by researchers to measure IC (Bontis *et al.*, 2015; Bornemann, 1999; Nimtrakoon, 2015; Ramandeep and Narwal, 2016; Tseng and Goo, 2005) since they are useful for comparison of companies and to demonstrate the financial value of intangible assets (Nimtrakoon, 2015; Sydler, Haefliger, and Pruksa, 2014). Furthermore, studies that adopted survey methods make their results difficult to compare across firms (Bornemann, 1999; Chang and Hsieh, 2011; Pulic, 2000) and these types of measures are subjective and not suitable for empirical research (Ilyin, 2014). All theoretical papers were included in a separate group in order to try to capture tendencies in the field of IC, such as conceptualization of the IC dimensions and measurement. In order to select papers of a minimum quality, all accepted papers were from peer-reviewed journals. Finally, all papers without the full text were deleted.

The combination of the four searches was exported to Endnote X7, which leads us to a starting sample of 417 publications. All duplicated papers were deleted. After deletion of papers, we arrived at a sample of 305 papers. Then, after reading the abstracts, and the full text when necessary, we selected the relevant papers and deleted all those which did not focus on our study objectives. Furthermore, we separated empirical from theoretical papers. These steps led us to a final sample of 111 empirical and 35 theoretical papers. Finally, the papers were imported into RefViz software to map the intellectual territory of our final sample. Data for descriptive statistics is based on categories, e.g. authors, journals, year of publication provided by Web of Science analysis and Endnote software.

It is also worth mentioning that in order to review IC base concepts, we decided to include in our analyses influential books (e.g., Andriessen, 2004; Edvinsson and Malone, 1997; Stewart, 1997; Sveiby, 1997), as they contain most pioneering IC concepts and IC valuation measures, and are referred to in peer-reviewed journal papers in our final sample.

2. Results from Web of Science™ Analysis

We resort to Web of Science™ analyses of results to gain an initial perspective of the relationship between financial and IC evolution. The analyses of Web of Science™ results are presented in this section.

2.1. Evolution of the Number of Published Papers

According to Figure 1, a growing trend is noticed in the number of papers published, reaching fifty-nine papers in 2016. It is of note that the number of papers published in 2016 was double that of 2014 (twenty-three papers). Therefore, we conclude that researchers have been giving more attention to the financial perspectives of IC from 2014 onwards.

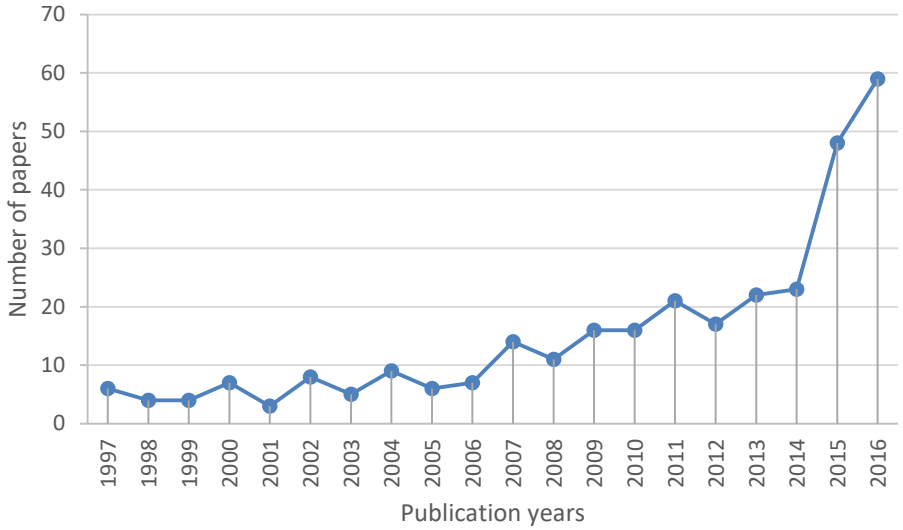

Figure 1 - Evolution of paper publications

2.2. Published Articles per Journal

Regarding journals' representativeness, two were identified as leaders in terms of the number of publications (see Figure 2), i.e., Journal of Intellectual Capital and Management Decision. These two journals together account for 36% of the total publications and we may consider the Journal of Intellectual Capital as the dominant journal in the field.

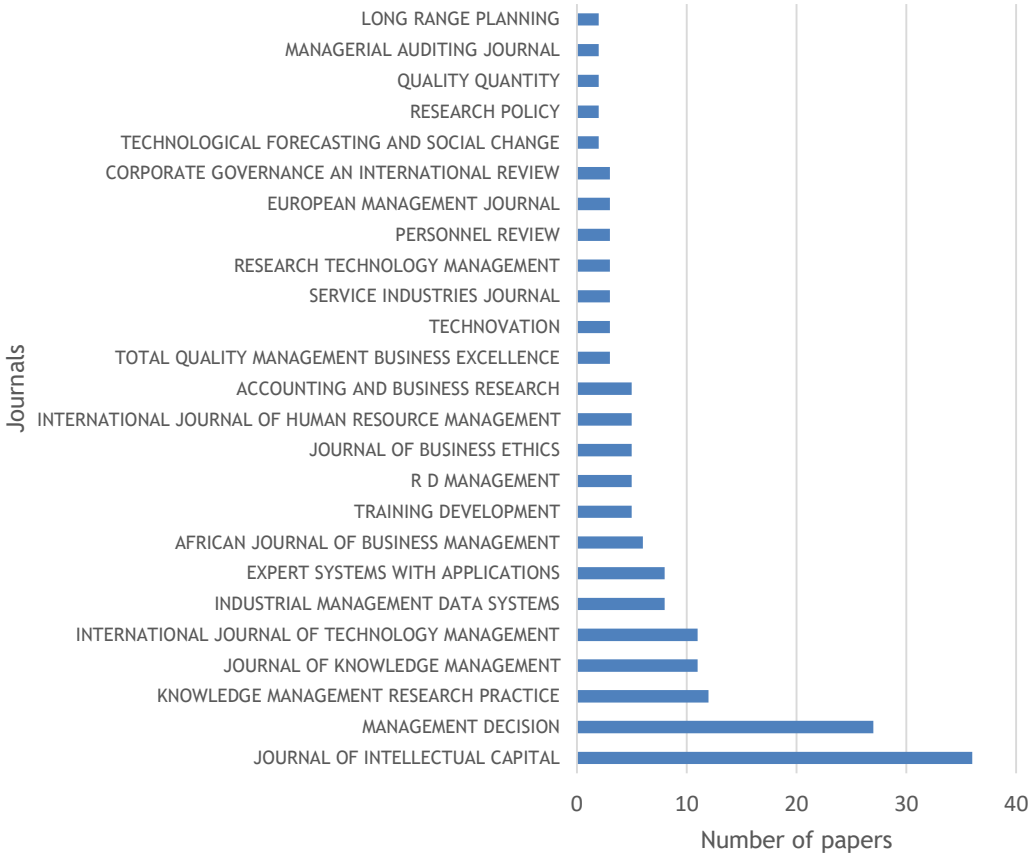

Figure 2 - Top 25 Journals (According to Web of Science Analysis)

2.3. Number of Publications per Author

Regarding the most prolific authors, N. Bontis leads the list (see Figure 3), contributing ten scientific papers.

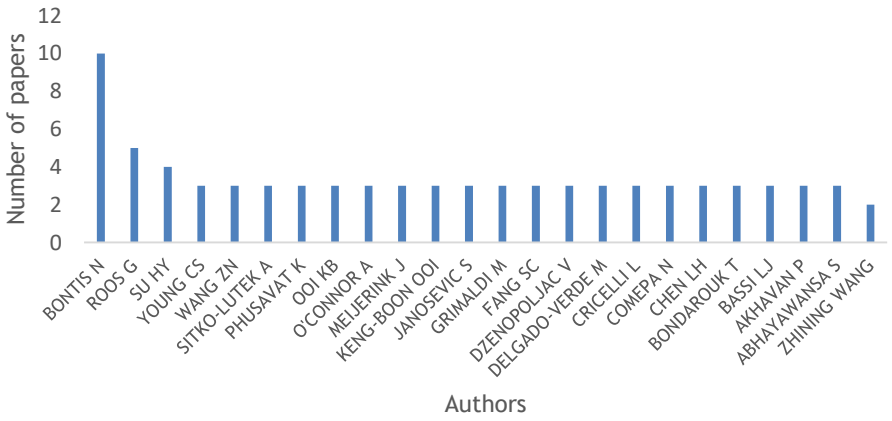

Figure 3 - Top 25 authors

3. Research Subject Mapping

In order to understand the content of the final sample, RefViz was used to map the intellectual territory of the 146 papers. RefViz allowed organization and the creation of groups of references by applying mathematical algorithms to the information contained in the papers' titles and abstracts (Agrawal, 2009). The exploratory galaxy view was drawn via definition of the major and minor keywords as well as personalization of the available thesaurus. Four main groups were identified (see Figure 4).

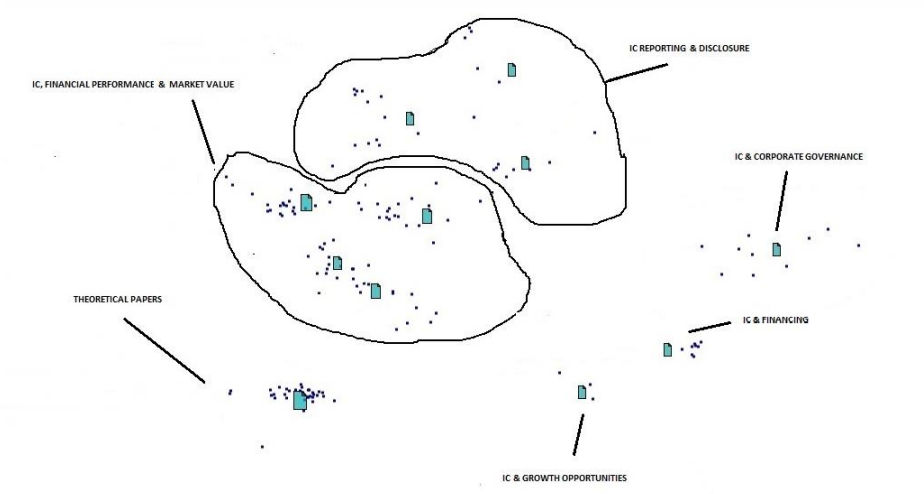

Figure 4 - Groups obtained from RefViz data-mining results

Concerning the representativeness of the identified groups, *IC, Financial performance & Market Value* leads in terms of the number of papers (41,8% of the total number), followed by *Theoretical papers* (24 % of the total number), *IC Reporting & Disclosure* (19,9% of the total number), *Corporate Governance* (6,8% of the total number), *IC & Financing* (5,5% of the total number) and *IC & Growth Opportunities* (2,1% of the total number).

This Ph.D. thesis will follow the perspectives of the groups of *IC, Financial performance & Market Value*, *IC & Financing*, *IC & Growth Opportunities* and *IC & Corporate Governance*. As can be seen, these last two groups are older groups since most research relating to the IC and financial perspective focused on the impact of IC on firms' financial performance and market value.

4. IC Base Concepts

IC is an emerging and fast-evolving concept (Ilyin, 2014; Mehralian, Rasekh, Akhavan, and Sadeh, 2012) that has been capturing the attention of researchers and practitioners over the last two decades. It is a multidisciplinary and interdisciplinary concept (Bontis, 1999; Marr and Chatzkel, 2004; Morariu, 2014), which covers disciplines such as finance (e.g., Bose and Thomas, 2007; Dzenopoljac, Janosevic, and Bontis, 2016; Liu and Wong, 2011; Maditinos, Chatzoudes, Tsairidis, and Theriou, 2011; Scafarto, Ricci, and Scafarto, 2016; Schimmelpfennig, King, and Naseem, 2003; Sydler *et al.*, 2014), strategy (e.g., Gianpaolo Iazzolino and Laise, 2016; Massaro, Dumay, and Bagnoli, 2015; Wudhikarn, 2016), accounting (e.g., Cleary, 2015; Curado, Henriques, and Bontis, 2011; Haji, 2015; Liao, Chan, and Seng, 2013; Seetharaman, Helmi Bin Zaini Sooria, and Saravanan, 2002), economics (e.g., Bontis, 2004; Ståhle, Ståhle, and Lin, 2015), marketing (e.g., Baxter and Matear, 2004; FitzPatrick, Davey, Muller, and Davey, 2013), human resources (e.g., Donate, Pena, and Sanchez de Pablo, 2016; Olander, Hurmelinna-Laukkanen, and Heilmann, 2015; Ruta, 2009; Yang and Lin, 2009), among others. Consequently, due to the different backgrounds and perspectives among researchers, there is no generally accepted definition of IC (Choong, 2008; Mehralian *et al.*, 2012; Mondal and Ghosh, 2012; Morariu, 2014; Scafarto *et al.*, 2016). Nevertheless, several attempts to define IC can be seen in Table 2.

Table 2 – Examples of IC Definitions

Author	Definition
Itami (1987, p. 1)	"... intangible assets, such as a particular technology, accumulated consumer information, brand name, reputation and corporate culture, are invaluable to the firm's competitive power. In fact, these invisible assets are often the only real source of competitive edge that can be sustained over time."
Hall (1992, p. 136)	"Intangible assets are value drivers that transform productive resources into value-added assets"
Smith (1994) *	"all the elements of a business enterprise that exist in addition to working capital and tangible assets. They are the elements, after working capital and tangible assets, that make the business work and are often the primary contributors to the earning power of the enterprise. Their existence is dependent on the presence, or expectation, of earnings"
Brooking (1997, p. 13)	"market assets, human-centered assets, intellectual property assets, and infrastructure assets"
Edvinsson (1997, p. 22)	"Intangible assets are those that have no physical existence but are still of value to the company"
Edvinsson (1997, p. 367)	"… the gap between book value and market value"
Roos and Roos (1997, p. 415)	"Intellectual capital is the sum of the 'hidden' assets of the company not fully captured on the balance sheet, and thus includes both what is in the heads of organizational members, and what is left in the company when they leave."
Sveiby (1997, p. 10)	IC is a combination of three dimensions: employee competence, internal structure and external structure
Mouritsen (1998, p. 462)	"Broad organisational knowledge unique to a firm, which allows it constantly to adapt to changing conditions"

(*Continued*)

Table 2 - Continued

Author	Definition
Nahapiet and Ghoshal (1998, p. 245)	Intangible assets are "knowledge and knowing capability of a social collectivity, such as an organization, intellectual community or professional practice"
Stewart (1997, p. 11)	"Intellectual capital is intellectual material – knowledge, information, intellectual property, experience – that can be put to use to create wealth. It is a collective brainpower"
Stewart (1997, p. 67)	"packaged useful knowledge"
Bontis *et al.* (1999, p. 397)	"intellectual capital is quite simply the collection of intangible resources and their flows"
Granstrand (1999) *	Intellectual property "is property directly related to the creativity, knowledge and the identity of an individual"
Brennan and Connell (2000, p. 1)	"Knowledge-based equity of a company"
Harrison and Sullivan (2000, p. 34)	"Knowledge that can be converted into profit"
Brennan (2001, p. 423)	"IC encompasses intangibles such as patents, intellectual property rights, copyrights and franchises"
Heisig, Vorbeck, and Niebubr (2001, p. 60)	"IC is valuable, yet invisible"
Lev (2001, p. 5)	"An intangible asset is a claim to future benefit that does not have a physical or financial (a stock or a bond) embodiment"
Marr and Schiuma (2001, cited in Marr, 2004, p. 560)	"the group of knowledge assets attributed to an organization that most significantly contribute to an improved competitive position of this organization by adding value to the defined key stakeholders."
Rastogi (2003, p. 230)	"IC may properly be viewed as the holistic or meta-level capability of an enterprise to co-ordinate, orchestrate, and deploy its knowledge resources towards creating value in pursuit of its future vision"
Ordoñez de Pablos (2005, p. 142)	"… it is the difference between the market value of the firm and its book value. Knowledge-based resources that contribute to creation of a competitive advantage for the firm and are not registered in the financial accounts constitute the intellectual capital."
Martinez and Garcia-Meca (2005, p. 305)	"The knowledge, information, intellectual property and experience that can be put to use to create wealth"
Mavridis (2005, p. 43)	"An intangible asset with the potential to create value for the enterprise and the society itself"
Yalama and Coskun (2007, p. 257)	"IC can be defined as something which already exists in a firm, but cannot be seen on its balance sheet exactly, a competitive advantage over the firm's competitors, future values and includes all its intangibles assets, the value of knowledge, information, intellectual property and experience, a key factor influencing the future value of the firm."
Hsu and Fang (2009, p. 665)	"total capabilities, knowledge, culture, strategy, process, intellectual property, and relational networks of a company that create value or competitive advantages and help a company achieve its goals."
Mondal and Ghosh (2012, p. 516)	Intellectual capital "is used to refer to intangible assets or intangible business factors of the company, which have a significant impact on its performance and overall business success, although they are not explicitly listed in the balance sheet (if so, then under the term goodwill)"
Kweh, Chan, and Ting (2013, p. 312)	"IC refers to the accumulation of all the intangible assets or knowledge that include, but not exhaustively, intellectual property (like patents and trademarks), intellectual resources (e.g. customer relationship), and intellectual capabilities and competences (for instance, employees' professional skills)."
Lin, Lee, Chao, and Liu (2015, p. 208)	"IC comprises intangible assets, including skills, know-how, brands, corporate reputation, organizational capabilities, relationships with customers and suppliers, and employee innovativeness, and other identifiable intangible assets such as patents, and royalties "

* Source: Adapted from Choong (2008, Table I)

According to these definitions, it is of note that different terms have been used in a similar way to IC, such as intangible assets, invisible assets, intellectual property, hidden assets and knowledge-based assets, which shows the wide scope of the concept (Sydler *et al.*, 2014). Although the field is still in its embryonic stages (Kristandl and Bontis, 2007), researchers' efforts to develop the field make the emergent IC concept evolve faster (Ilyin, 2014; Mehralian *et al.*, 2012). In addition, the multidisciplinary and interdisciplinary characteristics of IC allows researchers to use and adopt different terminologies and nomenclatures (Bontis, 2001), and therefore, there is no single correct definition (Marr, 2007). In fact, it is difficult to reach consensus in developing a generally accepted definition of IC. Nevertheless, key terms from the definitions in Table 2 might suggest pathways towards a general definition and they can be found in the word cloud (see Figure 5).

Figure 5 - IC Definition Key Terms

Through analysis of the key terms, the definition of IC might have to take into consideration several points. The importance of relationships (internal and external) and networks, i.e., stakeholders (Hsu and Fang, 2009; Kweh *et al.*, 2013; Lin *et al.*, 2015). As stakeholders, we refer to "any group or individual who is affected by or can affect the achievement of an organization's objectives" (Freeman, 1984, p. 5), such as employees, customers, shareholders, suppliers, creditors, partners and society itself (Bontis *et al.*, 2015; Cabrita and Bontis, 2008; Edvinsson and Malone, 1997; Janosevic and Dzenopoljac, 2012; Meles, Porzio, Sampagnaro, and Verdoliva, 2016; Ting and Lean, 2009; Youndt, Subramaniam, and Snell, 2004), the dynamic capabilities and knowledge flows (Bontis *et al.*, 1999; Cabrita and Bontis, 2008; Saint-Onge, 1996; Shiri and Mousavi, 2015; Teece, Pisano, and Shuen, 1997), the collective knowledge (Bontis, 1998; Ghosh and Mondal, 2009; Nahapiet and Ghoshal, 1998; Phusavat, Comepa, Sitko-

Lutek, and Ooi, 2011; Stewart, 1997), the firm's innovativeness (Bontis, 1999; Bontis *et al.*, 2015; Chi, Lieu, Hung, and Cheng, 2016; Curado, 2008; Lev, 2001; Yu, Wang, and Chang, 2015), the fact that IC has no physical or financial embodiment (Bontis *et al.*, 2015; Edvinsson, 1997; Lev, 2001; St-Pierre and Audet, 2011), the competitive and sustained advantages over time (Bontis, 1998; Bontis *et al.*, 2015; Dzenopoljac *et al.*, 2016; Itami, 1987; Roos and Roos, 1997; St-Pierre and Audet, 2011), IC as a source of firm value (Bontis *et al.*, 1999; Bontis *et al.*, 2015; Dzenopoljac *et al.*, 2016; Edvinsson, 1997; El-Bannany, 2015; Hall, 1992; Hsu and Fang, 2009; Mavridis, 2005; Stewart, 1997; Yalama and Coskun, 2007), firm earnings (Harrison and Sullivan, 2000; Liu and Wong, 2011; Maaloul, Ben Amar, and Zeghal, 2016; Roos and Roos, 1997; Rylander, Jacobsen, and Roos, 2000; Zavertiaeva, 2016) and firm wealth (Edvinsson, 1997; Firer and Williams, 2003; Guerrini, Romano, and Leardini, 2014; Martinez and Garcia-Meca, 2005; Read, 1996; Riahi-Belkaoui, 2003; Stewart, 1997; Yang and Lin, 2009). Following the above-mentioned literature, this study defines IC as the knowledge-based activities and processes that contribute to firms' innovation, value creation, competitive advantages and future benefits by adding value for firms' stakeholders.

4.1. IC Dimensions and Their Conceptualisations

The synergetic value of IC is rooted in the interaction between its different dimensions (Bontis *et al.*, 2015; Cabrita and Bontis, 2008; Sydler *et al.*, 2014). According to Saint-Onge (1996) the system develops through flows, i.e., the increase in customer capital is a consequence of increased human and structural capital and, in turn, the growth of customer capital will lead to the growth of financial capital. Several attempts have been made to categorize IC (Bontis *et al.*, 2015; Scafarto *et al.*, 2016). Sveiby (1997) categorized IC in three dimensions, i.e., employee competences, internal structure and external structure. Brooking (1997) added a fourth dimension to this categorization, namely intellectual property. Following Sveiby's three-dimensional categorization of IC, Edvinsson (1997) renamed the IC dimensions as human capital, organizational capital and customer capital, which was accepted by Bontis (1998), Edvinsson and Malone (1997) and Stewart (1997). They later renamed organizational capital as structural capital. This categorization of IC is widely accepted and extensively used by researchers, sometimes renaming customer capital as relational capital, (e.g., Cabrita and Bontis, 2008; Chang, Chen, and Lai, 2008; Curado *et al.*, 2011; Ilyin, 2014; Janosevic and Dzenopoljac, 2012; Meles *et al.*, 2016; MERITUM, 2002; Nazari and Herremans, 2007; Saeed, Rasid, and Basiruddin, 2016; Sydler *et al.*, 2014; Ting and Lean, 2009), which is a broader term that considers all the firm's stakeholders (Ordoñez de Pablos, 2002). In line with these studies, we will follow the three-dimensional categorization of IC, i.e., human capital, structure capital and relational capital, as it provides the clearest and least ambiguous categorization (Sydler *et al.*, 2014).

4.1.1. Human Capital

Human capital is considered one of the core dimensions of IC and the firm's most important asset since it is the source of the firm's strategic renewal, creativity, innovation capacity and, consequently, of sustainable competitive advantage (Bontis, 1998; Bontis, Seleim, and Ashour, 2007; Brooking, 1997; Chi *et al.*, 2016; Edvinsson and Malone, 1997; Nonaka and Takeuchi, 1995; O'Sullivan and Schulte Jr, 2007). In the literature, human capital comprises knowledge, experience, know-how, teamwork capacity, motivation, satisfaction, loyalty, competency, learning capacity, individuals' education, values, creativity, employee flexibility, talent (Bontis *et al.*, 2015; Cabrita and Bontis, 2008; Edvinsson and Malone, 1997; Ghosh and Mondal, 2009; Janosevic and Dzenopoljac, 2012; Ting and Lean, 2009). This capital represents the tacit knowledge embedded in the minds of employees (Chang *et al.*, 2008; Hejazi, Ghanbari, and Alipour, 2016; Sydler *et al.*, 2014), providing firms with the collective ability to find innovative solutions (Bontis, 1999, 2001; Díez, Ochoa, Prieto, and Santidrián, 2010) and enhancing their problem-solving ability (Ilyin, 2014; Meles *et al.*, 2016; Phusavat *et al.*, 2011; Tsakalerou, 2015; Yu *et al.*, 2015).

Rooted in the employees' talents, skills and expertise (Cater and Cater, 2009; Ghosh and Mondal, 2009; Ilyin, 2014; Sydler *et al.*, 2014; Tsakalerou, 2015), human capital makes firms unique (O'Sullivan and Schulte Jr, 2007) in the development of added value goods, services and solutions for their customers' needs, thereby achieving customers' satisfaction and loyalty (Bontis *et al.*, 2007; Cabrita and Bontis, 2008; Ghosh and Mondal, 2009).

Investment in human capital should be recognized as investment rather than costs (Young, Su, Fang, and Fang, 2009), because expenditure on employees such as education and training produces human rather than physical or financial capital (Bontis *et al.*, 2015; Scafarto *et al.*, 2016), leading to greater employee effectiveness and efficiency and consequently higher productivity (Cabrita and Bontis, 2008; Clarke, Seng, and Whiting, 2011; Stovel and Bontis, 2002). Furthermore, firms with more and better human capital can enhance their income, performance and market value (Chi *et al.*, 2016; Chu, Hsiung, Huang, and Yang, 2008; Hejazi *et al.*, 2016).

Human capital cannot be owned by firms and this capital leaves firms with the employees (Bontis, Keow, and Richardson, 2000; Cabrita and Bontis, 2008; Ilyin, 2014; Roos and Roos, 1997; Scafarto *et al.*, 2016; Sydler *et al.*, 2014; Tsakalerou, 2015). Therefore, firms should pay attention to human resource practices as it is important to retain key experienced and educated employees and avoid knowledge leakages that may jeopardize firms' highly confidential innovative activities (Bontis *et al.*, 2000; Olander *et al.*, 2015; Saeed *et al.*, 2016). However, on the other hand, it may be an opportunity for firms to acquire fresh knowledge from newer employees (Bontis *et al.*, 2000).

4.1.2. Structural Capital

The value of structural capital is undeniable. This intellectual and strategic asset remains in the firm after employees have left (Bontis *et al.*, 2015; Cabrita and Bontis, 2008; Curado, 2008; Nazari and Herremans, 2007; St-Pierre and Audet, 2011; Stewart, 1997). This means that structural capital is independent of employees and is generally explicit (Chen, Lin, and Chang, 2006; Sydler *et al.*, 2014). Within structural capital there are two main elements, namely intellectual property and infrastructure assets. Intellectual property refers to the elements of IC protected by law (e.g., commercial rights and intellectual property rights) and infrastructure refers to IC elements such as processes, corporate culture, information and networking systems and research projects, which can be generated within the firm or acquired from outside (Bozzolan, 2003; Curado *et al.*, 2011; Díez *et al.*, 2010). Furthermore, in the literature, structural capital includes organisational and management processes, strategies, databases, software, information systems, routines, patents, copyrights, trademarks, brands, hardware, licenses, organisational culture, know-how, creativity and innovations (Bontis *et al.*, 2015; Bontis *et al.*, 2000; Janosevic and Dzenopoljac, 2012; Meles *et al.*, 2016; Phusavat *et al.*, 2011; St-Pierre and Audet, 2011; Sydler *et al.*, 2014; Ting and Lean, 2009; Tsakalerou, 2015).

Compared to the other IC dimensions, structural capital is less obvious but more specialized (Hejazi *et al.*, 2016; Moon and Kym, 2006). Structural capital can be seen as the skeleton of a firm (Cabrita and Bontis, 2008) and refers to non-human storehouses of knowledge (Bontis *et al.*, 2000; Chang *et al.*, 2008), i.e., to the knowledge embedded in the firm's processes, routines and practices (Bontis, Crossan, and Hulland, 2002; Díez *et al.*, 2010; Hejazi *et al.*, 2016; Ordoñez de Pablos, 2002) which results from a knowledge spiral of employees' intellectual inputs when reaching the organizational level (St-Pierre and Audet, 2011; Sydler *et al.*, 2014). Structural capital supports and empowers human capital (Bontis, 1998; Curado *et al.*, 2011; Díez *et al.*, 2010; Edvinsson, 1997; Ilyin, 2014; Lee and Mohammed, 2014; Tsakalerou, 2015), which is a vital factor in structural capital's development (Nazari and Herremans, 2007) to reach its full potential in the firm's value creation and performance (Bontis, 1998; Lee and Mohammed, 2014; St-Pierre and Audet, 2011; Sveiby, 1997). Even though structural capital and human capital are two independent IC dimensions (Chen, Zhu, and Xie, 2004; Nazari and Herremans, 2007), they are interdependent and interact in the creation of IC (Cabrita and Bontis, 2008). Unlike human capital, structural capital is owned by firms (Díez *et al.*, 2010; Ghosh and Mondal, 2009; Ilyin, 2014; Nazari and Herremans, 2007; Scafarto *et al.*, 2016). To some degree, it can be reported, shared and traded (Edvinsson, 1997; Hejazi *et al.*, 2016; Lee and Mohammed, 2014; Sydler *et al.*, 2014), and become intellectual property rights (e.g., patents, copyrights, trademarks and brands) legally owned by firms (Saeed *et al.*, 2016; Scafarto *et al.*, 2016; Ting and Lean, 2009). Structural capital is also pointed out as the supporting infrastructure for establishing external relationships (Molodchik, Shakina, and Barajas, 2014; Schiuma and Lerro, 2008).

4.1.3. Relational Capital

Relational Capital is firms' ability to create value from the complex relationships with external stakeholders (Cabrita and Bontis, 2008; Joshi, Cahill, Sidhu, and Kansal, 2013; Meles *et al.*, 2016; Sydler *et al.*, 2014; Tsakalerou, 2015). In the literature, examples of external stakeholders are clients, suppliers and partners, creditors, customers, resource providers, banks, shareholders, competitors, trade associations or government bodies, alliance partners, lobby organizations, distribution channels and related industry associations (Bontis, 1999; Bontis *et al.*, 2015; Joshi *et al.*, 2013; Nassari and Nasab, 2014; Ordoñez de Pablos, 2004; Sydler *et al.*, 2014).

Relational capital is the most difficult IC dimension to develop since, to some extent, it is outside the heart of the firm (Bontis, 1998; Scafarto *et al.*, 2016). It enhances human and structural capital's interaction with external stakeholders and influences the firm's wealth as well as external stakeholders' perceptions of the firm (Bontis *et al.*, 2015; Cabrita and Bontis, 2008; Meles *et al.*, 2016; Ting and Lean, 2009). Examples of this are brand loyalty, customer and supplier loyalty, market image, commercial power, customer satisfaction, links with suppliers, negotiating capacity with financial entities, reputation, and environmental activities (Janosevic and Dzenopoljac, 2012; Joshi *et al.*, 2013; Ting and Lean, 2009).

Relational capital is knowledge embedded in the identification, development and maintenance of external relationships (Bontis, 1999; Joshi *et al.*, 2013; Ordoñez de Pablos, 2004). Therefore, this capital should be properly managed and measured (Baxter and Matear, 2004; Chu *et al.*, 2008), as it forms the link between the conversion of IC into firms' market value and financial performance (Chen *et al.*, 2004; Scafarto *et al.*, 2016). Moreover, this capital allows firms to access knowledge and resources embedded in a network of relationships (Bontis, 1998; Chang *et al.*, 2008; Edvinsson and Malone, 1997; Meles *et al.*, 2016; Stewart, 1997).

Relational capital allows firms to develop databases with information from external stakeholders in order to anticipate and develop future firm strategies (Saeed *et al.*, 2016). Having a better understanding of external stakeholders, will help firms to develop and create products (Ordoñez de Pablos, 2004) in order to satisfy and build strong and lasting relationships with them (Ilyin, 2014; Meles *et al.*, 2016).

4.2. IC Measurement

A significant number of IC measurement models have evolved from different disciplines (Andriessen, 2004; Bontis, 2001; Bontis *et al.*, 1999; Janosevic and Dzenopoljac, 2012; Nazari and Herremans, 2007; Sveiby, 2001). Each model has its advantages and disadvantages according to the objectives of IC measurement (Nazari and Herremans, 2007; Sveiby, 2001; Sydler *et al.*, 2014). However, no single valuation model can easily describe the value of IC, which shows the difficulty in managing it (Sydler *et al.*, 2014) and the challenge faced by researchers and practitioners (Meles *et al.*, 2016).

Sveiby (2001) suggests the categorization of approaches to IC measurement. These are: (i) Direct Intellectual Capital (DIC) methods, (ii) Market Capitalization Methods (MCM), (iii) Return on Assets (ROA) methods, and (iv) Scorecard Methods (SC). Direct methods to measure IC focus on the monetary value of a specific intangible asset by identifying its various components. These include models such as Citation Weighted Patents (Bontis, 1996) and Value Explorer (Andriessen and Tissen, 2000). Market capitalization methods define the value of IC as the difference between a firm's market value and book value. In this approach, IC is measured by tools such as Tobin's q (Bontis, 1998; Stewart, 1997), and Market to Book Value (Stewart, 1997). Return on Assets methods define a firm's IC as the excess of return on its tangible assets. The most well-known ROA methods are the EVA method (Stewart, 1997), Calculated Intangible Value (Stewart, 1997), and Value Added Intellectual Coefficient (VAIC™) (Pulic, 1998, 2000). The scorecard approach consists of generating indicators and indices for the identified components of intangible assets. This includes models such as the Skandia Navigator (Edvinsson and Malone, 1997), Value Chain Scoreboard (Lev, 2001), Intangible Assets Monitor (Sveiby, 1997), and Balanced Scorecard (Kaplan and Norton, 1992).

There is no a single best model because each one has its pros and cons (Lu, Wang, Tung, and Lin, 2010; Sydler *et al.*, 2014). Nevertheless, ROA and MCM methods allow the use of audited historical financial data and facilitate the comparison of companies within the same industry (Lu *et al.*, 2010; Sydler *et al.*, 2014).

4.2.1. Proxies for IC Measurement

Considering the use of financial data to measure IC, Table 3 shows the different approaches followed by researchers.

Table 3 - Examples of proxies/Measurements of IC

IC Measurement	Papers
M/B ratio	Chu *et al.* (2008)
Tobin's Q	Chu *et al.* (2008), Chang *et al.*(2008), Wang (2013), Kweh *et al.* (2013), Wang (2015)
CIV	Kujansivu and Lönnqvist (2007), Chu *et al.* (2008), Shiri and Mousavi (2015)
VAIC™	Firer and Williams (2003), Chen, Cheng, and Hwang (2005), Gho (2005), Kamath (2007), Kujansivu and Lönnqvist (2007), Tan, Plowman, and Hancock (2007), Yalama and Coskun (2007), Chu *et al.* (2008), El-Bannany (2008), Ghosh and Mondal (2009), Ting and Lean (2009), Calisir, Gumussoy, Bayraktaroğlu, and Deniz (2010), Díez *et al.* (2010), Zéghal and Maaloul (2010), Chang and Hsieh (2011), Chu, Chan, and Wu (2011), Clarke *et al.* (2011), Maditinos *et al.* (2011), Janosevic and Dzenopoljac (2012), Komnenic and Pokrajčić (2012), Mehralian *et al.* (2012), Mondal and Ghosh (2012), Pal and Soriya (2012), Joshi *et al.* (2013), Kweh *et al.* (2013), Wang (2013), Amin, Hasan, Nezamoddin, and Tan (2014), Britto, Monetti, and Rocha Lima Jr (2014), Greco, Ferramosca, and Allegrini (2014), Guerrini *et al.* (2014), Ilyin (2014), Morariu (2014), Nassari and Nasab (2014), Stankeviciene and Cepulyte (2014), Bontis *et al.* (2015), El-Bannany (2015), Ousama and Fatima (2015), Shiri and Mousavi (2015), Singh and Narwal (2015), Soriya and Narwal (2015), Tripathy, Gil-Alana, and Sahoo (2015), Ahmad and Ahmed (2016), Alhassan and Asare (2016), Chi *et al.*(2016), Dzenopoljac *et al.* (2016), Hejazi *et al.* (2016), Meles *et al.* (2016), Saeed *et al.*(2016), Sherif and Elsayed (2016)
Extended/Modified VAIC™	Chen *et al.* (2005), Nazari and Herremans (2007), Nimtrakoon (2015), Tripathy, Sahoo, Kesharwani, and Mishra (2016), Tripathy *et al.* (2015), Vishnu and Gupta (2015)
EIC	Krstic and Bonic (2016)
ROIC	Changchien and Tsai (2005)
EVA	Chu *et al.* (2008), Shakina and Barajas (2014)
Adjusted RIM	Ilyin (2014), Sydler *et al.* (2014)
R&D expenditures	Väisänen, Kujansivu, and Lonnqvist (2007)
Patent Stock	Liu and Wong (2011)
Citation-weighted patent stock	Liu and Wong (2011)

Notes: M/B ratio – Market to book ratio, EIC – Efficiency in the use of total IC, CIV – Calculated Intangible Value, VAIC – Value Added Intellectual Coefficient, ROIC – Return on Investment of IC, EVA – Economic Value Added and Adjusted RIM - Adjusted dynamic residual income model.

Table 3 shows that the main IC proxy used by researchers is the VAIC™ model and its variations. VAIC™ allows measuring IC efficiency as well as the efficiency of IC components such as human capital and structural capital, and capital employed efficiency, i.e., physical and financial capital. The main goal to extend or modify VAIC™ is to add the relational capital measure.

4.2.2. Proxies to Measure IC Dimensions

Examples of measures of IC dimensions using financial data are presented in Table 4.

Table 4 - Examples of proxies for IC Dimensions

IC Dimension Measures	Papers
Human Capital	
Salary Expenses	Chu *et al.* (2008)
Revenue per Employees	Dzinkowski (2000), Kweh, Lu, and Wang (2014), Tseng, Lan, Lu, and Chen (2013), Sveiby (1997)
Total labour costs	Scafarto *et al.* (2016), Yu *et al.*(2015)
Structural Capital	
Administrative expenses plus R&D expenses	Vishnu and Gupta (2015)
R&D expenses	Lu *et al.* (2010), Phusavat *et al.*(2011), Scafarto *et al.* (2016)
R&D intensity	Edvinsson and Malone (1997), Lev and Sougiannis (1996), Tseng *et al.* (2013)
Current capital turnover rate	Wang and Chang (2005), Tseng *et al.* (2013)
Ratio of net sales to average working capital	Yu *et al.* (2015)
Ratio of net sales to average fixed assets	Scafarto *et al.* (2016), Yu *et al.*(2015)
Relational Capital	
Advertising expenditures	Chen *et al.* (2005)
Marketing costs	Nimtrakoon (2015)
Revenue growth	Sveiby (1997), Van Buren (1999), Dzinkowski (2000), Tseng *et al.* (2013)
Annual growth rate of premiums earned	Edvinsson and Malone (1997), Kweh *et al.* (2014)
Advertising, Marketing, Selling and Distribution expenses	Vishnu and Gupta (2015)
Selling, General and Administrative expenses	Scafarto *et al.* (2016)

Note: Proxies used to measure Innovation Capital and Process Capital were included in the Structural Capital dimension.

Several proxies have been used to measure IC dimensions. In order to use these proxies we had to consider access to data, e.g., we did not have access to firms' marketing or advertising expenses, which limits our options. Therefore, this study will use the VAIC™ model, which will be discussed in the next section, as it is useful for comparing between companies and across sectors. Furthermore, VAIC™ uses audited financial data (Pulic, 1998, 2000, 2004) and has been widely adopted by researchers and practitioners as a good indicator of IC performance (Bontis *et al.*, 2015).

5. Value Added Intellectual Coefficient - VAIC™ - Model

The traditional accounting measures of firm performance may be unsuitable for an economy where intellectual capital drives firms' competitive advantage and value creation (Bontis, 1998, 1999, 2001; Edvinsson, 1997; Firer and Williams, 2003; Pulic, 2000; Sveiby, 2001). Wrong conclusions may lead to inappropriate decisions regarding the allocation of scarce resources and ignoring IC performance may have negative consequences for the firm in the long run (Firer and Williams, 2003; Kamath, 2007). Pulic (1998, 2000) proposed value added as an indicator for measuring performance in a knowledge economy context. The model developed by Pulic, i.e., value added intellectual coefficient (VAIC™), allows managers, shareholders and other interested stakeholders to monitor and measure firms' IC performance and potential (Firer and Williams, 2003; Kamath, 2007). In other words, VAIC™ measures intellectual efficiency in firms' value creation through exploiting their economic resources (Greco *et al.*, 2014; Pulic, 2004). VAIC™ components measure the efficiency of two dimensions of IC, i.e., human capital and structural capital, as well as physical and financial resources. In line with this, VAIC™ results by summing its three components, i.e., human capital efficiency (HCE), structural capital efficiency (SCE) and capital employed efficiency (CEE). The higher the value of VAIC™, the greater the ability to create value through the firm's resources (human, structural, physical and financial capital) (Pulic, 1998, 2000, 2004). Next, we present the steps involved in measuring VAIC™.

5.1. VAIC™ Calculation

The VAIC™ model is derived from accounting information based on balance sheets and income statements (Pulic, 1998, 2000, 2004). The first step of VAIC™ calculation seeks to evaluate the firm's ability to create value added (VA). As such, $VA_{i,t}$, for firm i in the year t, is calculated as the difference between outputs (OUT) and inputs (IN), as shown in equation (1):

$$VA_{i,t} = OUT_{i,t} - IN_{i,t} \qquad (1)$$

where, $OUT_{i,t}$ is the total revenue generated from all products and services sold on the market for firm i in the year t. $IN_{i,t}$ is the operating expenses in generating the revenue excluding employee costs for firm i in the year t. Employee costs are treated as investment, not as expenses, due to the important role of human capital in the value creation process. Value added can also be calculated as indicated in equation (2).

$$VA_{i,t} = OP_{i,t} + EC_{i,t} + D_{i,t} + A_{i,t} \qquad (2)$$

where, $OP_{i,t}$ is the operating profit for firm i in the year t, $EC_{i,t}$ is the employee costs for firm i in the year t, $D_{i,t}$ is depreciation for firm i in the year t and $A_{i,t}$ is amortization for firm i in the year t.

The second step involves the calculation of VAIC™ components HCE, SCE and CEE. The VAIC™ components are obtained as shown in equations (3), (4) and (5).

$$HCE_{i,t} = \frac{VA_{i,t}}{HC_{i,t}} \quad (3)$$

where, $HC_{i,t}$ refers to employee total salary and wage costs for firm i in the year t. The model focuses on human capital's contribution to firms' value creation. This is coherent with the context of a knowledge-based economy since human capital is a key factor of value creation (Pulic, 2004). Structural capital includes organisational and management processes, strategies, databases, software, information systems, and so on. Structural capital supports and empowers human capital (Bontis, 1998; Curado *et al.*, 2011; Díez *et al.*, 2010; Edvinsson, 1997; Ilyin, 2014; Lee and Mohammed, 2014; Tsakalerou, 2015), which is a vital factor of structural capital development (Nazari and Herremans, 2007). Equation (4) calculates structural capital efficiency, $SCE_{i,t}$ for firm i in the year t.

$$SCE_{i,t} = \frac{SC_{i,t}}{VA_{i,t}} \quad (4)$$

where, $SC_{i,t}$ is the structural capital for firm i in the year t, and can be obtained by subtracting human capital costs from value added: $SC_{i,t} = VA_{i,t} - HC_{i,t}$. The capital employed efficiency, $CEE_{i,t}$ for firm i in the year t, can be obtained through the ratio between value added and capital employed as shown in equation (5).

$$CEE_{i,t} = \frac{VA_{i,t}}{CE_{i,t}} \quad (5)$$

where, $CE_{i,t}$ is the book value of the net assets of firm i in the year t.

The third step involves calculation of IC efficiency, $ICE_{i,t}$ for the firm i in year t, which is obtained by summing human capital efficiency and structural capital efficiency, as can be seen in equation (6).

$$ICE_{i,t} = HCE_{i,t} + SCE_{i,t} \quad (6)$$

Finally, the VAIC™ is the sum of intellectual capital efficiency and capital employed efficiency as shown in equation (7).

$$VAIC_{i,t} = ICE_{i,t} + CEE_{i,t} \quad (7)$$

where, $VAIC_{i,t}$ is the value added intellectual coefficient for firm i in the year t. This indicator reveals intellectual ability. In other words, VAIC™ measures how much new value has been created per invested monetary unit. The advantages and disadvantages of VAIC™ are discussed in the next section.

5.2. VAIC™ Advantages and Limitations

Until now, there has been no single, generally accepted model to measure IC and the popularity gained by VAIC™ among researchers is evident (e.g., Ahmad and Ahmed, 2016; Alhassan and Asare, 2016; Amin *et al.*, 2014; Bontis *et al.*, 2015; Britto *et al.*, 2014; Chang and Hsieh, 2011; Chi *et al.*, 2016; Chu *et al.*, 2008; Clarke *et al.*, 2011; Dzenopoljac *et al.*, 2016; El-Bannany, 2015; Firer and Williams, 2003; Gho, 2005; Ghosh and Mondal, 2009; Greco *et al.*, 2014; Guerrini *et al.*, 2014; Ilyin, 2014; Janosevic and Dzenopoljac, 2012; Kamath, 2007; Komnenic and Pokrajčić, 2012; Kweh *et al.*, 2013; Maditinos *et al.*, 2011; Mehralian *et al.*, 2012; Meles *et al.*, 2016; Morariu, 2014; Nassari and Nasab, 2014; Ousama and Fatima, 2015; Saeed *et al.*, 2016; Sherif and Elsayed, 2016; Shiri and Mousavi, 2015; Singh and Narwal, 2015; Soriya and Narwal, 2015; Stankeviciene and Cepulyte, 2014; Tan *et al.*, 2007; Ting and Lean, 2009; Tripathy *et al.*, 2015; Wang, 2013; Zéghal and Maaloul, 2010).

Nevertheless, there has been some criticism of the VAIC™ model. According to Iazzolino and Laise (2013), part of the criticism that VAIC™ has received derives from misunderstandings of different meanings that Pulic gave to human capital (HC) and structural capital (SC) in comparison to Skandia Navigator, namely the words used by the IC research community. The authors claim that the main weakness of the model developed by Pulic lies in attempting to provide an alternative to the existing ones, e.g., Economic Value Added (EVA), for performance measurement. According to the authors, VAIC™ measures a different dimension of performance that is not considered by the other measures, i.e., it considers the value created by IC.

Several drawbacks to VAIC™ were also pointed out by Ståhle *et al.* (2011). The model is based on financial indicators, which rely on past strategy and decision-making. According to the authors, the model does not measure IC, but only measures operational efficiency in different ways, i.e., the efficiency of labour and capital invested by firms. For example, since human capital embeds factors such as employees' skills and knowledge, training and motivation, the model only takes into consideration the annual salaries of human resources. SC has a similar problem. The authors also indicated problems in the way the model is calculated. In the case of human capital, the higher the HC, the higher the human capital value will be. However, in calculating HCE, the lower the HC, the greater the efficiency of human capital will be. This problem could be eliminated if it is considered that HCE measures the use of human capital. Furthermore, according to Ståhle *et al.* (2011), there is a limitation to the comparability of high salary firms with low salary firms, since to compare VAIC and IC efficiency (ICE), ICE = HCE + SCE, the same level of salaries has to be taken into consideration. The authors also suggest

that the application of value added (VA) is problematic. Value added is given by the expression VA = OP + EC + A + D, where OP is the firm's operating profit and EC is personnel costs consisting of salaries and social costs, A is depreciation in firm assets and D is write-downs in firms' long-term and current assets. According to the authors, A and D are independent of value added. In the case of structural capital (SC), this is given by VA minus human capital costs (OP + A + D) and thus binds VAIC and the SC variable, which limits the comparability of capital-intensive with non-capital-intensive industries or capital-rich countries with capital-poor countries due to the differences in human capital costs.

According to Maditinos *et al.* (2011), VAIC™ disregards firms' level risk, which is a key factor in determining firm and IC value. Chu *et al.* (2011) also pointed out some limitations to the VAIC™ model. According to the authors, the model cannot handle negative book value or negative operating profit. Bontis, Keow, and Richardson (2000) suggested there may be interaction among IC components which does not allow determination of the exact contribution of each component, or their synergetic effects (Andriessen, 2004).

Despite the above-mentioned disadvantages, several advantages are pointed out regarding the adoption of VAIC™. VAIC™ treats human capital as the most important source of IC (Greco *et al.*, 2014; Mondal and Ghosh, 2012). All the values used in the computation of VAIC™ derive from firms' income statements (Joshi *et al.*, 2013; Mondal and Ghosh, 2012; Nimtrakoon, 2015; Saeed *et al.*, 2016; Tan *et al.*, 2007) and, therefore, VAIC™ uses authentic and audited information (Clarke *et al.*, 2011; El-Bannany, 2015; Firer and Williams, 2003; Greco *et al.*, 2014; Kujansivu and Lönnqvist, 2007; Maditinos *et al.*, 2011; Pulic, 1998, 2000; Tan *et al.*, 2007; Young *et al.*, 2009). Moreover, VAIC™ is more objective, verifiable and quantitative (Firer and Williams, 2003; Maditinos *et al.*, 2011; Mehralian *et al.*, 2012; Mondal and Ghosh, 2012; Nimtrakoon, 2015; Pulic, 1998, 2000; Young *et al.*, 2009) and it provides a standardized and consistent measure (El-Bannany, 2015; Greco *et al.*, 2014; Maditinos *et al.*, 2011; Nimtrakoon, 2015), which makes it more informative regarding the firm's value creation through IC for stakeholders (Mondal and Ghosh, 2012; Nimtrakoon, 2015). This model is easy, simple and straightforward to compute (Alhassan and Asare, 2016; El-Bannany, 2015; Firer and Williams, 2003; Joshi *et al.*, 2013; Maditinos *et al.*, 2011; Nimtrakoon, 2015), is better for statistical analysis (Andriessen, 2004), and is appropriate for cross-sectional comparisons, i.e., comparisons across multi-national and multi-industry companies (Chen, Liu, and Kweh, 2014; Firer and Williams, 2003; Nimtrakoon, 2015; Phusavat *et al.*, 2011; Tan *et al.*, 2007; Young *et al.*, 2009; Zéghal and Maaloul, 2010). According to Firer and Williams (2003), the other models of IC measurement developed are customized to fit a specific firm's profile, which limits comparability, and their underlying indicators suffer from subjectivity (Clarke *et al.*, 2011; Williams, 2001). Clarke *et al.* (2011) extend the problems associated with other IC measures. The authors argue that the required information is not available to those outside the firm and

the often-qualitative information, which is based on judgements, cannot be translated to monetary value.

Therefore, this study will use VAIC™ to measure IC. Besides the fact that VAIC™ has been widely adopted by researchers, according to Zéghal and Maaloul (2010) VAIC™ is used by the UK's Department for Business, Innovation and Skills (BIS) as the indicator of firms' IC, which contributes to the validity of the VAIC™ model.

References

Agrawal, A. (2009). Using RefViz with EndNote *EndNote 1 - 2 - 3 Easy!: Reference Management for the Professional* (pp. 263-275). Boston, MA Springer US.

Ahmad, M., and Ahmed, N. (2016). Testing the relationship between intellectual capital and a firm's performance: An empirical investigation regarding financial industries of Pakistan. *International Journal of Learning and Intellectual Capital, 13*(2-3), 250-272.

Alhassan, A. L., and Asare, N. (2016). Intellectual capital and bank productivity in emerging markets: evidence from Ghana. *Management Decision, 54*(3), 589-609.

Amin, M., Hasan, H., Nezamoddin, R., and Tan, H. P. (2014). Intellectual capital and financial performance of companies listed in the Tehran stock exchange. *International Journal of Learning and Intellectual Capital, 11*(1), 71-90.

Andriessen, D. (2004). *Making sense of Intellectual capital: Designing a Method for the Valuation of Intangibles*. Boston: Butterworth-Heinemann.

Andriessen, D., and Tissen, R. (2000). *Weightless wealth, find your real value in a future of intangible assets*. London: Prentice Hall.

Baxter, R., and Matear, S. (2004). Measuring intangible value in business-to-business buyer-seller relationships: An intellectual capital perspective. *Industrial Marketing Management, 33*(6), 491-500.

Bontis, N. (1996). There's a price on your head: managing intellectual capital strategically. *Business Quarterly, 60*(4), 40-47.

Bontis, N. (1998). Intellectual capital: an exploratory study that develops measures and models. *Management Decision, 36*(2), 63-76.

Bontis, N. (1999). Managing organizational knowledge by diagnosing intellectual capital: Framing and advancing the state of the field. *International Journal of Technology Management, 18*(5-8), 433–462.

Bontis, N. (2001). Assessing knowledge assets: A review of the models used to measure intellectual capital. *International Journal of Management Reviews, 3*(1), 41-60.

Bontis, N. (2004). National intellectual capital index: a United Nations initiative for the Arab region. *Journal of Intellectual Capital, 5*(1), 13-39.

Bontis, N., Crossan, M. M., and Hulland, J. (2002). Managing an organizational learning system by aligning stocks and flows. *Journal of Management Studies, 39*(4), 437-469.

Bontis, N., Dragonetti, N. C., Jacobsen, K., and Roos, G. (1999). The knowledge toolbox: a review of the tools available to measure and to manage intangible resources. *European Management Journal, 17*(4), 391-402.

Bontis, N., Janosevic, S., and Dzenopoljac, V. (2015). Intellectual capital in Serbia's hotel industry. *International Journal of Contemporary Hospitality Management, 27*(6), 1365-1384.

Bontis, N., Keow, W. C. C., and Richardson, S. (2000). Intellectual capital and business performance in Malaysian industries. *Journal of Intellectual Capital, 1*(1), 85-100.

Bontis, N., Seleim, A., and Ashour, A. (2007). Human capital and organizational performance: a study of Egyptian software companies. *Management Decision, 45*(4), 789-801.

Bornemann, M. (1999). Potential of value systems according to the VAIC (TM) method. *International Journal of Technology Management, 18*(5-8), 463-475.

Bose, S., and Thomas, K. (2007). Valuation of intellectual capital in knowledge-based firms - The need for new methods in a changing economic paradigm. *Management Decision, 45*(9), 1484-1496.

Bozzolan, S. (2003). Italian annual intellectual capital disclosure: an empirical analysis. *Journal of Intellectual Capital, 4*(4), 543-558.

Brennan, N. (2001). Reporting intellectual capital in annual reports: Evidence from Ireland. *Accounting, Auditing and Accountability Journal, 14*(4), 423-436.

Brennan, N., and Connell, B. (2000). Intellectual capital: current issues and policy implications. *Journal of Intellectual Capital, 1*(3), 206-240.

Briner, R. B., and Denyer, D. (2012). Systematic Review and Evidence Synthesis as a Practice and Scholarship Tool (Rousseau ed., pp. 1-47): Oxford University Press.

Britto, D. P., Monetti, E., and Rocha Lima Jr, J. (2014). Intellectual capital in tangible intensive firms: The case of Brazilian real estate companies. *Journal of Intellectual Capital, 15*(2), 333-348.

Brooking, A. (1997). *Intellectual Capital: Core Asset for the Third Millennium Enterprise*. London: Thomson Business Press.

Cabrita, M. d. R., and Bontis, N. (2008). Intellectual capital and business performance in the Portuguese banking industry. *International Journal of Technology Management, 43*(1-3), 212-237.

Calisir, F., Gumussoy, C. A., Bayraktaroğlu, A. E., and Deniz, E. (2010). Intellectual capital in the quoted Turkish ITC sector. *Journal of Intellectual Capital, 11*(4), 538-554.

Cater, T., and Cater, B. (2009). (In)tangible resources as antecedents of a company's competitive advantage and performance. *Journal for East European Management Studies, 14*(2), 186-209.

Chang, S. C., Chen, S.-S., and Lai, J.-H. (2008). The effect of alliance experience and intellectual capital on the value creation of international strategic alliances. *Omega-International Journal of Management Science, 36*(2), 298-316.

Chang, W. S., and Hsieh, J. (2011). The dynamics of intellectual capital in organizational development. *African Journal of Business Management, 5*(6), 2345-2355.

Changchien, S., and Tsai, P. Y. (2005). Measuring Return on Investment of Intellectual Capital – ROIC. *International Journal of Learning and Intellectual Capital, 2*(3), 219-245.

Chen, F.-C., Liu, Z. J., and Kweh, Q. L. (2014). Intellectual capital and productivity of Malaysian general insurers. *Economic Modelling, 36*, 413-420.

Chen, J., Zhu, Z., and Xie, H. Y. (2004). Measuring intellectual capital: a new model and empirical study. *Journal of Intellectual Capital, 5*(1), 195-212.

Chen, M. C., Cheng, S. J., and Hwang, Y. (2005). An empirical investigation of the relationship between intellectual capital and firms' market value and financial performance. *Journal of Intellectual Capital, 6*(2), 159-176.

Chen, Y. S., Lin, M. J. J., and Chang, C. (2006). The influence of intellectual capital on new product development performance – the manufacturing companies of Taiwan as an example. *Total Quality Management & Business Excellence, 17*(10), 1323–1339.

Chi, C. W., Lieu, P. T., Hung, K., and Cheng, H. W. (2016). Do industry or firm effects drive performance in Taiwanese knowledge-intensive industries? *Asia Pacific Management Review, 21*(3), 170-179.

Choong, K. K. (2008). Intellectual capital: definitions, categorization and reporting models. *Journal of Intellectual Capital, 9*(4), 609-638.

Chu, P. Y., Hsiung, H.-H., Huang, C.-H., and Yang, C.-Y. (2008). Determinants of the valuation of intangible assets - a contrast between Taiwanese and American IC design houses. *International Journal of Technology Management, 41*(3-4), 336-358.

Chu, S. K. W., Chan, K. H., and Wu, W. W. Y. (2011). Charting intellectual capital performance of the gateway to China. *Journal of Intellectual Capital, 12*(2), 249-276.

Clarke, M., Seng, D., and Whiting, R. H. (2011). Intellectual capital and firm performance in Australia. *Journal of Intellectual Capital, 12*(4), 505-530.

Cleary, P. (2015). An empirical investigation of the impact of management accounting on structural capital and business performance. *Journal of Intellectual Capital, 16*(3), 566-586.

Crossan, M. M., and Apaydin, M. (2010). A multi-dimensional framework of organizational innovation: A systematic review of the literature. *Journal of Management Studies, 47*(6), 1154-1191.

Curado, C. (2008). Perceptions of knowledge management and intellectual capital in the banking industry. *Journal of Knowledge Management, 12*(3), 141–155.

Curado, C., Henriques, L., and Bontis, N. (2011). Intellectual capital disclosure payback. *Management Decision, 49*(7-8), 1080-1098.

Díez, J. M., Ochoa, M. L., Prieto, M. B., and Santidrián, A. (2010). Intellectual capital and value creation in Spanish firms. *Journal of Intellectual Capital, 11*(3), 348-367.

Donate, M. J., Pena, I., and Sanchez de Pablo, J. D. (2016). HRM practices for human and social capital development: effects on innovation capabilities. *International Journal of Human Resource Management, 27*(9), 928-953.

Dumay, J., and Garanina, T. (2013). Intellectual capital research: A critical examination of the third stage. *Journal of Intellectual Capital, 14*(1), 10-25.

Dzenopoljac, V., Janosevic, S., and Bontis, N. (2016). Intellectual capital and financial performance in the Serbian ICT industry. *Journal of Intellectual Capital, 17*(2), 373-396.

Dzinkowski, R. (2000). The measurement and management of intellectual capital: An introduction. *Management Accounting Research, 78*(2), 32-36.

Edvinsson, L. (1997). Developing intellectual capital at Skandia. *Long Range Planning, 30*(3), 320-331.

Edvinsson, L., and Malone, M. (1997). *Intellectual Capital: Realizing Your Company's True Value by Finding its Hidden Roots*. New York, NY: Harper Collins.

El-Bannany, M. (2008). A study of determinants of intellectual capital performance in banks: The UK case. *Journal of Intellectual Capital, 9*(3), 487-498.

El-Bannany, M. (2015). Explanatory study about the intellectual capital performance of banks in Egypt. *International Journal of Learning and Intellectual Capital, 12*(3), 270-286.

Firer, S., and Williams, M. (2003). Intellectual capital and traditional measures of corporate performance. *Journal of Intellectual Capital, 4*(3), 348-360.

FitzPatrick, M., Davey, J., Muller, L., and Davey, H. (2013). Value-creating assets in tourism management: Applying marketing's service-dominant logic in the hotel industry. *Tourism Management, 36*, 86-98.

Freeman, R. E. (1984). *Strategic Management: A Stakeholder Approach*. Massachusetts, USA: Pitman Publishing Company.

Gho, P. C. (2005). Intellectual capital performance of commercial banks in Malaysia. *Journal of Intellectual Capital, 6*(3), 385-396.

Ghosh, S., and Mondal, A. (2009). Indian software and pharmaceutical sector IC and financial performance. *Journal of Intellectual Capital, 10*(3), 369-388.

Granstrand, O. (1999). *The Economics and the Management of Intellectual Property*. Cheltenham, UK: Edward Elgar Publishing.

Greco, G., Ferramosca, S., and Allegrini, M. (2014). Exploring intellectual capital in family firms. An empirical investigation. *International Journal of Learning and Intellectual Capital, 11*(2), 91-106.

Guerrini, A., Romano, G., and Leardini, C. (2014). Does intellectual capital efficiency affect financial performance the case of Italian listed firms. *International Journal of Learning and Intellectual Capital, 11*(2), 127-148.

Guthrie, J., Ricceri, F., and Dumay, J. (2012). Reflections and projections: A decade of intellectual capital accounting research. *The British Accounting Review, 44*(2), 68-82.

Haji, A. A. (2015). The role of audit committee attributes in intellectual capital disclosures Evidence from Malaysia. *Managerial Auditing Journal, 30*(8-9), 756-784.

Hall, R. (1992). The strategic analysis of intangible resources. *Strategic Management Journal,, 13*(2), 135–144.

Harrison, S., and Sullivan, P. H. (2000). Profiting from intellectual capital – learning from leading companies. *Journal of Intellectual Capital, 1*(1), 33-46.

Heisig, P., Vorbeck, J., and Niebubr, J. (2001). Intellectual capital. In K. Mertins, P. Heisig, and J. Vorbeck (Eds.), *Knowledge Management – Best Practices in Europe* (pp. 57-73). Berlin: Springer.

Hejazi, R., Ghanbari, M., and Alipour, M. (2016). Intellectual, Human and Structural Capital Effects on Firm Performance as Measured by Tobin's Q. *Knowledge and Process Management, 23*(4), 259-273.

Hsu, H. Y., and Fang, W. (2009). Intellectual capital and new product development performance: The mediating role of organizational learning capability. *Technological Forecasting and Social Change, 76*(5), 664-677.

Iazzolino, G., and Laise, D. (2013). Value added intellectual coefficient (VAIC): A methodological and critical review. *Journal of Intellectual Capital, 14*(4), 547-563.

Iazzolino, G., and Laise, D. (2016). Value creation and sustainability in knowledge-based strategies. *Journal of Intellectual Capital, 17*(3), 457-470.

Ilyin, D. S. (2014). The Impact Of Intellectual Capital On Companies` Performance: Evidence From Emerging Markets. *Korporativnye finansy*(4), 46-66.

Inkinen, H. (2015). Review of empirical research on intellectual capital and firm performance. *Journal of Intellectual Capital, 16*(3), 518-565.

Itami, H. (1987). *Mobilizing Invisible Assets*. Cambridge, MA: Harvard University Press.

Janosevic, S., and Dzenopoljac, V. (2012). Impact of intellectual capital on financial performance of Serbian companies. *Actual Problems of Economics,133*(7), 554-564.

Joshi, M., Cahill, D., Sidhu, J., and Kansal, M. (2013). Intellectual capital and financial performance: An evaluation of the Australian financial sector. *Journal of Intellectual Capital, 14*(2), 264-285.

Kamath, G. B. (2007). The intellectual capital performance of the Indian banking sector. *Journal of Intellectual Capital, 8*(1), 96-123.

Kaplan, R. S., and Norton, D. P. (1992). The Balanced Scorecard – measures that drive performance. *Harvard Business Review, 70*(1), 71-79.

Komnenic, B., and Pokrajčić, D. (2012). Intellectual capital and corporate performance of MNCs in Serbia. *Journal of Intellectual Capital, 13*(1), 106-119.

Kristandl, G., and Bontis, N. (2007). Constructing a definition for intangibles using the resource based view of the firm. *Management Decision, 45*(9), 1510-1524.

Krstic, B., and Bonic, L. (2016). EIC: A NEW TOOL FOR INTELLECTUAL CAPITAL PERFORMANCE MEASUREMENT. *Prague Economic Papers, 25*(6), 723-741.

Kujansivu, P., and Lönnqvist, A. (2007). Investigating the value and efficiency of intellectual capital. *Journal of Intellectual Capital, 8*(2), 272-287.

Kweh, Q. L., Chan, Y. C., and Ting, I. W. K. (2013). Measuring intellectual capital efficiency in the Malaysian software sector. *Journal of Intellectual Capital, 14*(2), 310-324.

Kweh, Q. L., Lu, W.-M., and Wang, W.-K. (2014). Dynamic efficiency: intellectual capital in the Chinese non-life insurance firms. *Journal of Knowledge Management, 18*(5), 937-951.

Lee, S. P., and Mohammed, S. I. (2014). Intellectual capital on listed agricultural firms' performance in Malaysia. *International Journal of Learning and Intellectual Capital, 11*(3), 202-221.

Lev, B. (2001). *Intangibles: Management, Measurement, and Reporting*. Washington D.C.: Brookings Institution Press.

Lev, B., and Sougiannis, T. (1996). The capitalization, amortization, and value-relevance of R&D. *Journal of Accounting and Economics, 21*(1), 107-138.

Liao, P. C., Chan, A. L.-C., and Seng, J.-L. (2013). Intellectual capital disclosure and accounting standards. *Industrial Management & Data Systems, 113*(8), 1189-1205.

Lin, Y.-M., Lee, C.-C., Chao, C.-F., and Liu, C.-L. (2015). The information content of unexpected stock returns: Evidence from intellectual capital. *International Review of Economics & Finance, 37*, 208-225.

Liu, Q., and Wong, K. P. (2011). Intellectual Capital and Financing Decisions: Evidence from the US Patent Data. *Management Science, 57*(10), 1861-1878.

Lu, W.-M., Wang, W.-K., Tung, W.-T., and Lin, F. (2010). Capability and efficiency of intellectual capital: The case of fabless companies in Taiwan. *Expert Systems with Applications, 37*(1), 546-555.

Maaloul, A., Ben Amar, W., and Zeghal, D. (2016). Voluntary disclosure of intangibles and analysts' earnings forecasts and recommendations. *Journal of Applied Accounting Research, 17*(4), 421-439.

Maditinos, D., Chatzoudes, D., Tsairidis, C., and Theriou, G. (2011). The impact of intellectual capital on firms' market value and financial performance. *Journal of Intellectual Capital, 12*(1), 132-151.

Marr, B. (2004). Measuring and benchmarking intellectual capital. *Benchmarking: An International Journal, 11*(6), 559–570.

Marr, B. (2007). What is intellectual capital? In L. A. Jaia (Ed.), *Strategies for Information Technology and Intellectual Capital: Challenges and Opportunities*. Hershey, PA: IGI Global.

Marr, B., and Chatzkel, J. (2004). Intellectual capital at the crossroads: managing, measuring, and reporting of IC. *Journal of Intellectual Capital, 5*(2), 224-229.

Marr, B., and Schiuma, G. (2001). Measuring and managing intellectual capital and knowledge assets in new economy organizations. In M. Bourne (Ed.), *Handbook of Performance Measurement*. London: Gee Publisher.

Martinez, I., and Garcia-Meca, E. (2005). Assessing the quality of disclosure on intangibles in the Spanish capital market. *European Business Review, 17*(4), 305-313.

Massaro, M., Dumay, J., and Bagnoli, C. (2015). Where there is a will there is a way IC, strategic intent, diversification and firm performance. *Journal of Intellectual Capital, 16*(3), 490-517.

Mavridis, D. (2005). Intellectual capital performance drivers in the Greek banking sector. *Management Research News, 28*(5), 43-62.

Mehralian, G., Rasekh, H. R., Akhavan, P., and Sadeh, M. R. (2012). The Impact of Intellectual Capital Efficiency on Market Value: An Empirical Study from Iranian Pharmaceutical Companies. *Iranian Journal of Pharmaceutical Research, 11*(1), 195-207.

Meles, A., Porzio, C., Sampagnaro, G., and Verdoliva, V. (2016). The impact of the intellectual capital efficiency on commercial banks performance: Evidence from the US. *Journal of Multinational Financial Management, 36*, 64-74.

MERITUM. (2002). *MERITUM Guidelines for Managing and Reporting on Intangibles*. Madrid: MERITUM.

Molodchik, M. A., Shakina, E. A., and Barajas, A. (2014). Metrics for the elements of intellectual capital in an economy driven by knowledge. *Journal of Intellectual Capital, 15*(2), 206-226.

Mondal, A., and Ghosh, S. K. (2012). Intellectual capital and financial performance of Indian banks. *Journal of Intellectual Capital, 13*(4), 515-530.

Moon, Y. J., and Kym, H. G. (2006). A model for the value of intellectual capital. *Canadian Journal of Administrative Sciences, 23*(3), 253–269.

Morariu, C. M. (2014). Intellectual capital performance in the case of Romanian public companies. *Journal of Intellectual Capital, 15*(3), 392-410.

Mouritsen, J. (1998). Driving Growth: Economic Value Added versus Intellectual Capital. *Management Accounting Research, 9*, 461-482.

Nahapiet, J., and Ghoshal, S. (1998). Social Capital, Intellectual Capital, and the Organizational Advantage. *The Academy of Management Review, 23*(2), 242-266.

Nassari, Y. P., and Nasab, S. A. M. (2014). Analysis of the effects of intangible assets on corporate financial value. *International Journal of Learning and Intellectual Capital, 11*(4), 273-285.

Nazari, J. A., and Herremans, I. M. (2007). Extended VAIC model: Measuring intellectual capital components. *Journal of Intellectual Capital, 8*(4), 595-609.

Nimtrakoon, S. (2015). The relationship between intellectual capital, firms' market value and financial performance Empirical evidence from the ASEAN. *Journal of Intellectual Capital, 16*(3), 587-618.

Nonaka, I., and Takeuchi, H. (1995). *The Knowledge Creating Company*. Oxford: University Press, Melea.

O'Sullivan, K. J., and Schulte Jr, W. D. (2007). Models for human capital management: Human resource management of intellectual capital. *International Journal of Learning and Intellectual Capital, 4*(4), 453-466.

Olander, H., Hurmelinna-Laukkanen, P., and Heilmann, P. (2015). Human resources - strength and weakness in protection of intellectual capital. *Journal of Intellectual Capital, 16*(4), 742-762.

Ordoñez de Pablos, P. (2002). Evidence of intellectual capital measurement from Asia, Europe and the Middle East. *Journal of Intellectual Capital, 3*(3), 287-302.

Ordoñez de Pablos, P. (2004). The importance of relational capital in service industry: the case of the Spanish banking sector. *International Journal of Learning and Intellectual Capital, 1*(4), 431-440.

Ordoñez de Pablos, P. (2005). Intellectual capital reports in India: Lessons from a case study. *Journal of Intellectual Capital, 6*(1), 141-149.

Ousama, A. A., and Fatima, A. H. (2015). Intellectual capital and financial performance of Islamic banks. *International Journal of Learning and Intellectual Capital, 12*(1), 1-15.

Pal, K., and Soriya, S. (2012). IC performance of Indian pharmaceutical and textile industry. *Journal of Intellectual Capital, 13*(1), 120-137.

Petty, R., and Guthrie, J. (2000). Intellectual capital literature review: Measurement, reporting and management. *Journal of Intellectual Capital, 1*(2), 155-176.

Phusavat, K., Comepa, N., Sitko-Lutek, A., and Ooi, K.-B. (2011). Interrelationships between intellectual capital and performance Empirical examination. *Industrial Management & Data Systems, 111*(5-6), 810-829.

Pittaway, L., and Cope, J. P. (2007). Entrepreneurship education: a systematic review of the evidence. *International Small Business Journal, 25*(5), 479-510.

Pittaway, L., Robertson, M., Munir, K., Denyer, D., and Neely, A. (2004). Networking and innovation: A systematic review of the evidence. *International Journal of Management Reviews, 5-6*(3-4), 137-168.

Pulic, A. (1998). *Measuring the Performance of intellectual potential in Knowledge Economy*. Paper presented at the paper presented at the 2nd McMaster World Congress on Measuring and Managing Intellectual Capital, 21-23 January 1998, Hamilton, Ontario.

Pulic, A. (2000). VAIC (TM) - an accounting tool for IC management. *International Journal of Technology Management, 20*(5-8), 702-714.

Pulic, A. (2004). Intellectual capital – does it create or destroy value? *Measuring Business Excellence, 8*(1), 62-68.

Ramandeep, and Narwal, K. P. (2016). Investigating the impact of intellectual capital on financial performance in Indian manufacturing sector. *Jims8m-the Journal of Indian Management & Strategy, 21*(4), 28-32.

Read, W. H. (1996). Managing the knowledge-based organization: Five principles every manager can use. *Technology Analysis & Strategic Management, 8*(3), 223-232.

Riahi-Belkaoui, A. (2003). Intellectual capital and firm performance of US multinational firms: a study of the resource-based and stakeholder views. *Journal of Intellectual Capital, 4*(2), 215-226.

Roos, G., and Roos, J. (1997). Measuring your company's intellectual performance. *Long Range Planning, 30*(3), 413-426+325.

Rousseau, D. M., Manning, J., and Denyer, D. (2008). Evidence in Management and Organizational Science: Assembling the Field's Full Weight of Scientific Knowledge Through Syntheses. *The Academy of Management Annals, 2*(1), 475-515.

Ruta, C. D. (2009). HR portal alignment for the creation and development of intellectual capital. *International Journal of Human Resource Management, 20*(3), 562-577.

Rylander, A., Jacobsen, K., and Roos, G. (2000). Towards improved information disclosure on intellectual capital. *International Journal of Technology Management, 20*(5-8), 715-741.

Saeed, S., Rasid, S. Z. A., and Basiruddin, R. (2016). Relationship between intellectual capital and corporate performance of top Pakistani companies: An empirical evidence. *International Journal of Learning and Intellectual Capital, 13*(4), 376-396.

Saint-Onge, H. (1996). Tacit knowledge: the key to the strategic alignment of intellectual capital. *Strategy & Leadership, 24*(2), 10-14.

Saur-Amaral, I., Ferreira, P., and Conde, R. (2013). Linking past and future research in tourism management through the lens of marketing and consumption: a systematic literature review. *Tourism & Management Studies, 9*(1), 35-40.

Scafarto, V., Ricci, F., and Scafarto, F. (2016). Intellectual capital and firm performance in the global agribusiness industry. The moderating role of human capital. *Journal of Intellectual Capital, 17*(3), 530-552.

Schimmelpfennig, D., King, J. L., and Naseem, A. (2003). Intellectual capital in a Q-theory of Ag-biotech mergers. *American Journal of Agricultural Economics, 85*(5), 1275-1282.

Schiuma, G., and Lerro, A. (2008). Intellectual capital and company's performance improvement. *Measuring Business Excellence, 12*(2), 3-9.

Seetharaman, A., Helmi Bin Zaini Sooria, H., and Saravanan, A. S. (2002). Intellectual capital accounting and reporting in the knowledge economy. *Journal of Intellectual Capital, 3*(2), 128-148.

Serenko, A., and Bontis, N. (2004). Meta-review of knowledge management and intellectual capital literature: Citation impact and research productivity rankings. *Knowledge and Process Management, 11*(3), 185–198.

Serenko, A., and Bontis, N. (2013). Investigating the current state and impact of the intellectual capital academic discipline. *Journal of Intellectual Capital, 14*(4), 476-500.

Shakina, E., and Barajas, A. (2014). The dynamics of intellectual resources during the economic crisis. *Economic Research-Ekonomska Istrazivanja, 27*(1), 861-881.

Sherif, M., and Elsayed, M. (2016). The impact of intellectual capital on corporate performance: evidence from the Egyptian insurance market. *International Journal of Innovation Management, 20*(3).

Shiri, M. M., and Mousavi, K. (2015). Relationship between intellectual capital with productivity and market value added in Tehran Stock Exchange. *International Journal of Learning and Intellectual Capital, 12*(4), 386-415.

Singh, R. D., and Narwal, K. P. (2015). Intellectual capital and its consequences on company performance: a study of Indian sectors. *International Journal of Learning and Intellectual Capital, 12*(3), 300-322.

Smith, G. V. (1994). *The New Role of Intellectual Property in Commercial Transactions*. New York, NY: Wiley.

Soriya, S., and Narwal, K. P. (2015). Intellectual capital performance in Indian banks: A panel data analysis. *International Journal of Learning and Intellectual Capital, 12*(2), 103-121.

St-Pierre, J., and Audet, J. (2011). Intangible assets and performance: Analysis on manufacturing SMEs. *Journal of Intellectual Capital, 12*(2), 202-223.

Ståhle, P., Ståhle, S., and Aho, S. (2011). Value added intellectual coefficient (VAIC): a critical analysis. *Journal of Intellectual Capital, 12*(4), 531-551.

Ståhle, P., Ståhle, S., and Lin, C. Y. Y. (2015). Intangibles and national economic wealth - a new perspective on how they are linked. *Journal of Intellectual Capital, 16*(1), 20-57.

Stankeviciene, J., and Cepulyte, J. (2014). Sustainable value creation: coherence of corporate social responsibility and performance of socially responsible investment funds. *Economic Research-Ekonomska Istrazivanja, 27*(1), 882-898.

Stewart, T. A. (1997). *Intellectual capital: the new wealth of organizations*. New York, N.Y.: Doubleday & Co.

Stovel, M., and Bontis, N. (2002). Voluntary turnover: knowledge management friend or foe? *Journal of Intellectual Capital, 3*(3), 303–322.

Sveiby, K. E. (1997). *The New Organizational Wealth: Managing and Measuring Knowledge-Based Assets*. New York: Berrett-Koehler.

Sveiby, K. E. (2001, updated 27 April 2010). Methods for measuring intangible assets. Retrieved from <http://www.sveiby.com/articles/IntangibleMethods.htm> Accessed November 2016.

Sydler, R., Haefliger, S., and Pruksa, R. (2014). Measuring intellectual capital with financial figures: Can we predict firm profitability? *European Management Journal, 32*(2), 244-259.

Tan, H. P., Plowman, D., and Hancock, P. (2007). Intellectual capital and financial returns of companies. *Journal of Intellectual Capital, 8*(1), 76-95.

Teece, D. J., Pisano, G., and Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal, 18*(7), 509–533.

Ting, I. W. K., and Lean, H. H. (2009). Intellectual capital performance of financial institutions in Malaysia. *Journal of Intellectual Capital, 10*(4), 588-599.

Tranfield, D., Denyer, D., and Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management, 14*(3), 207-222.

Tranfield, D., and Mouchel, D. D. (2002). Developing an evidence-based approach to management knowledge using systematic review. *Advanced Management Research Centre: Cranfield School of Management*.

Tripathy, T., Gil-Alana, L. A., and Sahoo, D. (2015). The effect of intellectual capital on firms' financial performance: An empirical investigation in India. *International Journal of Learning and Intellectual Capital, 12*(4), 342-371.

Tripathy, T., Sahoo, D., Kesharwani, A., and Mishra, A. K. (2016). Competition, intellectual capital efficiency and firms' performance outcome in India: A structural equation modelling. *International Journal of Learning and Intellectual Capital, 13*(1), 72-95.

Tsakalerou, M. (2015). A meta-study of intellectual capital and firm performance: When the whole is more than the sum of its parts. *International Journal of Learning and Intellectual Capital, 12*(3), 287-299.

Tseng, C. Y., and Goo, Y. J. J. (2005). Intellectual capital and corporate value in an emerging economy: empirical study of Taiwanese manufacturers. *R & D Management, 35*(2), 187-201.

Tseng, K.-A., Lan, Y.-W., Lu, H.-C., and Chen, P.-Y. (2013). Mediation of strategy on intellectual capital and performance. *Management Decision, 51*(7), 1488-1509.

Väisänen, J., Kujansivu, P., and Lonnqvist, A. (2007). Effects of intellectual capital investments on productivity and profitability. *International Journal of Learning and Intellectual Capital, 4*(4), 377-391.

Van Buren, M. E. (1999). A yardstick for knowledge management. *Training & Development, 53*(5), 71-+.

Vishnu, S., and Gupta, V. K. (2015). Performance of intellectual capital in Indian healthcare sector. *International Journal of Learning and Intellectual Capital, 12*(1), 47-60.

Walker, K. (2010). A systematic review of the corporate reputation literature: Definition, measurement, and theory. *Corporate Reputation Review, 12*(4), 357-387.

Wang, M.-C. (2013). Value relevance on intellectual capital valuation methods: the role of corporate governance. *Quality & Quantity, 47*(2), 1213-1223.

Wang, M.-C. (2015). Value Relevance of Tobin's Q and Corporate Governance for the Taiwanese Tourism Industry. *Journal of Business Ethics, 130*(1), 223-230.

Wang, W. Y., and Chang, C. (2005). Intellectual capital and performance in causal models: Evidence from the information

technology industry in Taiwan. *Journal of Intellectual Capital, 6*(2), 222-236.

Williams, S. M. (2001). Is intellectual capital performance and disclosure practices related? *Journal of Intellectual Capital, 2*(3), 192-203.

Wudhikarn, R. (2016). An efficient resource allocation in strategic management using a novel hybrid method. *Management Decision, 54*(7), 1702-1731.

Yalama, A., and Coskun, M. (2007). Intellectual capital performance of quoted banks on the Istanbul stock exchange market. *Journal of Intellectual Capital, 8*(2), 256-271.

Yang, C.-C., and Lin, C. Y.-Y. (2009). Does intellectual capital mediate the relationship between HRM and organizational performance? Perspective of a healthcare industry in Taiwan. *International Journal of Human Resource Management, 20*(9), 1965-1984.

Youndt, M. A., Subramaniam, M., and Snell, S. A. (2004). Intellectual capital profiles: An examination of investments and returns. *Journal of Management Studies, 41*(2), 335-361.

Young, C.-S., Su, H.-Y., Fang, S.-C., and Fang, S.-R. (2009). Cross-country comparison of intellectual capital performance of commercial banks in Asian economies. *Service Industries Journal, 29*(11), 1565-1579.

Yu, H.-C., Wang, W.-Y., and Chang, C. (2015). The stock market valuation of intellectual capital in the IT industry. *Review of Quantitative Finance and Accounting, 45*(2), 279-304.

Zavertiaeva, M. (2016). Portfolio forming decisions: the role of intellectual capital. *Journal of Intellectual Capital, 17*(3), 439-456.

Zéghal, D., and Maaloul, A. (2010). Analysing value added as an indicator of intellectual capital and its consequences on company performance. *Journal of Intellectual Capital, 11*(1), 39-60.

CHAPTER 3

A European Empirical Study of the Relationship Between Firms' Intellectual Capital, Financial Performance and Market Value

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Abstract

Purpose - The purpose of this paper is to analyse the relationship between firms' intellectual capital (IC), financial performance and market value as well as the relationship between ownership concentration and IC performance. **Design/methodology/approach** - A large sample of non-financial listed firms belonging to 14 countries in Western Europe, for the period between 2004 and 2015, were investigated using the GMM system (1998) dynamic estimator and the effect of lagged explanatory variables on firm's financial performance and market value. **Findings** - The results reveal that IC is an important resource for firms' value creation. Human capital is found to be a key factor of firms' wealth. Results show that capital employed efficiency positively impacts on firms' financial performance in the short run. The impact of IC components on firms' market value may not be immediate. The structural capital positively affects firms' financial performance in the long run. Also, the results reveal that ownership concentration and owners' management involvement constrain firms' IC performance. **Originality/value** - The current study contributes to IC research by exploring a large sample of firms across countries in Western Europe using econometric modeling. Considering that the effect of IC on firms' financial performance needs time to be realized, thus to be measured, the effect of lagged explanatory variables on performance was tested, using dynamic panel estimators, specifically the GMM system (1998) dynamic estimator.

Keywords

Intellectual capital; Financial performance; Market value; Ownership concentration

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1. Introduction

In a knowledge-based economy, it is recognized the importance of Intellectual capital (IC) investments as the knowledge assets affect the firm long term competitive advantage and firm's value creation (Lev, 2001, Lev, 2004, Cabello-Medina *et al.*, 2011). Furthermore, IC is an important resource for firm's innovations and human development through knowledge share (European Commission, 2010, European Commission, 2013, Nonaka and Takeuchi, 1995). The recognized discrepancy between firm book and market values has been attributed to hidden values that are not recognized in the annual reports. In that sense, IC has been suggested to explain the gap between firm market value (MV) and book value (Lev, 2004).

The difficulties in evaluating IC investments increase agency costs due to the information asymmetry between the firm and the external investors (Aboody and Lev, 2000, Lev, 2004, Lev and Zambon, 2003). The specificities of IC investments may lead to adverse selection, moral hazard and an opportunistic behavior of managers (Holland, 2006, Aboody and Lev, 2000). High ownership concentration and lack of willingness to share control may block the entrance of qualified and well-trained managers (Miller and Le Breton-Miller, 2006, Westhead and Howorth, 2006, Greco *et al.*, 2014) and the presence of a high number of family members as executives can increase conflicts and loss of efficiency which affects the firm objectives (Gomez-Meja *et al.*, 2007, Miller and Le Breton-Miller, 2006, Greco *et al.*, 2014).

Ownership concentration can have a negative effect on IC value creation and development. On one hand, Gedajlovic and Carney (2010) argue that firms with ownership concentration are disadvantaged in value creation from IC. On the other hand, empirical evidence suggests that ownership concentration might positively impact on firm performance and firm value (Shleifer and Vishny, 1986, Denis and McConnell, 2003).

This study aims to extend the literature of IC (e.g., Ballester *et al.*, 2003, Chan *et al.*, 2001, Xing, 2014, ul Rehman *et al.*, 2011, Tseng *et al.*, 2013, Nimtrakoon, 2015) by analysing the impact of intellectual capital investments on firms' financial performance (FP), measured by ROA, and firms' MV, measured by Tobin's Q. These measures were used in several studies (Goebel, 2015, Bharathi Kamath, 2008, Mehralian *et al.*, 2012, Gerpott *et al.*, 2008). Moreover, this study also aims to verify the influence of ownership concentration and owner's management involvement on the firm IC performance in the context of countries in Western Europe.

In order to reach the study objective, it is used a large sample of non-financial listed firms across 14 countries in Western Europe (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden and United Kingdom) in order to capture some variability of the relevant variables in study, namely of IC investments. Data were collected for the period between 2004 and 2015. Considering that the effect of IC on firms' performance needs time to be realized, thus to be measured, Nimtrakoon (2015) argues that

studies exploring the effect of IC on lagged performance seem to require the use of econometric modeling techniques. Thus, following this suggestion, this study tests the effect of lagged explanatory variables on performance, using dynamic panel estimators, specifically the GMM system (1998) dynamic estimator

Findings allow contributing to IC literature, revealing that IC is an important resource for firms' value creation. Human capital, referring to employees' competence, knowledge, and innovativeness, is found to be a key factor for firms' wealth. Results show that capital employed efficiency positively impacts on firms' financial performance in the short run. The impact of IC components on firms' market value may not be immediate. According to the study findings, the structural capital positively affects firms' financial performance in the long run. If we take into consideration that SC comprises the firms' most valuable strategic assets (Bontis *et al.*, 2015, Denicolai *et al.*, 2015, Janosevic and Dzenopoljac, 2012), then it is understandable that takes time for employees assimilate and adapt to firms' particularities, such as, culture and processes. Also, results show that ownership concentration and owners' management involvement constrain firm IC performance.

The current paper is structured as follows. Section 2 presents a theoretical framework and hypotheses formulation; Section 3 describes the used methodology; Section 4 presents the results; the results discussion is presented in Section 5; and finally, Section 6 presents the conclusion and implications.

2. Literature Review and Hypotheses Development

2.1. IC and Firm's Financial Performance

IC can be defined as the sum all knowledge and knowing capabilities that allow firms to acquire and/or maintain a sustainable competitive advantage (Wang *et al.*, 2014, Nahapiet and Ghoshal, 1998, Youndt *et al.*, 2004). 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". Lev (2004) interprets intangible assets as claims of future benefits, but without physical or financial form. Moreover, there is consensus among academics that IC, i.e., non-monetary and non-physical resource, strongly contributes to value creation through employee's knowledge and organizational processes, databases and relationships (Serenko and Bontis, 2004, Youndt *et al.*, 2004, Wang *et al.*, 2014).

Although we can find different frameworks to conceptualize IC (Edvinsson and Malone, 1997, Sveiby, 1997, Sydler *et al.*, 2014), there are three components that are widely accepted among researchers, i.e., human capital (HC), structural (or organizational) capital (SC), and relational

(or customer) capital (RC) (ul Rehman *et al.*, 2011, Wang *et al.*, 2014, Nimtrakoon, 2015, Bontis *et al.*, 2015).

HC refers to the sum of employee's knowledge, competence, innovativeness, commitment and wisdom (Ahangar, 2011, Bontis, 1998, Morris, 2015, Johnson, 1999). 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 (Ahangar, 2011, Denicolai *et al.*, 2015, Janosevic and Dzenopoljac, 2012, Johnson, 1999). The RC is the knowledge obtained through the establishment of relationships with external stakeholders (Kweh *et al.*, 2014, Yu *et al.*, 2015, Johnson, 1999).

Previous studies investigated the impact of IC and IC components on firm's FP across different countries and industries. Regarding the relationship between IC and firm's FP, the majority of the studies show a positive and significant effect of IC on firm's FP (ul Rehman *et al.*, 2011, Tseng *et al.*, 2013, Nimtrakoon, 2015, Bontis, 1998, Ahangar, 2011, Denicolai *et al.*, 2015).

Regarding HC component of IC, ul Rehman *et al.* (2011) found a positive and significant impact on firm's FP. Tseng *et al.* (2013) used operating profit per employee as an indicator for HC component and verified a positive impact of HC on firm's FP. Wang *et al.* (2014) also found a positive and significant correlation between HC and firm's FP. Morris (2015) analysed the impact of HC across different industries and the results show a positive and significant association between HC and firm's FP. In the study conducted by Nimtrakoon (2015) across five ASEAN countries, i.e., Indonesia, Malaysia, Philippines, Singapore and Thailand, the results show a positive and statistically significant correlation between HC and firm's FP.

Concerning the SC component of IC, ul Rehman *et al.* (2011) study shows a positive and significant impact on firm's FP. In other study, Tseng *et al.* (2013), following Edvinson and Malone (1997) suggestion and decomposing SC into process capital (proxied by current capital turnover rate) and innovation capital (proxied by research and development (R&D) intensity), results show a positive relationship between innovation capital and firm's FP and a negative association between process capital and firm's FP. Wang *et al.* (2014) study verified a positive and statistically significant correlation between HC and firm's FP. Guo *et al.* (2012) examined the influence of patents and R&D expenses on accounting performance. Although results show a non-statistically significant relationship between patents and firm's FP, the authors found a negative and statistically significant effect of R&D on firm's FP. Also, when testing the influence of compensation of CEOs or Vice presidents (human capital), the authors found a positive and statistically significant correlation between salary and bonus for CEOs and firm's FP. Results from Nimtrakoon (2015) study revealed a positive and statistically significant correlation between SC and firm's FP for Malaysia and negative and statistically significant correlation between SC and firm's FP for Philippines.

Regarding RC component of IC, Tseng *et al.* (2013) used revenue growth rate as an indicator for RC. The authors found a positive correlation between RC and firm's FP. The study of Wang *et al.* (2014) shows a positive and statistically significant correlation between HC and firm's FP. The study conducted by Nimtrakoon (2015) shows a positive and statistically significant correlation between RC and firm's FP for Malaysian and Philippines. In accordance with the above-mentioned studies, the following hypotheses are proposed:

H1. IC has a positive impact on firms' FP

H1a. CEE has a positive impact on firms' FP

H1b. HCE has a positive impact on firms' FP

H1c. SCE has a positive impact on firms' FP

H1d. RC has a positive impact on firms' FP

2.2. IC and Firm's Market Value

Although the existence of empirical evidence on the positive impact of IC on firm's MV can be found in several studies (Ballester *et al.*, 2003, Chan *et al.*, 2001, Xing, 2014), there are several studies with contradictory results regarding the relationship between IC and firm's MV. Chen *et al.* (2005) carried out a study to analyse the impact of IC on firm's MV, using a sample of listed firms on Taiwan Stock Exchange. The results show a statistically significant positive relationship between IC and firm's MV. Next, when the authors analysed the effect of R&D and advertising, which are considered part of structural capital and relational capital, respectively, on firm's MV, the results reveal a positive and statistically significant relationship between R&D and firm's MV, however the relationship between advertising and firm's MV was not statistically significant. In other study, Ramirez and Hachiya (2012) also analysed the impact of R&D and advertising on firm's MV. The results obtained show that, although a positive and statistically significant relationship between R&D and firm's MV, the results for the advertising were mixed, which made the authors suggested that this divergence could be attributed to the type of industry. Tseng and Goo (2005) analysed the relation between IC and firm's MV on Taiwanese manufacturing industry. Results from Structural Equation Model reveal a positive association between IC and firm's MV. When analysing five ASEAN countries, Nimtrakoon (2015) did not find statistically significance in the association between IC and firm's MV, except for the case of Thailand.

Based on results from above-mentioned studies, it is suggested a positive impact of IC on firm's MV. Therefore, it is formulated the following hypotheses:

H2. IC has a positive impact on firms' MV

H2a. CEE has a positive impact on firms' MV

H2b. HCE has a positive impact on firms' MV

H2c. SCE has a positive impact on firms' MV

H2d. RC has a positive impact on firms' MV

2.3. The Influence of Ownership Concentration on IC Investments

Empirical evidence suggests that ownership concentration might positively impacts on firm performance and firm value (Shleifer and Vishny, 1986, Denis and McConnell, 2003). However, agency problems might be noticed among firms with ownership concentration. On one hand, the lack of willingness to share control may block the entrance of qualified and well-trained managers (Miller and Le Breton-Miller, 2006, Westhead and Howorth, 2006, Greco *et al.*, 2014). On the other hand, agency problems might be solved in firms managed by their owners (McVey and Draho, 2005, Miller and Le Breton-Miller, 2006) due to the absence of divergent interests between owners and managers (Lemmon and Lins, 2003).

Saleh *et al.* (2009) conducted a study, where results show a negative and statistically significant relation between ownership concentration and IC. Regarding the IC components, the authors also found a negative and statistically significant correlation between ownership concentration and SC. Contrasting with the previous study, Greco *et al.* (2014) found a positive and statistically significant association between ownership concentration and IC. However, when owners' management involvement was tested, the authors found a non-linear inverted-U-shaped relationship with IC. Therefore, it is predicted that ownership concentration reduces the investments on IC, and consistent with this perspective, it is formulated the following H3 and H4 hypotheses:

H3. Ownership concentration has a negative impact on IC performance

H4. Owner management involvement has a negative impact on IC performance

3. Data, Variables and Method

3.1. Database

In order to analyse the impact of firms' FP and MV as well as to capture some variability of the relevant variables in study, namely of IC investments, data of 2090 non-financial listed firms across 14 countries in Western Europe (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden and United Kingdom) were gathered for the period between 2004 and 2015. Table 1 reports the number of firms per country.

Table 1 - Descriptive statistics of the variables for the overall sample

Variable	Obs	Mean	SD	Min	Max
$ROA_{i,t}$	2090	.0105685	.2091852	-3.546324	3.991124
$TobinQ_{i,t}$	2090	1.712327	1.496299	.0701452	29.27833
$VAIC_{i,t}$	2090	1.747303	1.144375	-5.971396	5.994712
$CEE_{i,t}$	2090	.5699616	.4772858	-5.221453	5.794343
$HCE_{i,t}$	2090	1.244293	.8694041	-5.832143	5.991013
$SCE_{i,t}$	2090	.4733021	.6752345	-5.897365	5.921043
$RCap_{i,t}$	2090	.325609	1.418735	-5.323659	77.05882
$RDintensity_{i,t}$	2090	2.894352	78.47195	0	6099

The countries with more firms in the sample are France, Germany, and the UK, whereas Austria, Greece, Ireland and Portugal are the less represented countries. The data used in this study were retrieved from the DATASTREAM database by Thomson Reuters that provides current and historical economic and financial data for all listed firms from the major world stock exchanges. All financial firms are excluded. Ownership data was gathered from AMADEUS database by Bureau Van Dijk. The sample has an unbalanced panel structure, where the number of years varies between 4 to 12. Following the suggestions of Guariglia (2008), in order to mitigate potential survivor bias, it was allowed the entrance and exit of firms in the research sample. The observations at one percent tails were excluded in order to control the potential effects of outliers, which may derive from particular events, such as large mergers or errors in coding.

3.2. Estimation Method and Variables Measurement

Due to the dynamic character of the main research variables in the study, dynamic panel data estimators will be used, which allows the use of time series data taking into account the heterogeneity in adjustment dynamics between different type of firms. Therefore, this study uses GMM system (1998), which is a dynamic estimator proposed by Blundell and Bond (1998) that allows 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 the use of instruments; and (2) it should not exist second-order autocorrelation. In order to test the first condition, i.e., the validity of the restrictions created by the used instruments, the Hansen test is used where the null hypothesis is the validity of the restrictions created by the used instruments. For the second condition, the existence of second-order autocorrelation is tested, 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, it is possible to conclude that GMM system (1998) estimator is valid and robust.

This study uses the Value Added Intellectual Coefficient (VAIC™) model to measure IC. The VAIC™ model, developed by Pulic (1998), is one of the most adopted methods to valuate IC among researchers. Pulic (2000) proposed value added as an indicator for measuring performance in a knowledge economy context. Furthermore, VAIC™ components measure two dimensions of IC, HC and SC, and it also takes into consideration the capital employed efficiency (CEE). Therefore, VAIC™ measures the capital employed efficiency (CEE), human capital efficiency (HCE), and structural capital efficiency (SCE) (Firer and Williams, 2003, Montequin *et al.*, 2006, Pulic, 2000). However, one commonly identified limitation of VAIC™ is related to the absence of the RC component (Chen *et al.*, 2005, Nimtrakoon, 2015, Ståhle *et al.*, 2011). Therefore, in the current study, revenues growth is used as proxy of RC.

According to Iazzolino and Laise (2013), part of the criticism that VAIC™ has received derives from misunderstandings of different meanings that Pulic gave to human capital (HC) and structural capital (SC) in comparison to Skandia Navigator, namely the words used by IC research community.

Ståhle *et al.* (2011) pointed out several drawbacks to VAIC™ model. The model is based on financial indicators, which rely on past strategy and decision making. According to the authors, the model does not measure IC, it just measures operational efficiency in different ways, i.e., the efficiency of labour and capital invested by firms. For example, since human capital embeds factors such as employee's skills and knowledge, training and motivation, the model only takes into consideration the annual salaries of human resources. The SC has a similar problem. The authors also pointed problems in the way which the model is calculated. In the case of human capital, the higher the HC, the higher will be the human capital value. However, in the calculus of HCE, the lower the HC, the greater will be the efficiency of human capital. This problem could be eliminated if it is taken into account that HCE measures the use of human capital.

According to Ståhle *et al.* (2011), there is a limitation on the comparability of high salaries firms with low salaries firms, since to compare VAIC and IC efficiency (ICE), ICE = HCE + SCE, the same level of salaries has to be taken into consideration. The authors also suggest that the application of value added (VA) is problematic. Value added is given by the expression VA = OP

+ EC + A + D, where OP is the firm operating profit and EC is personnel costs consisting of salaries and social costs, A is depreciations in firm assets and D is write-downs in firm's long-term and current assets. According to the authors, A and D are independent of value added. In the case of structural capital (SC) which is given by VA minus human capital costs (OP + A + D) and thus it binds VAIC and SC variable, which limits the comparability of capital-intensive with non-capital-intensive industries or countries rich in capital with countries poor in capital due to the differences in human capital costs.

Despite the abovementioned disadvantages, VAIC model has been widely accepted by academics and practitioners has a good indicator of IC efficiency (Bontis *et al.*, 2015). Some of the pointed advantages of VAIC™ model are the accessibility of needed data as it is obtained from firm's financial reports, its simplicity to use to determine the IC value and for comparability purposes (Nimtrakoon, 2015, Young *et al.*, 2009, Janosevic *et al.*, 2013, Al-Musali and Ku Ismail, 2016). Moreover, according to Zéghal and Maaloul (2010) VAIC is used by the UK's Department for Business, Innovation and Skills (BIS) as the indicator of IC's use in firms which contributes to the VAIC model validity.

Considering that the main objective of the current study is to analyse the influence of IC on the firm´s financial performance and market value, as well as to analyse the influence of ownership concentration and owner management involvement on the IC performance, the following regression models were developed:

Equation (1):

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

Equation (2):

$$ROA_{i,t} = \propto_0 + \beta_1 ROA_{i,t-1} + \beta_2 CEE_{i,t} + \beta_3 HCE_{i,t} + \beta_4 SCE_{i,t} + \beta_5 CEE_{i,t-1} + \beta_6 HCE_{i,t-1} + \beta_7 SCE_{i,t-1} + \beta_8 RCap_{i,t} + \beta_9 RCap_{i,t-1} + \beta_{10} RDintensity_{i,t} + \beta_{11} OWNCONC_{i,t} + \beta_{12} Tlev_{i,t} + \beta_{13} SIZE_{i,t} + \beta_{14} AGE_{i,t} + \varphi_s D_s + \varphi_t d_t + \eta_i + \varepsilon_{i,t}$$

Equation (3):

$$TobinQ_{i,t} = \propto_0 + \beta_1 TobinQ_{i,t-1} + \beta_2 VAIC_{i,t} + \beta_3 RDintensity_{i,t} + \beta_4 OWNCONC_{i,t} + \beta_5 Tlev_{i,t} + \beta_6 SIZE_{i,t} + \beta_7 AGE_{i,t} + \varphi_s D_s + \varphi_t d_t + \eta_i + \varepsilon_{i,t}$$

Equation (4):

$$TobinQ_{i,t} = \propto_0 + \beta_1 TobinQ_{i,t-1} + \beta_2 CEE_{i,t} + \beta_3 HCE_{i,t} + \beta_4 SCE_{i,t} + \beta_5 CEE_{i,t-1} + \beta_6 HCE_{i,t-1} + \beta_7 SCE_{i,t-1} + \beta_8 RCap_{i,t} + \beta_9 RCap_{i,t-1} + \beta_{10} RDintensity_{i,t} + \beta_{11} OWNCONC_{i,t} + \beta_{12} Tlev_{i,t} + \beta_{13} SIZE_{i,t} + \beta_{14} AGE_{i,t} + \varphi_s D_s + \varphi_t d_t + \eta_i + \varepsilon_{i,t}$$

Equation (5):

$$VAIC_{i,t} = \propto_0 + \beta_1 VAIC_{i,t-1} + \beta_2 ROA_{i,t} + \beta_3 OWNCONC_{i,t} + \beta_4 OWNINVOLV_{i,t} + \beta_5 Tlev_{i,t} + \beta_6 SIZE_{i,t} + \beta_7 AGE_{i,t} + \varphi_s D_s + \varphi_t d_t + \eta_i + \varepsilon_{i,t}$$

Where: η_i are non-observable individual effects; and $\varepsilon_{i,t}$ is the error; d_t correspond to the year dummies; and D_s are 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 of the current period to total assets of the current period; $TobinQ_{i,t}$ is used as a proxy for firms' market value of the current year, given by the ratio of equity market value of the current period to equity book value of the current period. Next, measures for the independent variables are presented as follow: $TobinQ_{i,t-1}$ is used as a proxy for firms' market value of the previous year, given by the ratio of equity market value of the previous period to equity book value of the previous period. $VAIC_{i,t}$ is the value added intellectual coefficient of the current period (VAIC™) corresponding to sum of HCE plus SCE plus CEE, where: HCE is the human capital efficiency (HCE) = value added (VA) / human capital (HC); SCE structural capital efficiency (SCE) = structural capital (SC) / value added (VA); and CEE is the capital employed efficiency = value added (VA) / capital employed (CE). $VAIC_{i,t-1}$ is the value added intellectual coefficient of the previous period; $CEE_{i,t}$ is the Capital employed efficiency of the current period; $CEE_{i,t}$ = value added (VA) / capital employed (CE); VA=sales – operational expenses + employee costs; $CEE_{i,t-1}$ is the Capital employed efficiency of the previous period. $HCE_{i,t}$ is the human capital efficiency of the current period; HCE = value added (VA) /human capital (HC); $HCE_{i,t-1}$ is the human capital efficiency of the previous period; $SCE_{i,t}$ is the structural capital efficiency of the current period; SCE = structural capital (SC) / value added (VA); $SCE_{i,t-1}$ is the structural capital efficiency of the previous period; $RCap_{i,t}$ is the relational capital of the current period, given by revenues growth of the current period; and $RCap_{i,t-1}$ is the relational capital of the previous period, given by the revenues growth of the previous period. The measurement of control variables are as follows: $Tlev_{i,t}$ is the leverage of the current period, given by the ratio of book value of total debt of the current period to total assets of the current period; $RDintensity_{i,t}$ is the intensity of firms' R&D activities, given by the ratio of R&D expenses of

the current period to total revenues of the current period; $SIZE_{i,t}$ is the size of the current period, given by the natural logarithm of total assets of the current period; $AGE_{i,t}$ is firm age of the current period, given by the natural logarithm of the number of years of existence of the firm of the current period. Based on the variable NOSHEM (source: DATASTREAM database), which aggregates the percentage of holdings of 5% or more by employees or family members, a dummy variable $OWNCONC_{i,t}$ was created, which is a dummy variable that assumes the value of one if the firm has ownership concentration (if percentage of holdings is higher than 5%) and zero otherwise. $OWNINVOLV_{i,t}$ is a dummy variable which assumes the value of one if the firms' Global Ultimate Owner (GUO) has a function as director/manager or if GUO is a board member, and the value of zero otherwise.

4. Empirical Results

4.1. Descriptive Statistics and Correlation Matrix

Descriptive statistics of the variables used in the study are presented in Table 2. It summarizes the descriptive statistics of the dependent variables, related to firms' FP and MV, and independent variables used in this study.

Table 2 - Number of firms per country

Countries	Sample	% of sample
Austria	29	1,4%
Belgium	82	3,9%
Denmark	94	4,5%
Finland	109	5,2%
France	411	19,7%
Germany	352	16,8%
Greece	49	2,3%
Ireland	37	1,8%
Italy	195	9,3%
Netherlands	93	4,4%
Portugal	41	2,0%
Spain	59	2,8%
Sweden	200	9,6%
UK	339	16,2%
Total	2090	100%

ROA presents low mean scores of 0.01 suggesting that in firms have been facing difficulties in obtaining profits. The high standard deviation suggests high variations of FP across firms. The high value of TobinQ suggests that firms' market value is on average higher compared with the firms' book value of the firms analysed. The mean score of VAIC is 1.747, suggesting that Western Europe firms created an average of 1.747 for every 1 monetary unity utilized. Human capital is a key driver of firms' value creation as HCE presents the higher mean score of 1.244 compared to CEE and SCE, 0.569 and 0.473 respectively. The combined mean score of the

intangible components of IC, HCE and SCE, is 1,718, which is three times higher than the mean score of CEE. Therefore, this suggests that firms create much more value by the intangible components from IC than from the physical and financial component CEE. Furthermore, it shows the importance of IC for Western Europe firms' value creation in the actual knowledge economy. The relational capital, RCap, presents a mean score of 0.326 and RDintensity has a mean score of 2.894. However, the higher standard deviation of RCap and RDintensity, 1.419 and 78.472 respectively, suggest a high volatility of these variables. Due to the differences between the countries in Western Europe, the descriptive statistics of the variables by country can be seen in Table 3.

Regarding profitability, the countries with a higher median score for ROA are UK (0.057), Sweden (0.046), Finland (0.042) and Netherlands (0.042), whereas countries with the lowest median score for ROA are Italy (0.016) and Portugal (0.018). Concerning MV, the countries with a higher median score for TobinQ are UK (1.600) and Sweden (1.600). Countries with the lowest median score for TobinQ are Italy (1.100), Portugal (1.100) and Greece (1.000). The countries with higher VAIC median scores are UK (2.200), Austria (1.900), Netherlands (1.900), Finland (1.800), whereas the countries with the lowest median score are Sweden (1.000), Greece (1.100). Regarding the components of IC, i.e., SCE, HCE and CEE, it can be observed that HCE presents the higher median score for all countries. Only Belgium, Greece, Ireland and Italy present higher median scores of SCE compared to CEE, i.e., a tangible component of IC. Regarding the efforts taken by firms in the relational capital, Greece (0.170), Sweden (0.150) and UK (0.110) are the countries with a higher median score, and countries such as Spain (0.054), Netherlands (0.062) and Denmark (0.073) present the lowest median scores. The countries with higher median scores of RDintensity are Denmark (0.033), France (0.033) and Sweden (0.032), whereas Portugal (0.0012), Spain (0.0035) and Greece (0.0035) presents the lowest median scores.

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

Table 3 - Descriptive statistics of the variables by country

Country		$ROA_{i,t}$	$TobinQ_{i,t}$	$VAIC_{i,t}$	$CEE_{i,t}$	$HCE_{i,t}$	$SCE_{i,t}$	$RCap_{i,t}$	$RDintensity_{i,t}$
Austria	Obs	336	313	348	348	348	348	348	207
	Mean	.038	1.4	2	.4	1.3	.37	.22	.023
	Median	.045	1.3	1.9	.33	1.3	.28	.084	.011
	SD	.053	.44	.82	.28	.68	.59	.57	.069
Belgium	Obs	884	824	984	984	984	984	984	379
	Mean	.00039	1.6	1.6	.51	1.2	.57	.37	12
	Median	.031	1.2	1.5	.46	1.1	.49	.079	.025
	SD	.25	1.2	1.2	.43	1.1	.64	1.8	125
Denmark	Obs	1081	1033	1128	1128	1128	1128	1128	403
	Mean	-.0053	1.9	1.7	.58	1.1	.48	.24	1.3
	Median	.032	1.3	1.7	.48	1.1	.34	.073	.033
	SD	.25	2.1	1.1	.48	.93	.74	.95	9.2
Finland	Obs	1205	1149	1308	1308	1308	1308	1308	772
	Mean	.027	1.6	1.8	.66	1.2	.38	.28	.045
	Median	.042	1.3	1.8	.53	1.1	.27	.075	.015
	SD	.14	.91	.99	.48	.53	.56	1.2	.098
France	Obs	4415	4150	4932	4932	4932	4932	4932	1638
	Mean	-.0033	1.5	1.7	.55	1.2	.44	.35	7.9
	Median	.03	1.2	1.7	.43	1.1	.29	.085	.033
	SD	.22	1.2	1.1	.47	.9	.68	1.9	164
Germany	Obs	3660	3461	4224	4224	4224	4224	4224	2026
	Mean	-.0072	1.7	1.5	.57	1.1	.49	.33	1.3
	Median	.036	1.3	1.5	.5	1	.36	.1	.025
	SD	.25	1.4	1.1	.42	.79	.77	1.4	28
Greece	Obs	564	550	588	588	588	588	588	172
	Mean	.037	1.3	1.6	.48	1.4	.58	.46	.011
	Median	.03	1	1.1	.24	1	.6	.17	.0035
	SD	.09	.89	1.1	.42	.88	.63	1.4	.025
Ireland	Obs	386	354	444	444	444	444	444	100
	Mean	-.00093	1.9	1.8	.56	1.2	.71	.23	.17
	Median	.031	1.4	1.7	.45	1.1	.6	.092	.0039
	SD	.21	1.9	1.3	.71	1	.8	.44	.81
Italy	Obs	2133	2055	2340	2340	2340	2340	2340	493
	Mean	-.012	1.3	1.6	.38	1.2	.38	.26	3.5
	Median	.016	1.1	1.5	.27	1.1	.32	.081	.016
	SD	.19	.72	1.3	.36	.97	.83	.61	43
Netherlands	Obs	977	918	1116	1116	1116	1116	1116	371
	Mean	-.015	1.9	1.7	.63	1.2	.46	.23	6.7
	Median	.042	1.4	1.9	.54	1.1	.32	.062	.014
	SD	.3	2	1.2	.61	.93	.65	.54	87
Portugal	Obs	474	447	492	492	492	492	492	28
	Mean	.0041	1.2	1.6	.35	1.4	.28	.33	.0026
	Median	.018	1.1	1.5	.19	1.1	.29	.1	.0012
	SD	.15	.46	1.3	.34	.98	.82	.79	.0064
Spain	Obs	622	554	708	708	708	708	708	149
	Mean	.032	1.9	1.8	.43	1.4	.37	.17	.5
	Median	.035	1.4	1.7	.28	1.2	.32	.054	.0035
	SD	.12	1.6	1.1	.38	.77	.59	.39	4.7
Sweden	Obs	2040	1854	2400	2400	2400	2400	2400	838
	Mean	.0034	2.3	1.6	.8	1.1	.64	.45	.92
	Median	.046	1.6	1	1	1	.95	.15	.032
	SD	.23	2.4	1.1	.57	.73	.65	1.6	16
UK	Obs	3613	3376	4068	4068	4068	4068	4068	1410
	Mean	.063	2	2.2	.61	1.6	.48	.33	.11
	Median	.057	1.6	2.2	.53	1.4	.38	.11	.012
	SD	.13	1.4	1.1	.45	.85	.44	1.5	.93
Total	Obs	22390	21038	25080	25080	25080	25080	25080	8986
	Mean	.011	1.7	1.7	.57	1.2	.47	.33	2.9
	Median	.036	1.3	1.7	.47	1.1	.35	.094	.02
	SD	.21	1.5	1.1	.48	.87	.68	1.4	78

Table 4 – Pearson correlation matrix

Variables	$ROA_{i,t}$	$ROA_{i,t-1}$	$TobinQ_{i,t}$	$TobinQ_{i,t-1}$	$VAIC_{i,t}$	$VAIC_{i,t-1}$	$CEE_{i,t}$	$CEE_{i,t-1}$	$HCE_{i,t}$	$HCE_{i,t-1}$	$SCE_{i,t}$	$SCE_{i,t-1}$	$RCap_{i,t}$	$RCap_{i,t-1}$	$RDintensity_{i,t}$
$ROA_{i,t}$	1.0000														
$ROA_{i,t-1}$	0.5059**	1.0000													
$TobinQ_{i,t}$	-0.0889**	-0.0733**	1.0000												
$TobinQ_{i,t-1}$	-0.0193	-0.0989**	0.7457**	1.0000											
$VAIC_{i,t}$	0.3058**	0.2695**	0.0605**	0.0701**	1.0000										
$VAIC_{i,t-1}$	0.2590**	0.3024**	0.0425**	0.0659**	0.6334**	1.0000									
$CEE_{i,t}$	0.1914**	0.1350**	0.1022**	0.0972**	0.1082**	0.0724**	1.0000								
$CEE_{i,t-1}$	0.1500**	0.1953**	0.0899**	0.0938**	0.0968**	0.0966**	0.8262**	1.0000							
$HCE_{i,t}$	0.3534**	0.3109**	-0.0037	0.0178	0.6890**	0.5417**	0.0457**	0.0229	1.0000						
$HCE_{i,t-1}$	0.2977**	0.3523**	-0.0173	0.0045	0.5445**	0.6939**	0.0094	0.0462**	0.7246**	1.0000					
$SCE_{i,t}$	-0.1187**	-0.1005**	0.1657**	0.1641**	0.1577**	-0.0712**	0.0754**	0.0675**	-0.1312**	-0.0924**	1.0000				
$SCE_{i,t-1}$	-0.1251**	-0.1224**	0.1652**	0.1721**	-0.0881**	0.1606**	0.0480**	0.0747**	-0.1029**	-0.1327**	0.4554**	1.0000			
$RCap_{i,t}$	0.0023	0.0056	0.0025	0.0102	-0.0000	-0.0012	0.0051	-0.0002	-0.0072	-0.0088	0.0144	0.0023	1.0000		
$RCap_{i,t-1}$	0.0104	0.0075	0.0034	0.0062	-0.0002	-0.0024	0.0013	0.0070	-0.0083	-0.0104	0.0111	0.0175	0.0590**	1.0000	
$RDintensity_{i,t}$	-0.1361**	-0.1113**	0.0630**	0.0846**	-0.0396*	-0.0713**	-0.0389*	-0.0709**	-0.0833**	-0.0916**	0.0689**	0.0483**	0.0018	0.0020	1.0000

Notes:

Standard errors in parentheses

** p<0.01 and * p<0.05

Through the correlation coefficients analysis, it can be noticed that there are significant and positive correlations for the majority of variable pairs. VAIC has a significant and positive correlation with ROA (0.305) and TobinQ (0.065). Therefore, as expected, VAIC has a significant positive correlation with firm's FP and firms' MV, which indicates a significant association between IC efficiency and firms' FP and firms' MV. Regarding the components of VAIC, CEE has a positive and statistically significant correlation firms' FP and firms' MV while HCE has a statistically significant positive correlation with firms' FP and a statistically significant negative correlation with firms' MV. The correlations between RCap and firms' FP and firms' MV are not statistically significant. RDintensity has a negative and statistically significant correlation with firms' FP and a positive and statistically significant correlation with firms' MV. Through the correlation matrix analysis, it is notorious the statistically significant positive correlation between VAIC and its components. The strongest correlation between VAIC and its components is with HCE (0.689), followed by its correlation with SCE (0.157) and CEE (0.108). According to Aivazian *et al*. (2005) and Gujarati and Porter (2010), the problems of endogeneity between independent variables are relevant for correlation coefficients above 30%. Three correlations coefficients above 30% among independent variables were found, which are the VAIC components, CEE, HECE and SCE, between the current and previous periods. Therefore, to overcome the problem of endogeneity, GMM system (1998) dynamic estimator was applied as it allows the use of instrumental variables to reduce the endogeneity problem. Also, the coefficients of the correlations between the variables, ROA, TobinQ and VAIC of the current and previous periods are high. Therefore, ROA, Tobin Q and VAIC are variables with high persistence. Consequently, according to Blundell and Bond (1998), it is more appropriate to use the GMM system (1998) estimator than the GMM (1991) estimator.

Next, the results obtained with the application of GMM system (1998) are presented. According to the results of the Hansen test and second-order autocorrelation test, the null hypothesis cannot be rejected in both tests, for all estimations in this study. Therefore, the validity of the restrictions of the instruments is not rejected and the hypothesis of the existence of second-order autocorrelation for the estimated models is not rejected. This being so, the results of GMM system (1998) dynamic estimator are robust and can be used to support our interpretation of the empirical results.

4.2. IC Impact on Firms' Financial Performance and Firms' Market Value

The results for the estimated models, regarding firms' FP and firms' MV, using GMM system (1998) dynamic estimator are presented in Table 5.

Table 5 - Regressions (1), (2), (3), (4) and (5) results

Variables	Model (1) $ROA_{i,t}$	Model (3) $TobinQ_{i,t}$	Variables	Model (2) $ROA_{i,t}$	Model (4) $TobinQ_{i,t}$	Variables	Model (5) $VAIC_{i,t}$
$ROA_{i,t-1}$	0.41166***		$ROA_{i,t-1}$	0.07102***		$VAIC_{i,t-1}$	0.37651***
	(0.00755)			(0.01513)			(0.06251)
$TobinQ_{i,t-1}$		0.41376***	$TobinQ_{i,t-1}$		0.45218***	$ROA_{i,t}$	1.22736***
		(0.02330)			(0.02393)		(0.34149)
$VAIC_{i,t}$	0.01879***	0.27226***	$CEE_{i,t}$	0.26764***	-0.46654***	$OWNCONC_{i,t}$	-0.74921**
	(0.00300)	(0.04174)		(0.03161)	(0.16937)		(0.31447)
$RDintensity_{i,t}$	0.00020***	0.00172***	$HCE_{i,t}$	0.08236***	0.42427***	$OWNINVOLV_{i,t}$	-0.87687**
	(0.00004)	(0.00053)		(0.00376)	(0.08586)		(0.43775)
$OWNCONC_{i,t}$	0.28739***	-0.55388***	$SCE_{i,t}$	-0.02701***	0.17315***	$Tlev_{i,t}$	-0.00488
	(0.02079)	(0.13629)		(0.00427)	(0.02431)		(0.01444)
$Tlev_{i,t}$	-0.10609***	-0.02688***	$CEE_{i,t-1}$	-0.16446***	0.78421***	$SIZE_{i,t}$	0.29927**
	(0.00663)	(0.00342)		(0.01587)	(0.26684)		(0.13063)
$SIZE_{i,t}$	0.02877***	-0.13417***	$HCE_{i,t-1}$	0.00595	-0.22218***	$AGE_{i,t}$	0.22939
	(0.00288)	(0.01660)		(0.00391)	(0.05279)		(0.22641)
$AGE_{i,t}$	-0.02447**	0.04637*	$SCE_{i,t-1}$	-0.00009	0.02180	Constant	-7.28198*
	(0.01234)	(0.02546)		(0.00361)	(0.02341)		(4.19996)
Constant	-0.40245***	0.00000	$RCap_{i,t}$	0.06292***	-0.07583***		
	(0.01652)	(0.00000)		(0.00786)	(0.01700)		
			$RCap_{i,t-1}$	0.01835***	-0.27940***		
				(0.00246)	(0.05283)		
			$RDintensity_{i,t}$	0.00025**	0.00384***		
				(0.00010)	(0.00065)		
			$OWNCONC_{i,t}$	0.40482***	-0.72443**		
				(0.02837)	(0.30487)		
			$Tlev_{i,t}$	-0.15994***	-0.02147***		
				(0.01517)	(0.00330)		
			$SIZE_{i,t}$	0.03228***	-0.11766***		
				(0.00238)	(0.02703)		
			$AGE_{i,t}$	0.00190	-0.00065		
				(0.00605)	(0.02447)		
			Constant	-0.73241***	2.41364***		
				(0.04023)	(0.49237)		
Observations	7,825	7,648	Observations	7,143	7,586	Observations	7,250
F(N(0,1))	847.0***	524.5***	F(N(0,1))	24415***	88.24***	F(N(0,1))	8.584***
Hansen (N(0,1))	76.64	52.48	Hansen (N(0,1))	62.27	66.80	Hansen (N(0,1))	38.86
m1 (N(0,1))	-5.965***	-4.820***	m1 (N(0,1))	-5.790***	-4.981***	m1 (N(0,1))	-6.505***
m2 (N(0,1))	1.931*	-1.386	m2 (N(0,1))	0.305	-1.647	m2 (N(0,1))	1.514

Notes:

Standard errors in parentheses

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

Regarding the firms' FP, equation (1) results show that ROA of the previous period, VAIC, RDintensity, OWNCONC and SIZE have a positive impact on firms' FP, while Tlev and AGE have a negative impact on firms' FP. Results from equation (2) show that ROA of the previous period, CEE, HCE, RCap, Rcap of the previous period, RDintensity, OWNCONC and SIZE have a positive impact on firms' FP, while SCE, CEE of the previous period and Tlev negatively impact on firms' FP.

Concerning firms' MV, results from equation (3) show that TobinQ of the previous period, VAIC, RDintensity and AGE positively impact on firms' MV, whereas OWNCONC, Tlev and SIZE negatively impact on firms' MV. Results from equation (4) show that TobinQ of the previous period, HCE, SCE, CEE of the previous period, RDintensity have a positive impact on firms' MV, while CEE, HCE of the previous period, RCap, RCap of the previous period, OWNCONC, Tlev and SIZE have a negative impact on firms' MV.

Regarding the ownership concentration, the results of the equation (5), related to the influence of ownership concentration on IC performance, using GMM system (1998) dynamic estimator is presented in Table 5. The results show that VAIC of the previous period, ROA and SIZE positively impact on IC performance, while OWNCONC and OWNINVOLV negatively impact on IC performance.

5. Discussion of the Empirical Results

The hypotheses verified in this study are depicted in Table 6.

Table 6 - Hypotheses verified in this study

Hypothesis	Rejected/Not Rejected
H1. IC has a positive impact on firms' FP	Not Rejected
H1a. CEE has a positive impact on firms' FP	Not Rejected
H1b. HCE has a positive impact on firms' FP	Not Rejected
H1c. SCE has a positive impact on firms' FP	Rejected
H1d. RC has a positive impact on firms' FP	Not Rejected
H2. IC has a positive impact on firms' MV	Not Rejected
H2a. CEE has a positive impact on firms' MV	Rejected
H2b. HCE has a positive impact on firms' MV	Not Rejected
H2c. SCE has a positive impact on firms' MV	Not Rejected
H2d. RCap has a positive impact on firms' MV	Rejected
H3. Ownership concentration has a negative impact on IC performance	Not Rejected
H4. Owner involvement in management has a negative impact on IC performance	Not Rejected

Results from equation (1) suggest that IC enhances Western Europe firms' FP. According to the results, for each monetary unit invested on VAIC, it is expected that firms increase their ROA in 0.412 monetary unit. Therefore, the findings do not allow us to reject the previous formulated hypothesis H1. This result suggests that the efficient use of IC increases the Western Europe firms´ FP of the current year. A higher level of IC investments is associated with greater efficiency, which affects positively the firms´ FP and, likely, the firms' growth and wealth. This result is consistent with previous studies (Chen *et al.*, 2005, Ting and Lean, 2009).

Regarding the components, VAIC and RCap, results from equation (2) do not allow to reject the formulated sub-hypotheses H1a, H1b and H1d. The findings show that CEE, HCE and RCap of the current period have a positive effect on ROA, while SCE of the current period has a negative impact on ROA. Therefore, although the sub-hypotheses H1a, H1b and H1d cannot be rejected, the sub-hypothesis H1c is rejected. The results for the impact of IC components on firms' FP are in line with previous studies (Bontis *et al.*, 2015, Nimtrakoon, 2015, Chen *et al.*, 2005, Ting and Lean, 2009, Tseng *et al.*, 2013). Financial capital, physical capital and human capital are beneficial sources for firms' higher performance. The human capital is a key driver of firms' FP. The investment in employees' knowledge and competencies increases firms' capacity to innovate, on processes, products, services, and so on. The investment in relational capital allows firms to establish relationships with their customers, suppliers, and partners as well as to increase their relational networks, which seem to be fundamental for firm's FP.

The analysis of the impact of CEE, HCE, SCE and RCap of the previous period on firms' FP, results show that only CEE of the previous period has a negative impact on firms' FP. Moreover, results show no statistical significance for the impact of HCE and SCE of the previous period on firms' FP. These results reveal the importance on the long run of the financial and physical capital for firms' future financial performance. Also, the results of the investment in relational capital show persistence over time, which leads to the development of trust in the relationships between firms and their relational networks.

Regarding the impact of IC on firms' MV, results of equation (3) and (4) suggest that IC has a positive effect on firms' MV. It is expected that for each monetary unit invested on IC, firms increase their MV in 0.414 monetary unit, and therefore hypothesis H2 cannot be rejected. This result corroborates previous studies (Nimtrakoon, 2015, Shiu, 2006). Positive reactions of investors seem to increase the firms' MV. IC investments allow firms to innovate and disclose signals to the market about their growth opportunities, which probably leads to the increase of firms' MV.

According to the results of equation (4), CEE and RCap of the current period have a negative impact on the firms' MV, and therefore, the sub-hypotheses H2a and H2d are rejected. SCE and HCE of the current period have a positive effect on firms' MV, thus the sub-hypotheses H2b and H2c cannot be rejected. These results are broadly in line with findings of previous studies

(Nimtrakoon, 2015, Shiu, 2006, Morris, 2015). Human capital is an important resource for the firms' value creation. Structural capital comprises the firms' most valuable strategic assets (Bontis *et al.*, 2015, Denicolai *et al.*, 2015, Janosevic and Dzenopoljac, 2012, Tseng and Goo, 2005). The interaction of human capital with structural capital allows firms to innovate through the development of products, patents, trademarks, and so on. Therefore, investors recognize these events that seem to contribute to the increase of firms' MV.

Taking into account the CEE, SCE, HCE and RCap of the previous period, results suggest that CEE and RCap of the previous period have a negative impact on firms' MV, while HCE of the previous period positively impacts on firms' MV. Results suggest that SCE of the previous period has no statistical significance on firms' MV. Although, the inexistence of a positive effect of capital employed efficiency (CEE) of the current period on firms' MV, the findings reveal that the CEE of the previous period positively impacts on the firms' MV. Interestingly, the financial and physical capital investments in the past are recognized by investors as an opportunity for firms' value creation. These results suggest that these investments lead to better conditions to the appliance of employees' knowledge.

Regarding the ownership concentration, the findings show that the existence of ownership concentration has a positive effect on firms' FP, corroborating previous studies (Shleifer and Vishny, 1986, Denis and McConnell, 2003), but a negative effect on firms' MV. The alignment of interests between owners and managers' increases firms' financial performance. The ownership concentration provides commitment, knowledge, and capabilities as well as it enforces relationships with the stakeholders in the long run (Greco *et al.*, 2014). However, this alignment of interests is not recognized by investors and therefore, it negatively impacts on firms' MV.

Results from equation (5) show that ownership concentration and owner's management involvement have a negative effect on IC performance (VAIC), which corroborates the study of Saleh *et al.* (2009). These results suggest that the opportunistic behavior of the owners in pursuing their personal interests and objectives at the expense of minorities decreases IC performance. Regarding owner's management involvement, the results suggest that the efficiency of IC is negatively affected by the owners' management involvement, which has negative consequences on IC performance (VAIC).

6. Conclusion

In a knowledge-based economy, it is recognized the importance of IC investments in firms' value creation due to the distinctive characteristics that IC provides. Furthermore, IC is an important resource for firm's growth and innovation. Based on a large sample of non-financial listed firms of 14 countries in Western Europe, and using GMM system (1998) dynamic estimator, the current study seeks to analyse the impact of IC has on firms' financial performance and firms' market

value, as well as to analyse the influence of ownership concentration and owner's management involvement on IC performance. Regarding the empirical evidence provided by the current study, our findings reveal that IC is an important resource to enhance firms' financial performance and market value. Results show that ownership concentration and owner's management involvement constrain IC performance. Particularly, it was found a significant and positive relationship between IC and financial performance and market value, measured by ROA and Tobins' Q respectively. Regarding the VAIC components, the highest contributions to firms' financial performance were found to be the human component (HCE) and capital employed efficiency (CEE). Concerning firms' market value, the current study shows that human capital and structural capital have higher contribution to firm's market value. Therefore, human capital can be seen as the main driver of firms' future growth and innovativeness.

The results contribute to IC research, suggesting that IC is an important resource to firms' value creation in the Western Europe context. Also, by using dynamic panel data, our findings reveal that HCE of the previous period positively impacts on firms' financial performance, while CEE and SCE of the previous period positively impact on firms' market value. These results suggest that IC investments do not produce immediate outcomes. Furthermore, results suggest that ownership concentration and owner's management involvement constrain IC performance.

Several practical implications of results from this study can be addressed. Managers should invest in human capital, particularly in firms, verifying higher ownership concentration and/or firms which owner' are management involved. Investing in human capital, employees contribute with the knowledge to the firm, therefore the firm benefits form innovative capacity and greater financial performance. Also, firms should invest in continuous training programs, because it increases HCE and the performance of managers and employees. However, it may occur that the outcomes of IC are not immediate due to aspects, such as the style of management and internal processes of the firm. Regarding the policy-makers, it is suggested the creation of incentives for the investment on IC due to the difficulty that firms may have to finance this type of assets, which contributes to firms' value creation, country wealth, and human development.

The current study has the following limitations. Given that a large sample of countries in Western Europe was used, the differences between countries were not analysed, which limits our extrapolation of the results to each country as well as to the type of industry. This being so, some of the direction of the relationships may change for individual countries due to the country characteristics, such as legal aspects, accounting practices or industrial sectors. For future research, it is suggested longitudinal studies comparing countries and industries. Finally, it is suggested to extend the analysis of the relationship between different corporate governance variables and IC.

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References

Aboody, D., and Lev, B. (2000). Information asymmetry, R&D and insider gains. *The Journal of Finance, 55*(6), 2747-2766.

Ahangar, R. G. (2011). The relationship between intellectual capital and financial performance: An empirical investigation in an Iranian company. *African Journal of Business Management, 5*(1), 88-95.

Aivazian, V. A., Ge, Y., and Qiu, J. (2005). The impact of leverage on firm investment: Canadian evidence. *Journal of Corporate Finance, 11*(1-2), 277-291.

Al-Musali, M. A., and Ku Ismail, K. N. I. (2016). Cross-country comparison of intellectual capital performance and its impact on financial performance of commercial banks in GCC countries. *International Journal of Islamic and Middle Eastern Finance and Management, 9*(4), 512-531.

Ballester, M., Garcia-Ayuso, M., and Livnat, J. (2003). The economic value of the R&D intangible asset. *European Accounting Review, 12*(4), 605-633.

Bharathi Kamath, G. (2008). Intellectual capital and corporate performance in Indian pharmaceutical industry. *Journal of Intellectual Capital, 9*(4), 684-704.

Blundell, R., and Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics, 87*, 115-143.

Bontis, N. (1998). Intellectual capital: an exploratory study that develops measures and models. *Management Decision, 36*(2), 63-76.

Bontis, N., Janosevic, S., and Dzenopoljac, V. (2015). Intellectual capital in Serbia's hotel industry. *International Journal of Contemporary Hospitality Management, 27*(6), 1365-1384.

Cabello-Medina, C., Lopez-Cabrales, A., and Valle-Cabrera, R. (2011). Leveraging the innovative performance of human capital through HRM and social capital in Spanish firms. *International Journal of Human Resource Management, 22*(4), 807-828.

Chan, L. K. C., Lakonishok, J., and Sougiannis, T. (2001). The stock market valuation of research and development expenditures. *The Journal of Finance, 56*(6), 2431-2456.

Chen, M., Cheng, S., and Hwang, Y. (2005). An empirical investigation of the relationship between intellectual capital and firms' market value and financial performance. *Journal of Intellectual Capital, 6*(2), 159-176.

Denicolai, S., Ramusino, E. C., and Sotti, F. (2015). The impact of intangibles on firm growth. *Technology Analysis & Strategic Management, 27*(2), 219-236.

Denis, D. K., and McConnell, J. J. (2003). International corporate governance. *Journal of Financial and Quantitative Analysis, 38*(1), 1-36.

Edvinsson, L., and Malone, M. (1997). *Intellectual Capital: Realizing Your Company's True Value by Finding its Hidden Roots*. New York, NY: Harper Collins.

European Commission. (2010). *Europe 2020. A European strategy for smart, sustainable and inclusive growth*. Brussels: European Commission.

European Commission. (2013). *Public-private partnerships in Horizon 2020: a powerful tool to deliver on innovation and growth in Europe*. Brussels: European Commission.

Firer, S., and Williams, S. M. (2003). Intellectual capital and traditional measures of corporate performance. *Journal of Intellectual Capital, 4*(3), 348-360.

Gedajlovic, E., and Carney, M. (2010). Markets, hierarchies, and families: Toward a transaction costs theory of the family firm. *Entrepreneurship: Theory and Practice, 34*(6), 1145-1171.

Gerpott, T. J., Thomas, S. E., and Hoffmann, A. P. (2008). Intangible asset disclosure in the telecommunications industry. *Journal of Intellectual Capital, 9*(1), 37-61.

Goebel, V. (2015). Estimating a measure of intellectual capital value to test its determinants. *Journal of Intellectual Capital, 16*(1), 101-120.

Gomez-Meja, L. R., Haynes, K. T., Núñez-Nickel, M., Jacobson, K. J. L., and Moyano-Fuentes, J. (2007). Socioemotional wealth and business risks in family-controlled firms: evidence from Spanish olive oil mills. *Administrative Science Quarterly, 52*(1), 106-137.

Greco, G., Ferramosca, S., and Allegrini, M. (2014). Exploring intellectual capital in family firms. An empirical investigation. *International Journal of Learning and Intellectual Capital, 11*(2), 91-106.

Guariglia, A. (2008). Internal financial constraints, external financial constraints, and investment choice: Evidence from a panel of UK firms. *Journal of Banking & Finance, 32*(9), 1795-1809.

Gujarati, D., and Porter, D. (Eds.). (2010). *Essentials of Econometrics* (4th ed ed.). New York: McGraw – Hill International.

Guo, W.-C., Shiah-Hou, S.-R., and Chien, W.-J. (2012). A study on intellectual capital and firm performance in biotech companies. *Applied Economics Letters, 19*(16), 1603-1608.

Holland, J. (2006). Fund management, intellectual capital, intangibles and private disclosure. *Managerial Finance, 32*(4), 281.

Iazzolino, G., and Laise, D. (2013). Value added intellectual coefficient (VAIC): A methodological and critical review. *Journal of Intellectual Capital, 14*(4), 547-563.

Janosevic, S., and Dzenopoljac, V. (2012). Impact of intellectual capital on financial performance of serbian companies. *Actual Problems of Economics, 133*(7), 554-564.

Janosevic, S., Dzenopoljac, V., and Bontis, N. (2013). Intellectual capital and financial performance in Serbia. *Knowledge and Process Management,, 20*(1), 1-11.

Johnson, W. H. A. (1999). An integrative taxonomy of intellectual capital: measuring the stock and flow of intellectual capital components in the firm. *International Journal of Technology Management, 18*(5-8), 562-575.

Kweh, Q. L., Lu, W.-M., and Wang, W.-K. (2014). Dynamic efficiency: intellectual capital in the Chinese non-life insurance firms. *Journal of Knowledge Management, 18*(5), 937-951.

Lemmon, M. L., and Lins, K. V. (2003). Ownership Structure, Corporate Governance and Firm Value: Evidence from the East Asian Financial Crisis. *The Journal of Finance, 58*(4), 1445-1468.

Lev, B. (2001). *Intangibles: Management, Measurement, and Reporting*. Washington D.C.: Brookings Institution Press.

Lev, B. (2004). Sharpening the intangibles edge. *Harvard Business Review, 82*(6), 109-116.

Lev, B., and Zambon, S. (2003). Intangibles and intellectual capital: an introduction to a special issue. *European Accounting Review, 12*(4), 597-603.

McVey, H., and Draho, J. (2005). U.S. family-run companies – They may be better than you think. *Journal of Applied Corporate Finance, 17*(4), 134-143.

Mehralian, G., Rajabzadeh, A., Sadeh, M. R., and Rasekh, H. R. (2012). Intellectual capital and corporate performance in Iranian pharmaceutical industry. *Journal of Intellectual Capital, 13*(1), 138-158.

Miller, D., and Le Breton-Miller, I. (2006). Family governance and firm performance: Agency, stewardship, and capabilities. *Family Business Review, 19*(1), 73-87.

Montequin, V., Fernandez, F., Cabal, V., and Gutierrez, N. (2006). An integrated framework for intellectual capital measurement and knowledge management implementation in small and medium-sized enterprises. *Journal of Information Science, 32*(6), 525-538.

Morris, C. (2015). An industry analysis of the power of human capital for corporate performance: Evidence from South Africa. *South African Journal of Economic and Management Sciences, 18*(4), 486-499.

Nahapiet, J., and Ghoshal, S. (1998). Social Capital, Intellectual Capital, and the Organizational Advantage. *The Academy of Management Review, 23*(2), 242-266.

Nimtrakoon, S. (2015). The relationship between intellectual capital, firms' market value and financial performance Empirical evidence from the ASEAN. *Journal of Intellectual Capital, 16*(3), 587-618.

Nonaka, I., and Takeuchi, H. (1995). *The Knowledge Creating Company*. Oxford: University Press, Melea.

Pulic, A. (1998). *Measuring the Performance of intellectual potential in Knowledge Economy*. Paper presented at the paper presented at the 2nd McMaster World Congress on Measuring and Managing Intellectual Capital, 21-23 January 1998, Hamilton, Ontario.

Pulic, A. (2000). VAIC (TM) - an accounting tool for IC management. *International Journal of Technology Management, 20*(5-8), 702-714.

Ramirez, P. G., and Hachiya, T. (2012). Intangible assets and market value of Japanese industries and firms. *International Journal of Technology Management, 59*(1-2), 1-21.

Saleh, N. M., Rahman, M. R. C. A., and Hassan, M. S. (2009). Ownership structure and intellectual capital performance in Malaysia. *Asian Academy of Management Journal of Accounting and Finance, 5*(1), 1-29.

Serenko, A., and Bontis, N. (2004). Meta-review of knowledge management and intellectual capital literature: citation impact and research productivity rankings. *Knowledge and Process Management, 11*(3), 185-198.

Shiu, H.-J. (2006). Application of the VAIC method to measures of corporate performance: a quantile regression approach. *The Journal of American Academy of Business, 8*(2), 156-160.

Shleifer, A., and Vishny, R. W. (1986). Large shareholders and corporate control. *The Journal of Political Economy, 94*(3), 461-488.

Ståhle, P., Ståhle, S., and Aho, S. (2011). Value added intellectual coefficient (VAIC): a critical analysis. *Journal of Intellectual Capital, 12*(4), 531-551.

Sveiby, K. E. (1997). *The New Organizational Wealth: Managing and Measuring Knowledge-Based Assets*. New York: Berrett-Koehler.

Sydler, R., Haefliger, S., and Pruksa, R. (2014). Measuring intellectual capital with financial figures: Can we predict firm profitability? *European Management Journal, 32*(2), 244-259.

Ting, I. W. K., and Lean, H. H. (2009). Intellectual capital performance of financial institutions in Malaysia. *Journal of Intellectual Capital, 10*(4), 588-599.

Tseng, C.-Y., and Goo, Y.-J. J. (2005). Intellectual capital and corporate value in an emerging economy: empirical study of Taiwanese manufacturers. *R & D Management, 35*(2), 187-201.

Tseng, K.-A., Lan, Y.-W., Lu, H.-C., and Chen, P.-Y. (2013). Mediation of strategy on intellectual capital and performance. *Management Decision, 51*(7), 1488-1509.

ul Rehman, W., Ilyas, M., and ur Rehman, H. (2011). Intellectual capital performance and its impact on financial returns of companies: An empirical study from insurance sector of Pakistan. *African Journal of Business Management, 5*(20), 8041-8049.

Wang, Z., Wang, N., and Liang, H. (2014). Knowledge sharing, intellectual capital and firm performance. *Management Decision, 52*(2), 230-258.

Westhead, P., and Howorth, C. (2006). Ownership and management issues associated with family performance and company objectives. *Family Business Review, 19*(4), 301-316.

Wooldridge, J. M. (2007). *Econometric analysis of cross section and panel data*. Cambridge: The MIT Press.

Xing, H. (2014). The Effect of Advertising Expenditures on the Intangible Capital Aspect: Sample Firms of Us Leading Advertisers. *International Business and Management, 9*(2), 124-129.

Youndt, M. A., Subramaniam, M., and Snell, S. A. (2004). Intellectual capital profiles: an examination of investments and returns. *Journal of Management Studies, 41*(2), 335-361.

Young, C.-S., Su, H. Y., Fang, S. C., and Fang, S. R. (2009). Cross-country comparison of intellectual capital performance of commercial banks in Asian economics. *The Service Industries Journal, 29*(11), 1565-1579.

Yu, H.-C., Wang, W.-Y., and Chang, C. (2015). The stock market valuation of intellectual capital in the IT industry. *Review of Quantitative Finance and Accounting, 45*(2), 279-304.

Zéghal, D., and Maaloul, A. (2010). Analysing value added as an indicator of intellectual capital and its consequences on company performance. *Journal of Intellectual Capital, 11*(1), 39-60.

CHAPTER 4

Financial Performance and Intellectual Capital: An Empirical Analysis in the Context of the Euronext Market Countries

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Abstract

The current paper seeks to analyse the impact of intellectual capital on financial performance, using the Value Added Intellectual Coefficient (VAIC™) method, in the European context. Based on a sample of non-financial listed firms in Euronext stock market countries (Belgium, France, the Netherlands and Portugal) for the period between 2005 and 2015, we explore the impact of IC on firms' financial performance, using dynamic panel estimators, specifically the GMM system (1998) dynamic estimator. Results suggest that IC investments have a positive impact on firms' financial performance in the short and long run. The human capital component is of greater importance in enhancing firms' financial performance in both previous and current periods. Also, the results reveal that firms investing in R&D have greater financial performance, while the recent financial crisis produced a negative effect on financial performance in 2008 and 2009. The results contribute to the literature, as intellectual capital is an important resource for firms' value creation in the European context. Suggestions are made for practitioners and policy-makers.

Keywords

Intellectual capital, Financial performance, Euronext stock market, Panel data

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1. Introduction

Various studies show the importance of intangible investments for firms' growth, competitiveness and success. In the current knowledge-based economy, firms are giving more importance to investment in research and development (R&D), software, training, intellectual property, patents, etc. Concerning investment in intangible assets, there is growing awareness and acceptance of the importance of intellectual capital (IC) as a source of competitive advantage. IC includes unique resources that are not easily accessible to competitors, contributing to the competitiveness, productivity, efficiency and performance of the firm (Hall, 1992; Sharabati, Shawqi, and Bontis, 2010; Stewart, 1997; Sveiby, 1997). IC has been identified has a key value driver for firms in the context of the new economy due to its importance for their survival and performance (Nimtrakoon, 2015).

Various authors (Bontis, 2001; Sveiby, 1997) suggest breaking down IC in three components: human capital; structural capital; and relational capital. Human capital refers to the knowledge and competence of firms' human resources, and is considered one of the most important sources of innovation (Stewart, 1997). Structural capital includes firms' internal elements, such as patents, software, trademarks, copyrights (Bontis, Keow, and Richardson, 2000; Sydler, Haefliger, and Pruksa, 2014). 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).

In spite of recognizing IC's importance for firms' value creation and competitive advantage, financial statements fail to report IC due to the difficulty of identifying, measuring and evaluating it (Nimtrakoon, 2015; Skinner, 2008). Therefore, Pulic (1998) developed the Value Added Intellectual Coefficient model (VAIC™), which monitors and measures value added based on the efficiency of firms' IC (Ståhle, Ståhle, and Aho, 2011). Furthermore, VAIC™ allows the individual components of IC to be measured: physical and financial capital (CEE), human capital (HCE), and structural capital (SCE) (Firer and Williams, 2003; Montequin, Fernandez, Cabal, and Gutierrez, 2006; Pulic, 2000). However, one commonly identified limitation of VAIC™ is related to the absence of the relational capital component (Chen, Cheng, and Hwang, 2005; Nimtrakoon, 2015).

The current paper seeks to analyse the impact of intellectual capital on financial performance, using the Value Added Intellectual Coefficient (VAIC™) method. To reach the paper´s objective, we analyse the impact of VAIC as well as the impact of its three inputs: physical and financial capital, human capital, and structural capital on the firm's financial performance measured by Return on Assets in the context of the Euronext stock market countries: Belgium, France, the Netherlands and Portugal, for the period 2005-2015. The GMM system (1998) was used to analyse our data set. The results suggest that IC investments have a positive impact on firms' financial performance in the short and long run. The human capital component shows greater

importance in enhancing firms' financial performance in both the previous and current periods. The results also reveal that firms investing in R&D have greater financial performance, while the recent financial crisis caused a negative effect on financial performance in 2008 and 2009. The results contribute to the literature, as intellectual capital is an important resource for firms' value creation in the European context. Also, we use dynamic panel data to analyse our results, which allows us to analyse the effect of lagged independent variables on firms' financial performance.

The current paper is structured as follows. Section 2 presents the theoretical framework and hypothesis development; in Section 3, we present the methodology; in Section 4, we present the results; Section 5 discusses the results; and Section 6 presents the conclusion and implications.

2. Literature Review and Hypothesis Development

Consensus is found among researchers regarding the importance of IC as a key driver of firms' growth and value creation (Serenko and Bontis, 2004; Wang, Wang, and Liang, 2014; Youndt, Subramaniam, and Snell, 2004). IC can be defined as the sum of all knowledge and innovative capacities inside firms that allow them to develop competitive advantages over other market players (Nahapiet and Ghoshal, 1998; Wang et al., 2014; Youndt et al., 2004).

Several authors and studies claim a positive relationship between IC and firm's financial performance (e.g., Chen et al., 2005; Nimtrakoon, 2015; Serenko and Bontis, 2004; Wang et al., 2014; Youndt et al., 2004), but there are some contradictory results (e.g., Morariu, 2014). Using a sample of United States multinational firms, Riahi-Belkaoui (2003) found a positive relationship between IC and FP. The results of Chen et al. (2005) identified a positive and significant relationship between IC and firms' FP after analysing Taiwanese listed firms. Zéghal and Maaloul (2010) analysed three groups of industries: high tech, traditional and services, and identified a positive impact of IC on firms' FP, irrespective of the industry sector. Rahman (2012) studied 100 United Kingdom listed firms and concluded that a higher value of IC increases firms' FP. Tseng, Lan, Lu, and Chen (2013) used a sample of Taiwanese IT listed firms and the results indicate a significant, positive relationship between IC and FP. The results of Nimtrakoon (2015) reveal that the effect of IC on firms' FP is significant and positive for all ASEAN countries. Contradicting this positive relationship between IC and firms' financial performance, the results of Morariu (2014) show a significant, negative relationship between IC and firms' FP.

Based on the above, we formulate the following hypotheses:

H1: IC positively impacts on firms' financial performance

H2: CEE positively impacts on firms' financial performance

H3: HCE positively impacts on firms' financial performance

H4: SCE positively impacts on firms' financial performance

3. Data, Variables and Method

3.1. Database

The current research was carried out with publicly listed firms in Euronext stock market countries: Belgium, France, the Netherlands and Portugal. Table 1 presents the sample composition.

Table 1. Number of Firms per Country

Countries/Stock exchange	Sample	% of sample
Belgium/BELPRC	82	13,1%
France/ CAC	411	65,6%
Netherlands/AEX	93	14,8%
Portugal/PSI	41	6,5%
Total	627	100,0%

France presents the highest number of listed firms in the sample (n=411), followed by the Netherlands (n=93), Belgium (n=82) and Portugal (n=41).

Data was retrieved from the DATASTREAM database by Thomson Reuters as this provides current and historical time series data, such as stocks, stock indices and share prices as well as data from firms' financial statements for all listed firms in the world's major stock exchanges. We used all listed firms in the Belgian, French, Dutch and Portuguese stock exchanges and financial firms were excluded. The sample consists of 7524 observations from 627 listed firms. Data was collected for the period between 2005 and 2015. The study uses unbalanced panel data.

3.2. Estimation Method and Variable Measurement

Due to the dynamic characteristics of the variables in the study, we use Generalized Method of Moments (GMM) proposed by Blundell and Bond (1998). The efficiency of this estimator lies in the possibility to control correlation errors over time and heteroscedasticity across firms. Two conditions must be met for the estimation results to be valid: (1) validity of the restrictions created by using the instruments; and (2) there should be no second-order autocorrelation. In order to test the first condition, we use the Hansen test where the null hypothesis is validity of the restrictions created by the instruments used. For the second condition, we test for second-

order autocorrelation, where the null hypothesis indicates there is no second-order autocorrelation. In the case of not rejecting the null hypothesis for the Hansen and second-order autocorrelation tests, we conclude that the GMM system (1998) estimator is valid and robust. We used a two-step procedure with the correction proposed by Windmeijer (2005), which provides more accurate inference of the two-step procedure especially for the GMM system (1998) estimator (Roodman, 2009).

Next, we present our estimation models:

Equation (1)

$$ROA_{i,t} = \propto_0 + \beta_1 ROA_{i,t-1} + \beta_2 VAIC_{i,t} + \beta_3 VAIC_{i,t-1} + \beta_4 Tlev_{i,t} + \beta_5 RDintensive + \beta_6 AGE_{i,t} + \beta_7 SIZE_{i,t} + \beta_8 Dcrisis_{08;09} + \varphi_c D_c + \varphi_s D_s + + \eta_i + \varepsilon_{i,t}$$

Equation (2)

$$ROA_{i,t} = \propto_0 + \beta_1 ROA_{i,t-1} + \beta_2 CEE_{i,t} + \beta_3 HCE_{i,t} + \beta_4 SCE_{i,t} + \beta_5 CEE_{i,t-1} + \beta_6 HCE_{i,t-1} + \beta_7 SCE_{i,t-1} + \beta_8 Tlev_{i,t} + \beta_9 RDintensive + \beta_{10} AGE_{i,t} + \beta_{11} SIZE_{i,t} + \beta_{12} Dcrisis_{08;09} + \varphi_c D_c + \varphi_s D_s + \eta_i + \varepsilon_{i,t}$$

Where: η_i are non-observable individual effects; and $\varepsilon_{i,t}$ is the error; D_c is country dummy; and D_s is industry sector dummy. The 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; $VAIC_{i,t}$ is the value added intellectual coefficient in the current period (VAIC™) corresponding to the sum of HCE plus SCE plus CEE, where: HCE is human capital efficiency (HCE) = value added (VA) / human capital (HC); SCE structural capital efficiency (SCE) = structural capital (SC) / value added (VA); and CEE is the capital employed efficiency = value added (VA) / capital employed (CE). Where VA = sales – operational expenses except employee costs; $VAIC_{i,t-1}$ is the value added intellectual coefficient of the previous period; $CEE_{i,t-1}$ is the Capital employed efficiency of the previous period; $HCE_{i,t-1}$ is the human capital efficiency of the previous period; $SCE_{i,t-1}$ is the structural capital efficiency of the previous period; $Tlev_{i,t}$ is the leverage of 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 size in the previous period, given by the natural logarithm of total assets in the current period; $AGE_{i,t-1}$ is firm age in the previous period, given by the natural logarithm of the number of years the firm has been in existence in the current period; $RDintensive$ is the intensity of R&D activities, which is a dummy variable that assumes the value of one if the firm has R&D expenses and zero

otherwise; and $Dcrisis_{08;09}$ is a dummy representing financial crisis for the periods of 2008 and 2009. It assumes the value of 1 in 2008 or 2009, and the value of 0 for the remaining years in the study.

4. Empirical Results

4.1. Descriptive Statistics and Correlation Matrix

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

Table 2 - Descriptive Statistics for Full Sample

Variables	Observations	Mean	Median	SD
Dependent variables				
$ROA_{i,t}$	6750	-.0039	.03	.23
Independent variables				
$VAIC_{i,t}$	7524	1.7	1.7	1.1
$CEE_{i,t}$	7524	.54	.43	.48
$HCE_{i,t}$	7524	1.2	1.1	.93
$SCE_{i,t}$	7524	.45	.31	.68
Control variables				
$Tlev_{i,t}$	6752	0.25	.22	0.21
$AGE_{i,t}$	7143	3.2	3.3	.94
$SIZE_{i,t}$	6758	13	13	2.5

ROA presents a negative mean score of -0.004 suggesting a low level of profitability. The high standard deviation suggests a high variance between firms and countries. The mean score of VAIC is 1.7, suggesting that European firms create an average of 1.7 monetary units for every 1 monetary unit utilized. Among the VAIC components, HCE presents the highest mean score (1.2), followed by CEE (0.54) and SCE (0.45). Tlev presents a mean score of 0.25 and the proximity of the standard deviation value to the mean score indicates high variance of levels of debt between firms and countries.

The correlation and magnitude of the variables are presented in the correlation matrix (see Table 3).

Table 3 - Correlation Matrix

Variables	$ROA_{i,t}$	$ROA_{i,t-1}$	$VAIC_{i,t}$	$VAIC_{i,t-1}$	$CEE_{i,t}$	$HCE_{i,t}$	$SCE_{i,t}$	$CEE_{i,t-1}$	$HCE_{i,t-1}$	$SCE_{i,t-1}$	$Tlev_{i,t}$	$AGE_{i,t}$	$SIZE_{i,t}$
$ROA_{i,t}$	1.0000												
$ROA_{i,t-1}$	0.4558*	1.0000											
$VAIC_{i,t}$	0.3109*	0.2809*	1.0000										
$VAIC_{i,t-1}$	0.2617*	0.3100*	0.6350*	1.0000									
$CEE_{i,t}$	0.2116*	0.1565*	0.1467*	0.0910*	1.0000								
$HCE_{i,t}$	0.3736*	0.3458*	0.6891*	0.5607*	0.0901*	1.0000							
$SCE_{i,t}$	-0.1665*	-0.1482*	0.1306*	-0.0761*	0.0259	-0.1492*	1.0000						
$CEE_{i,t-1}$	0.1600*	0.2388*	0.1245*	0.1485*	0.7602*	0.0718*	0.0196	1.0000					
$HCE_{i,t-1}$	0.2878*	0.3705*	0.5417*	0.7013*	0.0294	0.7442*	-0.1133*	0.1035*	1.0000				
$SCE_{i,t-1}$	-0.1687*	-0.1652*	-0.0901*	0.1315*	0.0071	-0.1285*	0.4884*	0.0109	-0.1497*	1.0000			
$Tlev_{i,t}$	-0.0372	-0.0357	-0.0134	-0.0140	0.0172	-0.0045	0.0180	0.0175	-0.0051	0.0184	1.0000		
$AGE_{i,t}$	0.1701*	0.1625*	0.1238*	0.1273*	-0.0839*	0.1127*	-0.2120*	-0.0793*	0.1079*	-0.2210*	0.0082	1.0000	
$SIZE_{i,t}$	0.2659*	0.2423*	0.2647*	0.2806*	-0.0697*	0.3060*	-0.0969*	-0.0896*	0.3083*	-0.1060*	-0.0905*	0.2529*	1.0000

Note: * Statistical significance at 1%.

The correlation matrix shows a positive and significant correlation among most pairs of variables used in this study. VAIC and its components present a positive significant correlation with ROA, except SCE, which presents a negative and significant correlation with ROA. Also, SCE in the previous period has a negative and significant correlation with ROA. The problems of endogeneity between independent variables are relevant for correlation coefficients above 30% (Gujarati and Porter, 2010). This is the case for nine pairs of independent variables. Also, we found persistence between ROA in the current period and ROA in the previous period. Therefore, following the suggestion of Blundell and Bond (1998), we applied the GMM system (1998) dynamic estimator, which is more appropriate for this study than the GMM (1991) estimator.

According to the results of the Hansen test and second-order autocorrelation test, we cannot reject the null hypothesis in both tests 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 the existence of second-order autocorrelation for the estimated models. Thus, the results of the GMM system (1998) dynamic estimator are robust and can be used to support our interpretation of the empirical results.

4.2. Intellectual Capital and Firms' Financial Performance

The results of GMM (1998) for equation (1) and (2) are presented in Table 4.

The results of equation (1) show that VAIC in the current period, VAIC in the previous period, Tlev, RDintensive and SIZE have a positive and significant relationship with ROA, whereas ROA in the previous period, AGE and Dcrisis have a significant negative relationship with ROA.

The results of equation (2) reveal that CEE in the current period, HCE in the current period, SCE in the current period, HCE in the previous period, SCE in the previous period, Tlev, RDintensive and SIZE have a significant positive relationship with ROA, while, ROA in the previous period, CEE in the previous period, AGE and Dcrisis have a negative impact on ROA.

Table 4 - Estimation Results from GMM system (1998)

Independent variables	*Dependent variable*: $ROA_{i,t}$	
	Equation (1)	Equation (2)
$ROA_{i,t-1}$	-0.20688***	-0.11618**
	(0.03240)	(0.05310)
$VAIC_{i,t}$	0.04609***	
	(0.00897)	
$VAIC_{i,t-1}$	0.05990***	
	(0.00622)	
$CEE_{i,t}$		0.09852***
		(0.01907)
$HCE_{i,t}$		0.04800**
		(0.01909)
$SCE_{i,t}$		0.04205**
		(0.01639)
$CEE_{i,t-1}$		-0.04643**
		(0.02102)
$HCE_{i,t-1}$		0.05691***
		(0.01671)
$SCE_{i,t-1}$		0.04018***
		(0.01514)
$Tlev_{i,t}$	0.00003***	0.00016*
	(0.00000)	(0.00008)
$RDintensity_{i,t}$	0.17370***	0.16386**
	(0.05808)	(0.07164)
$AGE_{i,t}$	-0.18672***	-0.16196***
	(0.02657)	(0.03452)
$SIZE_{i,t}$	0.23623***	0.15678***
	(0.01023)	(0.01813)
$Dcrisis_{08;09}$	-0.01722***	-0.01777***
	(0.00361)	(0.00441)
Constant	-0.86725	-3.79191*
	(1.76014)	(1.93804)
Observations	5,397	6,009
Number of Firms	614	618
F	183.16***	47.75***
Hansen (N(0,1))	39.90	40.79
m1 (N(0,1))	-2.250**	-2.859***
m2 (N(0,1))	0.599	0.806

Notes: Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1.

5. Discussion of the Empirical Results

The results enhance the role of VAIC in firms' financial performance. In fact, both VAIC in the current period and VAIC in the previous period have a positive effect on ROA. These results suggest that intellectual capital positively impacts on firms' financial performance as shown in several studies (Chen et al., 2005; Nimtrakoon, 2015; Rahman, 2012; Riahi-Belkaoui,2003; Zéghal and Maaloul, 2010). The results also suggest that efficient application of Intellectual Capital by firms in the past also positively impacts on firms' financial performance.

The results indicate that each of the components of VAIC has a similar pattern, given that CEE, HCE and SCE in the current period have a positive impact on firms' financial performance. These results show the importance of physical, financial, human and structural capital for firms' financial performance, which is in line with previous studies (Ahangar, 2011; Bontis, 1998; Denicolai, Ramusino, and Sotti, 2015; Nimtrakoon, 2015; Tseng et al., 2013; ul Rehman, Ilyas, and ur Rehman, 2011). When we observe the VAIC components in the previous period, it is noted that only CEE does not have a positive impact on ROA in the current period. These results suggest that firms' efficient use of human capital and structural capital have a positive impact on ROA in the current period. In European firms, the results show the greater importance of past investment in human capital as it presents a higher impact on firms' financial performance in the current period. However, physical and financial capital seems to be more important in the current period for enhancing current profitability. Furthermore, the results reveal that R&D investment increases firms' financial performance. This result is important as this type of firm strongly embodies intellectual capital in its activities. The findings also reveal a negative impact of the recent financial crisis on firms' financial performance.

6. Conclusion

The importance of intellectual capital for firms' value creation, competitive advantage, internationalization and success motivated the current study, which seeks to analyse the relationship between Intellectual Capital and financial performance in publicly listed firms of Euronext market countries: Belgium, France, the Netherlands and Portugal. To reach this objective we used Pulic's VAIC™ model to analyse the impact of VAIC as well as of each of its components - CEE, HCE and SCE - on ROA, which measures firms' financial performance. The results of the GMM system (1998) dynamic estimator indicate that IC investments have a positive impact on firms' financial performance in the short and long run. The human capital component shows greater importance for enhanced financial performance in both previous and current periods. The results also reveal that firms investing in R&D have greater financial performance, while the recent financial crisis had a negative effect on financial performance in 2008 and 2009.

The results contribute to the literature, as intellectual capital is an important resource for firms' value creation in the European context. Moreover, we use dynamic panel data to analyse our results, which allowed us to analyse the effect of lagged independent variables on firms' financial performance. On the practical side, it is important that managers pay more attention to intellectual capital and its positive impact on firms' value creation and growth. For policy-makers, it is important to pay attention to firms' difficulties in investing in intellectual capital, as this is an intangible resource that positively contributes not only to firms' value creation but also to developing countries' wealth.

Several limitations can be mentioned and addressed in future research. This study used the VAIC model, which does not allow us to analyse the impact of relational capital on firms' financial performance. Secondly, comparing countries as well as industry sectors would give new insights into the impact of intellectual capital on firms' growth and value creation.

References

Ahangar, R. G. (2011). The relationship between intellectual capital and financial performance: An empirical investigation in an Iranian company. *African Journal of Business Management*, 5(1), 88-95.

Blundell, R., and Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87, 115-143.

Bontis, N. (1998). Intellectual capital: an exploratory study that develops measures and models. *Management Decision*, 36(2), 63-76.

Bontis, N. (2001). Assessing knowledge assets: a review of the models used to measure intellectual capital. *International Journal of Management Reviews*, 3(1), 41-60.

Bontis, N., Keow, W. C. C., and Richardson, S. (2000). Intellectual capital and business performance in Malaysian industries. *Journal of Intellectual Capital*, 1(1), 85-100.

Chen, M., Cheng, S., and Hwang, Y. (2005). An empirical investigation of the relationship between intellectual capital and firms' market value and financial performance. *Journal of Intellectual Capital*, 6(2), 159-176.

Denicolai, S., Ramusino, E. C., and Sotti, F. (2015). The impact of intangibles on firm growth. *Technology Analysis & Strategic Management*, 27(2), 219-236.

Firer, S., and Williams, S. M. (2003). Intellectual capital and traditional measures of corporate performance. *Journal of Intellectual Capital*, 4(3), 348-360.

Gujarati, D., and Porter, D. (Eds.). (2010). Essentials of Econometrics (4th ed ed.). New York: McGraw – Hill International.

Hall, R. (1992). The strategic analysis of intangible resources. *Strategic Management Journal*, 13(2), 135–144.

Montequin, V., Fernandez, F., Cabal, V., and Gutierrez, N. (2006). An integrated framework for intellectual capital measurement and knowledge management implementation in small and medium-sized enterprises. *Journal of Information Science*, 32(6), 525-538.

Morariu, C. M. (2014). Intellectual capital performance in the case of Romanian public companies. *Journal of Intellectual Capital*, 15(3), 392-410.

Nahapiet, J., and Ghoshal, S. (1998). Social Capital, Intellectual Capital, and the Organizational Advantage. *Academy of Management Review*, 23, 242-266.

Nimtrakoon, S. (2015). The relationship between intellectual capital, firms' market value and financial performance Empirical evidence from the ASEAN. *Journal of Intellectual Capital*, 16(3), 587-618.

Pulic, A. (1998). *Measuring the Performance of intellectual potential in Knowledge Economy*. Paper presented at the paper presented at the 2nd McMaster World Congress on Measuring and Managing Intellectual Capital, 21-23 January 1998, Hamilton, Ontario.

Pulic, A. (2000). VAIC (TM) - an accounting tool for IC management. *International Journal of Technology Management*, 20(5-8), 702-714.

Rahman, S. (2012). The role of intellectual capital in determining differences between stock market and financial performance. *International Research Journal of Finance and Economics*, 89, 46-77.

Riahi-Belkaoui, A. (2003). Intellectual capital and firm performance of US multinational firms: a study of the resource-based and stakeholder views. *Journal of Intellectual Capital*, 4(2), 215-226.

Roodman, D. M. (2009). A note on the theme of too many instruments. *Oxford Bulletin of Economics and Statistics*, 71(1), 135-158.

Serenko, A., and Bontis, N. (2004). Meta review of knowledge management and intellectual capital literature: citation impact and research productivity rankings. *Knowledge and Process Management*, 11(3), 185-198.

Sharabati, A., Shawqi, N., and Bontis, N. (2010). Intellectual capital and business performance in the pharmaceutical sector of Jordan. *Management Decision*, 48(1), 105-131.

Skinner, D. J. (2008). Accounting for intangibles - a critical review of policy recommendations. *Accounting and Business Research*, 38(3), 191-204.

Ståhle, P., Ståhle, S., and Aho, S. (2011). Value added intellectual coefficient (VAIC): a critical analysis. *Journal of Intellectual Capital*, 12(4), 531-551.

Stewart, T. A. (1997). *Intellectual capital: the new wealth of organizations*. New York, N.Y.: Doubleday & Co.

Sveiby, K. E. (1997). *The New Organizational Wealth: Managing and Measuring Knowledge-Based Assets*. New York: Berrett-Koehler.

Sydler, R., Haefliger, S., and Pruksa, R. (2014). Measuring intellectual capital with financial figures: Can we predict firm profitability?. *European Management Journal*, 32(2), 244-259.

Tseng, K.-A., Lan, Y.-W., Lu, H.-C., and Chen, P.-Y. (2013). Mediation of strategy on intellectual capital and performance. *Management Decision*, 51(7), 1488-1509.

ul Rehman, W., Ilyas, M., and ur Rehman, H. (2011). Intellectual capital performance and its impact on financial returns of companies: An empirical study from insurance sector of Pakistan. *African Journal of Business Management*, 5(20), 8041-8049.

Wang, Z., Wang, N., and Liang, H. (2014). Knowledge sharing, intellectual capital and firm performance. *Management Decision*, 52(2), 230-258.

Windmeijer, F. (2005). A finite sample correction for the variance of linear efficient two-step GMM estimators. *Journal of Econometrics*, 126, 25–51.

Youndt, M. A., Subramaniam, M., and Snell, S. A. (2004). Intellectual capital profiles: an examination of investments and returns. *Journal of Management Studies*, 41(2), 335-361.

Zéghal, D., and Maaloul, A. (2010). Analysing value added as an indicator of intellectual capital and its consequences on company performance. *Journal of Intellectual Capital*, 11(1), 39-60.

CHAPTER 5

Intellectual Capital and Financial Performance considering the crisis period: A European empirical study

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Abstract

The current study seeks to analyse the impact of intellectual capital (IC) on financial performance measured by Return on Assets in the European context for the period 2004-2015 as well as the global financial crisis effect on firms' financial performance. This study uses data from non-financial listed firms in 8 European countries for the period between 2004 and 2015. In order to differentiate the financial crisis 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 in this study is the GMM system (1998) estimator. The results indicate that IC efficiency in the current period has a positive impact on financial performance. The three components of the VAIC™ Model - CEE, HCE and SCE in the current period have a positive impact on financial performance, with the exception of SCE which for the first group of countries has a negative impact on financial performance. The findings suggest that the financial crisis negatively affects financial performance in both groups of countries. These results may be a consequence of the reduction in demand as well as in firms' investments, 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, namely, facing unfavourable terms of credit, given that group 1 is composed of the countries most affected by the global financial crisis, which had negative consequences on the amount as well as on the terms of credit. 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 financial crisis differently.

Keywords

Intellectual Capital; Financial Performance; Value Added Intellectual Coefficient model

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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 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). In recession periods, like the one following the recent global financial crisis, firms tend to have scarce financial resources (Hall, Moncada-Paternò-Castello, Montresor, and Vezzani, 2016). Financial crisis has a 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. Spain, Portugal, Greece and Italy appeared to be the countries in the Eurozone with the highest probability of financial distress, which led to a financial assistance program (Greece and Portugal). The most affected countries, such as Portugal, Greece, Spain and Italy, implemented several measures to deal with the excessive sovereign debt, with firms' consequent difficulty in accessing credit. These may have worsened firms' financial performance (FP), which was aggravated by the reduction of demand, forcing firms to look to new sources to gain competitive advantages (Ferrando et al., 2015). Therefore, in order to incentivize innovation, the European Union (EU) made efforts to fund innovation through projects such as Horizon 2020 (Veugelers et al., 2015). IC investments, often referred to as intangible assets, aim for future benefits, not having physical or financial form (Lev, 2004) and strongly contributing to value creation through employees' knowledge, organizational processes and innovation and relationships (Serenko and Bontis, 2004; Wang, Wang, and Liang, 2014).

By extending the research on IC to European countries, this study seeks to analyse the impact of intellectual capital on FP measured by Return on Assets in the European context for the period 2004-2015, as well as the effect of the 2008 financial crisis on firms' FP. We will use the Value Added Intellectual Coefficient model (VAIC™) (Pulic, 1998), which is a method that evaluates IC, allowing measurement of the individual components of IC: physical and financial capital (CEE), human capital (HCE), and structural capital (SCE) (Nimtrakoon, 2015; Pulic, 1998). In order to reach our main objective, we use a large sample of non-financial listed firms from 8 European countries for the period between 2004 and 2015. In order to analyse the financial crisis impact on European countries, and considering the European Investment Bank (2016) classification regarding the vulnerability of member states, 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). We use econometric modelling techniques, specifically resorting to the GMM system (1998) estimator to analyse dynamic panel data.

We find that IC efficiency in the current period has a positive impact on FP. Corroborating this result, the components of the VAIC model, which measures IC efficiency, i.e., CEE, HCE and SCE in the current period, are positively related to FP. However, SCE in the first group of

countries has a negative impact on FP. Leverage has a negative impact on FP for the first group of countries, while in the second group of countries, results show that leverage positively impacts on FP. Finally, the results suggest that the global financial crisis negatively affects FP in both groups of countries.

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

2. Literature Review and Hypotheses Development

Researchers' interest in IC is notable (Serenko and Bontis, 2013). Despite the absence of a generalized definition of IC, several authors (Nahapiet and Ghoshal, 1998; Wang et al., 2014; Youndt, Subramaniam, and Snell, 2004) suggest that IC can be defined as the sum of all knowledge and knowing capabilities that allows firms to gain and/or maintain a sustainable competitive advantage. IC provides firms with innovative capacity (Chen, Cheng, and Hwang, 2005). This innovative capacity allows them to invest in their core competences, which are not easy imitable by competitors (Seyoum, 2004).

The components of IC decomposition are widely accepted among researchers (Bontis, Janosevic, and Dzenopoljac, 2015; Nimtrakoon, 2015; ul Rehman, Ilyas, and ur Rehman, 2011), i.e., human capital (HC), structural (or organizational) capital (SC), and relational (or customer) capital (RC). HC refers to the sum of employees' knowledge, competence, innovativeness, commitment and wisdom (Bontis, 1998; Dzinkowski, 2000; Edvinsson and Malone, 1997; Roos and Roos, 1997). SC comprises the firm's most valuable strategic assets, such as organizational capabilities, culture, processes, patents, copyrights, trademarks, databases, and so on (Bontis, 1998; Edvinsson and Malone, 1997; Stewart, 1997). RC is the knowledge obtained through establishing relationships with external stakeholders (Dzinkowski, 2000; Edvinsson and Malone, 1997; Roos and Roos, 1997).

Firms that strongly embody intangible assets in their activities see the degrees of sunkness of their investments increase (Lev and Zambon, 2003). This fact makes it difficult to identify and measure the value of IC and, therefore, financial statements fail to report IC's value (Lev, 2004; Nimtrakoon, 2015). Several authors provided an overview of IC evaluation models (Andriessen, 2004; Bontis, 2001; Sveiby, 1997; Sydler, Haefliger, and Pruksa, 2014).

One of the methods most adopted among researchers to evaluate IC is the Value Added Intellectual Coefficient model (VAIC™) developed by Pulic (1998). Pulic (2000) proposed value added as an indicator to measure performance in a knowledge economy context. According to

Iazzolino and Laise (2013), part of the criticism that VAIC™ has received derives from misunderstandings of different meanings that Pulic gave to human capital (HC) and structural capital (SC) in comparison to Skandia Navigator, commonly used words by the IC research community. The authors believe that VAIC™ is important to connect the notions of value added and value creation in a knowledge economy context and it complements existing performance measures as it is an innovative indicator of intellectual capital efficiency (ICE).

In spite of various studies showing a positive and significant effect of IC on firms' FP, using VAIC™ as an IC efficiency measure, there are contradictory results, which may be attributed to countries or industry specificities (Bontis, 1998; Chen et al., 2005; Denicolai, Ramusino, and Sotti, 2015; Nimtrakoon, 2015; Tseng, Lan, Lu, and Chen, 2013; ul Rehman et al., 2011). Tan, Plowman, and Hancock (2007) analysed the effect of IC on firms' FP across different industries. Their findings show that the positive relationship between IC and FP varies across industries. The results of the study by Janosevic and Dzenopoljac (2012) 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 concluded that that a 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. The results show a significant negative relationship between IC and firms' FP. Using a sample of listed firms from ASEAN countries, the results of the study by Nimtrakoon (2015) reveal that the effect of IC on firms' FP is significant and positive for 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. In the study conducted by Nimtrakoon (2015) in five selected ASEAN countries, i.e., Indonesia, Malaysia, Philippines, Singapore and Thailand, the results show a positive and significant correlation between HC and FP. Concerning the SC component of IC, the study by ul Rehman et al. (2011) shows a positive and significant impact on FP. Wang et al. (2014) found a positive and significant correlation between SC and FP. The 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 R&D expenses on accounting performance. Although the results show a non-significant relationship between patents and FP, the authors found a negative and significant effect of R&D on FP. Nimtrakoon (2015) revealed a positive and significant correlation between SC and FP for Malaysia and a negative and significant correlation between SC and FP for the Philippines.

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

H1. IC has a positive impact on firms' FP

H1a. CEE has a positive impact on firms' FP

H1b. HCE has a positive impact on firms' FP

H1c. SCE has a positive impact on firms' FP

In recession periods, like the one following the recent global financial crisis, firms tend to have scarce financial resources (Hall et al., 2016). Financial crisis has a 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. Spain, Portugal, Greece and Italy appeared to be the countries in the Eurozone with the highest probability of financial distress, which led to a financial assistance program (Greece and Portugal). The most affected countries, such as Portugal, Greece, Spain and Italy, implemented several measures to deal with the excessive sovereign debt, with firms' consequent difficulty in accessing credit. These may have worsened firms' financial performance (FP), which was aggravated by the reduction of demand, forcing firms to look to new sources to gain competitive advantages (Ferrando et al., 2015). Therefore, we formulate the following hypothesis.

H2. Financial crisis has a negative impact on firms' FP

3. Data, Variables and Method

3.1. Database

We use a dataset of 25080 observations of 1052 non-financial listed firms, for the period between 2004 and 2015, in 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 dataset was gathered from the 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 varies from 3 to 12. Following the suggestions of Guariglia (2008) we mitigate potential survivor bias by allowing firms' 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 firms' extraordinary shocks.

3.2. Estimation Method and Variable Measurement

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 the endogeneity problem and avoids significant bias in estimates (Wooldridge, 2007). The results of the 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) absence of second-order autocorrelation. In order to test the first condition, i.e., the validity of the restrictions created by the instruments used, we use the Hansen test where the null hypothesis is validity of the restrictions created by the instruments used. For the second condition, we test for second-order autocorrelation, where the null hypothesis indicates there is no second-order autocorrelation. In the case of not rejecting the null hypothesis for the Hansen and second-order autocorrelation tests, we conclude that the GMM system (1998) estimator is valid and robust. We use the two-step GMM estimator corrected by Windmeijer (2005).

Our estimation models are presented as follows:

Equation (1):

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

Equation (2):

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

Where: η_i are non-observable individual effects; and $\varepsilon_{i,t}$ is the error; d_t corresponds to 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 variable 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 the sum of HCE plus SCE plus CEE, where: $HCE_{i,t}$ is 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 expenditure; and SC is given by the difference of VA and HC.

Finally, the measurement of control variables is 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 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 size in 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 the firm's existence in the current period; and $D_{08;09}$ is a dummy representing the global financial crisis for the years 2008 and 2009. It assumes the value of 1 if the year is equal to 2008 or 2009, and the value of 0 for the remaining years in study.

4. Empirical Results

4.1. Descriptive statistics

The descriptive statistics for the whole sample can be seen in Table 1, which summarizes the descriptive statistics of dependent and independent variables.

Table 1 - 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 1, group 2 presents higher mean values for ROA, VAIC, CEE and HCE, while group 1 only presents a higher mean score for SCE.

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. This being so, the results of the GMM system (1998) dynamic estimator are robust and, therefore, the empirical results are open to interpretation.

4.2. Intellectual Capital and Firms' Financial Performance

Table 2 presents the results of estimates. The results for group 1 countries are as follows:

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

Independent 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

Equation (1): The results show that ROA in the previous period, VAIC in the current and previous periods and 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): The results indicate that ROA in the previous period, CEE in the current and previous periods, HCE in the current and previous periods 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 follows:

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

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

5. Discussion of the Empirical Results

The results of equation (1) suggest that IC enhances firms' FP in 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, the results show that VAIC in the current period positively impacts on firms' FP. Therefore, IC has a positive impact on firms' FP. These results do not allow us to reject hypothesis H1. Efficient use of firms' IC enhances their FP. These results are in line with previous studies (Chen et al., 2005; Janosevic and Dzenopoljac, 2012; 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, the 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 in the first group of countries, which has a negative impact on ROA. In relation to IC

components in the previous period, the results show that for the first group there is a positive impact of CEE and HCE on ROA and that SCE has 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 on ROA in group 1. The results are broadly in line with previous studies (Bontis et al., 2015; Chen et al., 2005; Nimtrakoon, 2015; Ting and Lean, 2009; Tseng et al., 2013). European firms make efficient use of physical and financial capital, as this component has a greater impact on firms' FP 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 and copyrights (Bontis, Keow, and Richardson, 2000; Sydler et al., 2014).

Concerning the impact of the global financial crisis 2008-2009 on FP, the results show that the financial crisis had a negative effect on firms' financial performance in group 1 and group 2. Therefore, the hypothesis H2, formulated previously, is not rejected. The results obtained may be a consequence of the reduction of demand as well as of investment, namely in intangible assets. However, leverage has a negative impact on firms' FP in group 1, while in group 2, leverage is seen to have a positive impact on firms' FP. 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 study provides evidence of the importance of IC for firms' value creation, competitiveness and growth in the context of European countries. Our results reveal that IC efficiency in the current period has a positive impact on FP. The results also reveal that CEE, HCE and SCE in the current period have a positive impact on FP, with the exception of SCE in the first group, which has a negative impact on FP. Leverage has a negative impact on FP for the first group, while in the second group, the results show this has a positive impact on FP. Finally, the results suggest that the 2008 financial crisis negatively affected FP in both groups of countries.

The current study presents several contributions. It explores a sample of European countries, comparing firms from countries most affected by the 2008 financial crisis with others that apparently stood up to the global financial crisis better. We applied dynamic panel data analysis resorting to econometric models, which allowed us to make a longitudinal study.

On the practical side, we encourage managers to pay more attention to the importance of firms' IC in order to increase firms' capacity to innovate and develop new processes and products. For policy-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 VAIC model does not measure the efficiency of relational capital, and so we were unable to test the impact of relational capital on firms' FP. 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 studying industry sectors in different countries as well as analysing the impact of the 2008 financial crisis on firms' IC performance through a longitudinal study. Also suggested is analysis of the relationship between IC and FP considering the periods before and after the 2008 financial crisis.

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References

Andriessen, D. (2004). *Making sense of Intellectual capital: Designing a Method for the Valuation of Intangibles*. Boston: Butterworth-Heinemann.

Blundell, R., and Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87, 115-143.

Bontis, N. (1998). Intellectual capital: an exploratory study that develops measures and models. *Management Decision*, 36(2), 63-76.

Bontis, N. (2001). Assessing knowledge assets: a review of the models used to measure intellectual capital. *International Journal of Management Reviews*, 3(1), 41-60.

Bontis, N., Janosevic, S., and Dzenopoljac, V. (2015). Intellectual capital in Serbia's hotel industry. *International Journal of Contemporary Hospitality Management*, 27(6), 1365-1384.

Bontis, N., Keow, W. C. C., and Richardson, S. (2000). Intellectual capital and business performance in Malaysian industries. *Journal of Intellectual Capital*, 1(1), 85-100.

Chen, M., Cheng, S., and Hwang, Y. (2005). An empirical investigation of the relationship between intellectual capital and firms' market value and financial performance. *Journal of Intellectual Capital*, 6(2), 159-176.

Denicolai, S., Ramusino, E. C., and Sotti, F. (2015). The impact of intangibles on firm growth. *Technology Analysis & Strategic Management*, 27(2), 219-236.

Dzinkowski, R. (2000). The measurement and management of intellectual capital: An introduction. *Management Accounting Research*, 78(2), 32-36.

Edvinsson, L., and Malone, M. (1997). *Intellectual Capital: Realizing Your Company's True Value by Finding its Hidden Roots*. New York, NY: Harper Collins.

European Investment Bank. (2016). Investment and investment finance in Europe: Financing productivity growth. European Investment Bank.

Ferrando, A., Altomonte, C., Blank, S., Meinen, P., Iudice, M., Felt, M.-H., . . . Siedschlag, I. (2015). Assessing the financial and financing conditions of firms in Europe: the financial module in CompNet. European Central Bank.

Guariglia, A. (2008). Internal financial constraints, external financial constraints, and investment choice: Evidence from a panel of UK firms. *Journal of Banking & Finance*, 32(9), 1795-1809.

Guo, W.-C., Shiah-Hou, S.-R., and Chien, W.-J. (2012). A study on intellectual capital and firm performance in biotech companies. *Applied Economics Letters*, 19(16), 1603-1608.

Hall, B. H., Moncada-Paternò-Castello, P., Montresor, S., and Vezzani, A. (2016). Financing constraints, R&D investments and innovative performances: new empirical evidence at the firm level for Europe. *Economics of Innovation and New Technology*, 25(3), 183-196.

Iazzolino, G., and Laise, D. (2013). Value added intellectual coefficient (VAIC): A methodological and critical review. *Journal of Intellectual Capital*, 14(4), 547-563.

Janosevic, S., and Dzenopoljac, V. (2012). Impact of intellectual capital on financial performance of Serbian companies. *Actual Problems of Economics*, *133*(7), 554-564.

Lev, B. (2004). Sharpening the intangibles edge. Harvard Business Review, 82(6), 109-116.

Lev, B., and Zambon, S. (2003). Intangibles and intellectual capital: an introduction to a special issue. *European Accounting Review*, 12(4), 597-603.

Morariu, C. M. (2014). Intellectual capital performance in the case of Romanian public companies. *Journal of Intellectual Capital*, 15(3), 392-410.

Nahapiet, J., and Ghoshal, S. (1998). Social Capital, Intellectual Capital, and the Organizational Advantage. *Academy of Management Review*, 23, 242-266.

Nimtrakoon, S. (2015). The relationship between intellectual capital, firms' market value and financial performance Empirical evidence from the ASEAN. *Journal of Intellectual Capital*, 16(3), 587-618.

Pulic, A. (1998). *Measuring the Performance of intellectual potential in Knowledge Economy.* Paper presented at the paper presented at the 2nd McMaster World Congress on Measuring and Managing Intellectual Capital, 21-23 January 1998, Hamilton, Ontario.

Pulic, A. (2000). VAIC (TM) - an accounting tool for IC management. *International Journal of Technology Management*, 20(5-8), 702-714.

Quarterly Report on the Euro Area. (2013). Quarterly report on the euro area. June 2013 Volume 12 (2013) Issue 2. Retrieved from

http://ec.europa.eu/economy_finance/publications/qr_euro_area/2013/qrea2_en.htm, accessed 16/08/2015.

Rahman, S. (2012). The role of intellectual capital in determining differences between stock market and financial performance. *International Research Journal of Finance and Economics*, 89, 46-77.

Riahi-Belkaoui, A. (2003). Intellectual capital and firm performance of US multinational firms: a study of the resource-based and stakeholder views. *Journal of Intellectual Capital*, 4(2), 215-226.

Roos, G., and Roos, J. (1997). Measuring your company's intellectual performance. *Long Range Planning*, 30(3), 413-426.

Serenko, A., and Bontis, N. (2004). Meta review of knowledge management and intellectual capital literature: citation impact and research productivity rankings. *Knowledge and Process Management*, 11(3), 185-198.

Serenko, A., and Bontis, N. (2013). Global ranking of knowledge management and intellectual capital academic journals: 2013 update. *Journal of Knowledge Management*, 17(2), 307-326.

Seyoum, B. (2004). The role of factor conditions in high-technology exports: An empirical examination. *The Journal of High Technology Management Research*, 15(1), 145-162.

Stewart, T. A. (1997). *Intellectual capital: the new wealth of organizations*. New York, N.Y.: Doubleday & Co.

Sveiby, K. E. (1997). *The New Organizational Wealth: Managing and Measuring Knowledge-Based Assets*. New York: Berrett-Koehler.

Sydler, R., Haefliger, S., and Pruksa, R. (2014). Measuring intellectual capital with financial figures: Can we predict firm profitability? *European Management Journal*, 32(2), 244-259.

Tan, H. P., Plowman, D., and Hancock, P. (2007). Intellectual capital and financial returns of companies. *Journal of Intellectual Capital*, 8(1), 76-95.

Ting, I. W. K., and Lean, H. H. (2009). Intellectual capital performance of financial institutions in Malaysia. *Journal of Intellectual Capital*, 10(4), 588-599.

Tseng, K.-A., Lan, Y.-W., Lu, H.-C., and Chen, P.-Y. (2013). Mediation of strategy on intellectual capital and performance. *Management Decision*, 51(7), 1488-1509.

ul Rehman, W., Ilyas, M., and ur Rehman, H. (2011). Intellectual capital performance and its impact on financial returns of companies: An empirical study from insurance sector of Pakistan. *African Journal of Business Management*, 5(20), 8041-8049.

Veugelers, R., Cincera, M., Frietsch, R., Rammer, C., Schubert, T., Pelle, A., . . . Leijten, J. (2015). The Impact of Horizon 2020 on Innovation in Europe. *Intereconomics*, 50(1), 4-30.

Wang, Z., Wang, N., and Liang, H. (2014). Knowledge sharing, intellectual capital and firm performance. *Management Decision*, 52(2), 230-258.

Windmeijer, F. (2005). A finite sample correction for the variance of linear efficient two-step GMM estimators. *Journal of Econometrics*, 126, 25–51.

Wooldridge, J. M. (2007). *Econometric analysis of cross section and panel data*. Cambridge: The MIT Press.

Youndt, M. A., Subramaniam, M., and Snell, S. A. (2004). Intellectual capital profiles: an examination of investments and returns. *Journal of Management Studies*, 41(2), 335-361.

Zéghal, D., and Maaloul, A. (2010). Analysing value added as an indicator of intellectual capital and its consequences on company performance. *Journal of Intellectual Capital*, 11(1), 39-60.

CHAPTER 6

Intellectual Capital, Growth Opportunities and Financial Performance in European Firms: Dynamic Panel Data Analysis

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Abstract

The purpose of this paper is to (1) to analyse the impact of intellectual capital (IC) and growth opportunities on firms' financial performance as well as the moderating effect of IC on the relationship between growth opportunities and financial performance and (2) to analyse the impact of IC on growth opportunities. The current study uses a sample of non-financial listed firms consisting of 14 Western European countries for the period between 2004 and 2015. The estimation method used is specifically the GMM system (1998) estimator, a dynamic panel estimator, which allows to do longitudinal studies and to analyse the effect of lagged explanatory variables on performance and growth opportunities. The results reveal that IC efficiency of the current period has a positive impact on the financial performance of high, medium and low-tech European firms. Results reveal the non-linearity of the relationship between growth opportunities and financial performance. The current study findings, also suggest that the positive relationship between growth opportunities and financial performance is enhanced with the efficient use of firms' IC. The financial crisis of 2008-2009 had a negative effect on financial performance for high and medium-tech firms. Results indicate that the efficient use of IC in the current period has a greater impact on growth opportunities in high firms. Also, results reveal the non-linearity of the relationship between ownership concentration and growth opportunities. The current study contributes to the current literature by exploring a sample of firms across Western European countries, which is divided among high, medium-tech and low-tech firms. The econometric modelling which allow us to do a longitudinal study.

Keywords

Intellectual Capital; Financial Performance; Growth Opportunities; Ownership Concentration

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1. Introduction

In a knowledge-based economy, Intellectual Capital (IC) is recognised as a source of firms' growth, innovation and competitive advantage (Lev, 2004). The European Union (EU) acknowledge that innovations and the human factor – IC – can be seen as the main drivers of countries and firms' future growth as well as individuals' development (OECD, 2013). Therefore, the EU defined as the smart growth as one of the main priorities in the Europe 2020 strategy (Veugelers et al., 2015), i.e., economic growth based on innovation and knowledge.

IC is a key resource in a firm´s value creation process and to create sustainable competitive advantages (Holland, 2006; OECD, 2013). Despite the recognizing of the importance of IC for firms' future growth, contributing to growth opportunities, the innovation environment in the EU remains weak (Cincera, Ravet, and Veugelers, 2015). The access to external finance and the recent financial crisis accentuated the scarcity of financial resources, mainly to fund investments in intangible assets, such as IC (Cincera et al., 2015; Hall, Moncada-Paternò-Castello, Montresor, and Vezzani, 2016). Therefore, in order to incentivize innovation, the European Union (EU) has made efforts to fund innovation through projects such as the Horizon 2020 strategy (Veugelers et al., 2015). IC investments, often referred to as intangible assets, are claims of future benefits, which do not have physical or financial form (Lev, 2004) and strongly contribute to value creation through employees' knowledge, organizational processes and innovation and relationships (Serenko and Bontis, 2004; Wang, Wang, and Liang, 2014; Youndt, Subramaniam, and Snell, 2004).

In spite of the results of several studies (Bontis, 1998; Denicolai, Ramusino, and Sotti, 2015; Nimtrakoon, 2015; Tseng, Lan, Lu, and Chen, 2013; ul Rehman, Ilyas, and ur Rehman, 2011) that indicate a positive relationship between IC and financial performance, the difficulties in valuating IC investments increases agency costs due to the information asymmetry (Aboody and Lev, 2000; Lev, 2004; Lev and Zambon, 2003). Aboody and Lev (2000) suggest that information asymmetry between a firm's insiders and outsiders worsens in firms with high IC investments, due to assets' specificity. This specificity of IC investments may create adverse selection, moral hazard and opportunistic behaviour by managers (Aboody and Lev, 2000; Holland, 2006). On one hand, ownership concentration may block the entrance of high qualified and trained managers (Greco, Ferramosca, and Allegrini, 2014; Miller and Le Breton-Miller, 2006; Westhead and Howorth, 2006), due to the lack of willingness to share control. On the other hand, agency problems might be solved due to the alignment of interests between owners and managers (Lemmon and Lins, 2003). Previous empirical evidence shows contradictory results (Baber, Janakiraman, and Kang, 1996; Baker, 1993; Hutchinson, 2002; Hutchinson and Gul, 2004; Muniandy and Hillier, 2015; Serrasqueiro, Nunes, and Sequeira, 2007). Thus, ownership concentration may influence negatively or positively firm´s financial performance and growth opportunities.

Various authors (Abdolmohammadi, 2005; Tan, Plowman, and Hancock, 2007; Zéghal and Maaloul, 2010) conclude that the effect of IC on firms' financial performance depends on the industry sector and that IC investments influence the level of growth opportunities (Sudarsanam, Sorwar, and Marr, 2006). The current study differs from previous studies about the impact of IC on firms' financial performance (Bontis, 1998; Denicolai et al., 2015; Nimtrakoon, 2015; Tseng et al., 2013; ul Rehman et al., 2011), as it analyses the relationships between IC, growth opportunities and firms' financial performance in Western European high-tech, medium-tech and low-tech firms. Therefore, this study seeks to contribute to the current literature by addressing the following objectives: (1) to analyse the impact of IC and growth opportunities on firms' financial performance as well as the moderating effect of IC on the relationship between growth opportunities and financial performance; and (2) to analyse the impact of IC on growth opportunities.

Based on a sample of non-financial listed firms in 14 Western European countries for the period between 2004 and 2015, we defined high-tech, medium-tech and low-tech sub-samples following Ortega-Arguiles, Potters, and Vivarelli (2009). For the second part of the study, following the criteria of Moncada-Paternò-Castello (2016), we grouped the whole sample into high and low-tech sectors. The current study uses econometric modelling techniques, resorting specifically to the GMM system (1998) estimator to analyse dynamic panel data. The results reveal that IC efficiency of the current period has a positive impact on the financial performance of high, medium-tech and low-tech European firms. The results indicate the non-linearity of the relationship between growth opportunities and financial performance. The current study findings, also suggest that the positive relationship between growth opportunities and financial performance is enhanced with the efficient use of firms' IC. The financial crisis of 2008-2009 had a negative effect on financial performance in high and medium-tech firms. The findings indicate that the efficient use of IC in the current period has a greater impact on growth opportunities in high firms. Finally, results reveal the non-linearity of the relationship between ownership concentration and growth opportunities.

The current paper is structured as follows. In Section 2, we present the theoretical framework and hypothesis formulation; the methodology is described in Section 3; in Section 4, we present the results; Section 5 discusses the results; and finally, Section 6 presents the conclusion and implications.

2. Literature Review and Hypotheses Development

2.1. Intellectual Capital Concepts

Intangible assets, such as IC, are claims of future benefits, which do not have physical or financial form (Lev, 2004). Investment in intangible assets contributes greatly to firms' market

value, representing the part of firms' growth opportunities (Myers, 1977) which are beyond assets in place (Lev and Radhakrishnan, 2003).

IC is an emerging and fast-evolving concept (Ilyin, 2014). However, the characteristics of IC, i.e., a multidisciplinary and interdisciplinary concept (Bontis, 1999; Marr and Chatzkel, 2004; Morariu, 2014) allow researchers to adopt different nomenclatures and terminologies (Bontis, 2001) and, therefore, there is no agreement on a generally accepted definition (Marr, 2007). Bontis, Dragonetti, Jacobsen, and Roos (1999, p. 397) define IC as the collection of intangible resources and their flows. According to Stewart (1997, p. 11), IC is "intellectual material – knowledge, information, intellectual property, experience – that can be put to use to create wealth. It is a collective brainpower". 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". Also, IC has been pointed out as a possible explanation for the gap between firms' book value and market value (e.g., Edvinsson, 1997; Edvinsson and Malone, 1997; Lev, 2001, 2004; Ordoñez de Pablos, 2005). Since there is no consensus on the definition of IC, in this study IC represents the knowledge-based activities and processes that contribute to firms' innovation, value creation, competitive advantages and future benefits by adding value for firms' stakeholders.

IC can be decomposed in components, i.e., human capital, structural capital and relational capital, which are widely accepted among researchers (Bontis, Janosevic, and Dzenopoljac, 2015; Edvinsson and Malone, 1997; Nimtrakoon, 2015; Sveiby, 1997; Sydler, Haefliger, and Pruksa, 2014; ul Rehman *et al.*, 2011; Wang *et al.*, 2014). Moreover, human capital refers to the sum of employees' knowledge, competence, innovativeness, commitment and wisdom (Bontis, 1998; Johnson, 1999; Morris, 2015). This is the individual's knowledge that does not belong to the firm and that employees take with them when they leave the organization.

Structural capital comprises the firm's most valuable strategic assets, such as organizational capabilities, culture, processes, patents, copyrights, trademarks, databases, and so on (Denicolai *et al.*, 2015; Janosevic and Dzenopoljac, 2012; Johnson, 1999). Structural capital is more specialized than the other IC components (Hejazi, Ghanbari, and Alipour, 2016). This capital can be seen as the basic structure of a firm that supports and empowers human capital (Bontis, 1998; Curado, Henriques, and Bontis, 2011). Furthermore, structural capital is considered the support infrastructure for the establishment and maintenance of relationships with key external stakeholders (Molodchik, Shakina, and Barajas, 2014; Schiuma and Lerro, 2008).

Relational capital is the knowledge obtained through the establishment, maintenance and development of relationships with external stakeholders (Johnson, 1999; Kweh, Lu, and Wang, 2014; Yu, Wang, and Chang, 2015). Relational capital comprises employees' knowledge,

organizational processes, innovation capabilities, research and development projects, brand and relationships (Johnson, 1999; Serenko and Bontis, 2004; Wang *et al.*, 2014; Youndt *et al.*, 2004). This capital enhances and influences external stakeholders' perceptions of the firm (Bontis *et al.*, 2015; Cabrita and Bontis, 2008; Ting and Lean, 2009).

In spite of the importance of IC in firms' value creation, firms that strongly embody intangible assets in their activities see their degrees of investment sunkness increase (Lev and Zambon, 2003). This fact makes it difficult to identify and measure the value of IC, and therefore financial statements fail in reporting IC's value (Lev, 2004; Nimtrakoon, 2015). Several authors provided an overview of IC valuation models (Bontis, 2001; Sveiby, 1997; Sydler *et al.*, 2014). Until now, there has been no single, generally accepted model to measure IC. One of the most adopted methods among researchers is the Value Added Intellectual Coefficient (VAIC™) model (e.g., Bontis *et al.*, 2015; Chang and Hsieh, 2011; Janosevic and Dzenopoljac, 2012; Morariu, 2014; Nimtrakoon, 2015; Ting and Lean, 2009). The model developed by Pulic (1998, 2000) allows managers, shareholders and other interested stakeholders to monitor and measure firms' IC performance and potential. In other words, VAIC™ measures intellectual efficiency in firms' value creation through exploiting their economic resources (Pulic, 2004).

Despite several authors criticizing the model (c.f., Andriessen, 2004; Iazzolino and Laise, 2013; Maditinos, Chatzoudes, Tsairidis, and Theriou, 2011; Ståhle, Ståhle, and Aho, 2011), several advantages of VAIC™ are pointed out. It treats human capital as the most valuable source of IC (Greco, Ferramosca, and Allegrini, 2014; Mondal and Ghosh, 2012). The data used to compute the value of VAIC™ comes from financial statements, and therefore, the data is authentic and audited (Clarke, Seng, and Whiting, 2011; Firer and Williams, 2003; Pulic, 1998, 2000). VAIC™ is more objective, verifiable and quantitative (Firer and Williams, 2003; Pulic, 1998, 2000). This model is easy, simple and straightforward to compute (Firer and Williams, 2003; Nimtrakoon, 2015) better for statistical analysis (Andriessen, 2004), and appropriate for cross-sectional comparisons, i.e., comparisons across multi-national and multi-industry companies (Chen, Liu, and Kweh, 2014; Firer and Williams, 2003; Nimtrakoon, 2015; Young, Su, Fang, and Fang, 2009). According to Firer and Williams (2003), the other models of IC measurement developed are customized to fit a specific firm's profile, which limits comparability. Furthermore, Clarke *et al.* (2011) argue that the required information is not available to those outside the firm and the often-qualitative information, which is based on judgements, cannot be translated to monetary value. Therefore, this study will use VAIC™ to measure IC. Besides the fact that VAIC™ has been widely adopted by researchers, according to Zéghal and Maaloul (2010), VAIC™ is used by the UK's Department for Business, Innovation and Skills (BIS) as the indicator of firms' IC, which contributes to the validity of the VAIC™ model.

2.2. Intellectual Capital, Growth opportunities and Financial Performance

Despite the existence of various studies showing a positive and significant effect of IC on firms' financial performance, using VAIC™ as a measure of the efficiency of IC, there are several studies that did not find the same direction in that referred relationship, which may be attributed to country or industry specificities (Bontis, 1998; Chen, Cheng, and Hwang, 2005; Denicolai et al., 2015; Nimtrakoon, 2015; Tseng et al., 2013; ul Rehman et al., 2011). Riahi-Belkaoui (2003) used a sample of United States multinational firms to examine the association between IC and firms' financial performance, the results indicating a positive relationship. Chen et al. (2005) analysed the impact of IC on firms' financial performance on Taiwanese listed firms. The results show a positive and significant relationship between IC and firms' financial performance and may indicate benefits in future performance.

Zéghal and Maaloul (2010) analysed the impact of IC on firms' financial performance for three groups of industries, i.e., high techs, traditional and services and identified a positive impact of IC on firms' financial performance for firms, irrespective of the industry sector. In another study, Tan et al. (2007) analysed the effect of IC on firms' financial performance across different industries. Based on Singaporean listed firms, their findings show that the positive association between IC and firms' financial performance varies across industries. Based on 15 companies on the Belgrade Stock Exchange, the results of the study by 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. Based on a large sample of manufacturing firms in Thailand, Phusavat, Comepa, Sitko-Lutek, and Ooi (2011) found a significant, positive relationship between IC and firms' financial performance. Rahman (2012) studied 100 United Kingdom listed firms and concluded that a higher value of IC increases firms' financial performance. Tseng et al. (2013) used a sample of Taiwanese IT listed firms, the results indicating a significant, positive relationship between IC and firms' financial performance. Differing from previous studies, Morariu (2014) used a sample of Romanian firms to analyse the association between IC and firms' financial performance. The results show a significant, negative relationship between IC and firms' financial performance. Using a sample of listed firms in ASEAN countries, the results of Nimtrakoon (2015), reveal that the effect of IC on firms' financial performance is significant and positive for in all countries.

According to the above, we propose the following hypotheses:

H1. IC has a positive impact on firms' financial performance

H1a. IC has a positive impact on the financial performance of high-tech firms

H1b. IC has a positive impact on the financial performance of medium-tech firms

H1c. IC has a positive impact on the financial performance of low-tech firms

IC provides firms with innovative capacity to the firms (Chen et al., 2005; Lev and Sougiannis, 1996). This innovative capacity is recognised as a source of value creation and firms' growth. However, the investment in intangible assets increases investor's perception of risk due to the information asymmetry (Barth and Kasznik, 1999; Myers, 1984), as managers can act in order to maximize their own utility due to the discretionary expenditures of this type of investment (Gaver and Gaver, 1993; Hutchinson and Gul, 2004; Muniandy and Hillier, 2015). Some of these discretionary investments include expenses in advertising, marketing, R&D activities and product development (Adam and Goyal, 2008).

The capacity for expansion projects and innovation, through introducing new product lines, is greater in firms with growth options (Mason and Merton, 1985). Therefore, in the presence of growth opportunities, managers may invest in projects with a positive Net Present Value as they contribute to increasing the firm's value (Myers, 1977). According to Myers (1977), the lower the value of assets in place, the greater are the growth opportunities or investment opportunity set (IOS).

Studies related to the relationship between growth opportunities or IOS and firms' financial performance are scarce. Results from prior research show a negative relationship between IOS and firms' financial performance (Baber, Janakiraman, and Kang, 1996; Baker, 1993; Hutchinson, 2002; Hutchinson and Gul, 2004). For example, based on a sample of 269 Australian publicly listed firms, Hutchinson (2002) found a negative relationship between IOS and firms' financial performance. In another study, Hutchinson and Gul (2004) also found a negative relationship between IOS and firms' financial performance. Despite the direction of the previous study's results, Muniandy and Hillier (2015) used a sample of 151 South African firms listed on the Johannesburg Stock Exchange, and identified a positive relationship between growth opportunities and firms' financial performance. Serrasqueiro et al. (2007) found a non-linear relationship between growth opportunities and profitability, using a sample of 39 firms listed on the Portuguese Stock Exchange. The results also suggested that firms with limited and high growth opportunities have greater profitability than firms with medium growth opportunities.

Based on the above-mentioned studies, and their contradictory results, we propose the following hypotheses:

H2. Growth opportunities have a positive effect on firms' financial performance

H3. There is a non-linear relationship between growth opportunities and firms' financial performance

H4. Intellectual capital moderates the relationship between growth opportunities and firms' financial performance

Growth opportunities seem positively impact on firms' financial performance, contributing to firms' long-term sustainability. IC affects the dynamics of firm's growth opportunities due to the capacity to produce technological innovations (Liu and Wong, 2011) through the investment in research and development (R&D) activities (Chauvin and Hirschey, 1993; Chen et al., 2005; Lev and Sougiannis, 1996). These investments imply to resort to some firm resources that do not have a physical or financial form (Lev, 2004), such as human capital. Nevertheless, these type of assets produces high returns, i.e., "In a sense, intangibles are high-risk/high-reward assets" (Lev, 2005). Therefore, IC enhances earnings dynamics (Liu and Wong, 2011). The study of Moncada-Paternò-Castello (2016) shows that in EU the investments in IC, especially in R&D, are much higher in Medium-High and High R&D sectors' groups. Firms from advanced technology sectors need to invest in their human capital as they are part of firms' core competencies. This way, firms can upgrade their technology skills and innovativeness, which is not easy to imitate by their competitors, and, therefore, they are able to develop new products and/or services (Prahalad and Hamel, 1990; Seyoum, 2004). Based on the above mentioned, and considering VAIC™ as a measure of the efficiency of IC, we argue that high efficiency of IC positively impacts on growth opportunities, thus we formulate the following hypothesis:

H5. Higher efficiency of firms' IC generates greater growth opportunities

The principal-agent problem is classically associated with the dispersed ownership as described by Berle and Means (1932). This problem arises from the separation between firm´s control and ownership (Jensen and Meckling, 1976), which leads to the conflict of interests between controlling and minority shareholders (Shleifer and Vishny, 1997). When managers are not the firm's owners, their behavior may be influenced by self-interests. The selected projects that maximise the managers´ interests may not maximise the firm´s value and, therefore, may not converge with the interests of shareholders or owners (Berle and Means, 1932; Fama, 1980; Jensen and Meckling, 1976). Moreover, the opportunistic behavior of managers derives from information asymmetries, as shareholders may have access to limited information (Jensen and Meckling, 1976).

With the monitoring of managers' actions, controlling shareholders can force the convergence of interest (Demsetz and Lehn, 1985; Shleifer and Vishny, 1997). Also, the interests of managers and shareholders can converge if managers participate on of firm's ownership, reducing the agency costs (Jensen and Meckling, 1976; Leland and Pyle, 1977). Therefore, the higher the proportion of ownership, the higher the probability of managers to behave in order to increase firms' value. On one hand, ownership concentration may reduce agency problems. On the other hand, the excessive ownership concentration may produce adverse consequences (Burkart, Gromb, and Panunzi, 1997), i.e., namely it could prevent investment opportunities exploitation.

Burkart et al. (1997) suggest the existence of a trade-off between control and initiative ability. Carlin and Mayer (2003) argue that different ownership structures may differ according to firms' characteristics and activities. In low-tech industries, the ownership concentration seems to contribute to long-term commitment with investments (Carlin and Mayer, 2003). Therefore, authors suggest that a more dispersed ownership structure may be applied to high-tech industries as it may be an incentive device for managers to act more efficiently due to delegate decision-making (Burkart et al., 1997; Prendergast, 2002). The delegation of the decision-making might be more appropriately for uncertain environments (Prendergast, 2002).

Therefore, we argue that ownership concentration has a negative effect on growth opportunities.

Based on the above mentioned, we formulate the following hypotheses:

H6. Ownership concentration has a negative effect on growth opportunities

H7. The relationship between ownership concentration and growth opportunities is a non-linear relationship.

3. Data, Variables and Method

3.1. Database

We use a dataset of 2044 non-financial listed firms in 14 European countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden and United Kingdom (UK)) for the period between 2004 and 2015. Our dataset was gathered from the DATASTREAM database by Thomson Reuters as it provides current and historical economic and financial data for all listed firms in the world's major stock exchanges. All financial firms were excluded from our data set. The research sample has an unbalanced panel structure, where the number of firm-years present in the research sample, varies between 3 and 12. Following the suggestions of Guariglia (2008), Bond, Elston, Mairesse, and Mulkay (2003) and Cummins, Hasset, and Oliner (2006), we mitigate potential survivor bias by allowing the entrance and exit of firms. 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 extraordinary firms' shocks.

Based on the criteria used by Ortega-Arguiles et al. (2009), we used the FTSE/Dow Jones Industry Classification Benchmark (ICB) at the two-digit level, i.e., 45 industry and service

sectors[1] to classify industry and service sectors into high, medium-tech and low-tech sectors. This classification will be considered to test hypotheses H1 to H4.

For the second part of this study, we follow the criteria of Moncada-Paternò-Castello (2016), which divided medium-tech into Medium high-tech and Medium low-tech sectors. In order to divide the whole sample into two sub-samples, i.e., high and low-tech sectors, we grouped Medium high-tech to high group and Medium low-tech to Low tech group, which allowed us to have two balanced groups in terms of number of firms. This classification will be used to test hypotheses H5 to H7.

3.2. Estimation Method and Variables Measurement

Due to the dynamic character of the main research variables in the studied, we use dynamic panel data econometrics, which allows the use of time series data taking into account the heterogeneity in adjustment dynamics between different type 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 the 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 the GMM system (1998) estimator can only be valid under the following conditions: (1) validity of the restrictions created by the use of instruments; and (2) absence of second-order autocorrelation. In order to test the first condition, i.e., the validity of the restrictions created by the instruments used, we use the Hansen test where the null hypothesis is the validity of the restrictions created by the instruments used. For the second condition, we test for the existence of second-order autocorrelation, where the null hypothesis indicates that there is not second-order autocorrelation. In the case of not rejecting the null hypothesis for the Hansen and second-order autocorrelation tests, we conclude that the GMM system (1998) estimator is valid and robust.

Through the use of a high number of instruments, the GMM system (1998) estimator leads to dramatically improvements in efficiency compared with the first difference GMM estimator (Arellano and Bover, 1995; Blundell and Bond, 1998). Arellano and Bond (1991), Windmeijer (2005) and Roodman (2006) showed the reliability of the one-step estimator, 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 especially for the GMM system (1998) estimator (Roodman, 2009). Therefore, we used the two-step procedure with the correction proposed by Windmeijer (2005).

[1] See http://www.icbenchmark.com/.

Our estimation models, i.e., equation (1) will be used to verify H1 to H4 and equation (2) will be used to verify H5 and H7, are given by

Equation (1):

$$ROA_{i,t} = \propto_0 + \beta_1 ROA_{i,t-1} + \beta_2 VAIC_{i,t} + \beta_3 VAIC_{i,t-1} + \beta_4 TobinQ_{i,t} + \beta_5 TobinQ_{i,t}^2 + \beta_6 VAIC_{i,t} * TobinQ_{i,t} + \beta_7 SIZE_{i,t} + \beta_8 AGE_{i,t} + \beta_9 Tlev_{i,t} + \beta_{10} Dcrisis_{08;09} + \varphi_c D_c + \varphi_t d_t + \eta_i + \varepsilon_{i,t}$$

Equation (2):

$$TobinQ_{i,t} = \propto_0 + \beta_1 TobinQ_{i,t-1} + \beta_2 VAIC_{i,t} + \beta_3 VAIC_{i,t-1} + \beta_4 OWNCONC_{i,t} + \beta_5 OWNCONC_{i,t}^2 + \beta_6 Cash\ Flow_{i,t} + \beta_7 Tlev_{i,t} + \beta_8 SIZE_{i,t} + \beta_9 AGE_{i,t} + \varphi_c D_c + \varphi_t d_t + \eta_i + \varepsilon_{i,t}$$

Where: η_i are non-observable individual effects; and $\varepsilon_{i,t}$ is the error; d_t corresponds to the year dummy variables; and D_c country dummy variables. 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 of the current period to total assets of the current period and $TobinQ_{i,t}$ is used as a proxy for firms' growth opportunities of the current year, given by the ratio of equity market value of the current period to equity book value of 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 of the previous period to total assets of the previous period; $TobinQ_{i,t-1}$ is used as a proxy for firms' market value of the previous year, given by the ratio of equity market value of the previous period to equity book value of the previous period. $VAIC_{i,t}$ is the value added intellectual coefficient of the current period (VAIC™) corresponding to sum of HCE plus SCE plus CEE, where: HCE is the human capital efficiency (HCE) = value added (VA) / human capital (HC); SCE structural capital efficiency (SCE) = structural capital (SC) / value added (VA); and CEE is the capital employed efficiency = value added (VA) / capital employed (CE). $VAIC_{i,t-1}$ is the value added intellectual coefficient of the previous period; $TobinQ_{i,t}^2$ is the square of $TobinQ_{i,t}$; $OWNCONC_{i,t}$ is the ownership concentration, given by the variable NOSHEM (source: DATASTREAM database), which aggregates the percentage of holdings of 5% or more by employees or family member; and $OWNCONC_{i,t}^2$ is the square of $OWNCONC_{i,t}$.

Finally, the measurement of control variables are as follows: $Cash\ Flow_{i,t}$ is profitability of the current period, given by the ratio of earnings before interest and taxes of the current period to total assets of the current period; $Tlev_{i,t}$ is the leverage of the current period, given by the ratio of book value of total debt of the current period to total assets of the current period; $SIZE_{i,t}$ is the size of the previous period, given by the natural logarithm of total assets of the

current period; $AGE_{i,t}$ is firm age of the previous period, given by the natural logarithm of the number of years of existence of the firm of the current period; and $Dcrise_{08;09}$ is a dummy representing financial crisis for the periods 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 1. It summarises the descriptive statistics of dependent and independent variables.

Table 1 - Descriptive statistics of Full sample

Variables	Observations	Mean	Median	SD	Min	Max
$ROA_{i,t}$	21188	.017	.035	.12	-1.1	.37
$VAIC_{i,t}$	17940	2.3	2.1	1.3	.0015	16
$TobinQ_{i,t}$	20225	1.6	1.3	1.1	.5	11
$Tlev_{i,t}$	21395	.23	.21	.18	0	1
$SIZE_{i,t}$	20998	13	13	2.2	7.7	19
$AGE_{i,t}$	23294	3.3	3.2	1.1	.69	7.6

ROA presents a low mean score of 0.02 suggesting a low level of profitability. The high standard deviation suggests the existence of high variance between firms. The mean score of VAIC is 2.1, suggesting that European firms create an average of 2.1 monetary unity for every 1 monetary unity utilised. The high value of Tobin's Q suggests that on average the firms' market value is higher than firms' book value, and therefore, the existence of growth opportunities in firms from European countries.

Table 2 reports the statistics descriptive based on sub-samples of high, medium-tech and low-tech sectors.

Table 2 - Descriptive statistics by sub-samples

Variables	High-tech (n = 457 firms)				Medium-tech (n = 587 firms)				Low-tech (n = 1000 firms)			
	Obs	Mean	Median	SD	Obs	Mean	Median	SD	Obs	Mean	Median	SD
$ROA_{i,t}$	4683	-.011	.034	.17	6196	.021	.038	.11	10309	.028	.034	.095
$VAIC_{i,t}$	3722	2.1	2,00	1.2	5248	2.2	2	1.1	8970	2.4	2.1	1.4
$TobinQ_{i,t}$	4466	1.8	1.4	1.2	5934	1.6	1.3	1	9825	1.6	1.3	.98
$Tlev_{i,t}$	4793	.16	.13	.16	6247	.23	.21	.16	10355	.26	.26	.18
$SIZE_{i,t}$	4726	12	12	2.2	6145	13	13	2	10127	14	14	2.1
$AGE_{i,t}$	5296	3	3	.89	6717	3.4	3.3	1.1	11281	3.3	3.3	1.2

Low-tech firms seem to be on average more profitable than medium-tech and high firms. In fact, we see a negative low score mean of ROA for high firms. Nevertheless, high present higher growth opportunities than medium-tech and low-tech firms. Low-tech firms are more efficient in creating VA from their intellectual, physical and financial resources (VAIC™ = 2,4) than medium-tech (VAIC™ = 2,2) and high firms (VAIC™ = 2,1). Although the results seem surprisingly, Zéghal and Maaloul (2010) and UK DTI (2006, p. 51) in the "Value Added Scoreboard" found that in United Kingdom, traditional sectors create more VA since these sectors are much modernised, innovative and competitive (DTI, 2006; Zéghal and Maaloul, 2010). Low-tech firms present a higher mean value of leverage than high and low-tech firms. High-tech firms are younger and smaller than medium-tech and low-tech firms.

Table 3 reports the statistics descriptive based on sub-samples of high and low-tech sectors.

Table 3 - Descriptive statistics by sub-samples

Variables	High-tech (n = 887 firms)				Low-tech (n = 1157 firms)			
	N	Mean	Median	SD	N	Mean	Median	SD
$TobinQ_{i,t}$	8830	1.7	1.4	1.1	11395	1.6	1.3	.99
$VAIC_{i,t}$	7507	2.1	2	1.1	10433	2.4	2.1	1.4
$OWNCONC_{i,t}$	9145	17	0	23	11796	15	0	24
$CashFlow_{i,t}$	8858	.13	.11	.08	11686	.12	.11	.078
$Tlev_{i,t}$	9486	.19	.17	.16	12120	.26	.25	.18
$SIZE_{i,t}$	9258	12	12	2.1	11740	14	13	2.1
$AGE_{i,t}$	10221	3.2	3.1	1	13073	3.3	3.2	1.2

It can be noticed that low-tech firms present on average higher values of VAIC than high firms, which indicates that low-tech firms tend to be more efficient in creating more VA from their intellectual, physical and financial resources. High firms present on average greater growth opportunities ($TobinQ_{i,t}$) and ownership concentration than low-tech firms. Also, High-tech firms show on average lower levels of leverage, which may be a result of unfavourable terms in accessing to credit. However, high firms present on average greater levels of Cash Flow than low-tech firms.

The correlation and magnitude of the variables in the study were analysed with Pearson correlation coefficient and can be seen in Table 4. There are significant correlations 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%. We found five correlations above 30% among independent variables, which are ROA from the previous period with VAIC from the current and previous period, between VAIC from the current period and VAIC from the previous period and Cash Flow with Tobin's Q from the current and previous period, respectively. Therefore, to overcome the

problem of endogeneity, we applied the GMM system (1998) dynamic estimator as we can use the instrumental variables to reduce the endogeneity problem. Also, we found high persistency in the correlation of dependent variables, ROA and Tobin's Q, between current and previous periods, due to the high correlation coefficients. This being so, we follow the suggestions of Blundell and Bond (1998) and in our study, we applied the GMM system (1998) dynamic estimator, which is more appropriate to use here than the GMM (1991) estimator.

Table 4 - Correlation matrix

Variables	$ROA_{i,t}$	$ROA_{i,t-1}$	$VAIC_{i,t}$	$VAIC_{i,t-1}$	$TobinQ_{i,t}$	$TobinQ_{i,t-1}$	$OWNCONC_{i,t}$	$CashFlow_{i,t}$	$SIZE_{i,t}$	$AGE_{i,t}$	$Tlev_{i,t}$
$ROA_{i,t}$	1.0000										
$ROA_{i,t-1}$	0.6491**	1.0000									
$VAIC_{i,t}$	0.4096**	0.3539**	1.0000								
$VAIC_{i,t-1}$	0.3471**	0.4009**	0.6068**	1.0000							
$TobinQ_{i,t}$	0.1128**	0.0531**	0.1673**	0.1337**	1.0000						
$TobinQ_{i,t-1}$	0.1335**	0.1137**	0.1727**	0.1735**	0.8078**	1.0000					
$OWNCONC_{i,t}$	0.0011	-0.0000	-0.0611**	-0.0617**	-0.0445**	-0.0504**	1.0000				
$CashFlow_{i,t}$	0.2886**	0.2237**	0.2874**	0.2361**	0.5088**	0.4753**	-0.0231	1.0000			
$SIZE_{i,t}$	0.2420**	0.2528**	0.2003**	0.2116**	-0.1508**	-0.1296**	-0.2240**	-0.0778**	1.0000		
$AGE_{i,t}$	0.1176**	0.1160**	-0.0347**	-0.0315**	-0.1239**	-0.1276**	-0.0350**	-0.0641**	0.2282**	1.0000	
$Tlev_{i,t}$	-0.0411**	-0.0096	0.0237	0.0033	-0.1064**	-0.0101	0.0027	-0.1276**	0.1703**	0.0033	1.0000

Note: ** Statistical significance at 1%; * Statistical significance at 5%

Next, we present the GMM system (1998) results. According to the results of the Hansen and second-order autocorrelation tests, we cannot reject the null hypothesis in both tests 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 the existence of second-order autocorrelation for the estimated models. This being so, the results of the GMM system (1998) dynamic estimator are robust and can be used to support our interpretation of the empirical results.

4.2. Intellectual Capital, Growth Opportunities and Financial Performance

The results obtained with the GMM system (1998) dynamic estimator for the equation (1) are presented in Table 5.

Table 5 - Estimation results of equation (1)

Independent Variables	*Dependent variable*: $ROA_{i,t}$			
	Full sample	High-tech - GMM (1998)	Medium-tech - GMM (1998)	Low-tech - GMM (1998)
$ROA_{i,t-1}$	0.26858***	0.29274***	0.37903***	0.22393***
	(0.06349)	(0.02574)	(0.03534)	(0.03529)
$VAIC_{i,t}$	0.02236**	0.01202***	0.03243***	0.01005***
	(0.01110)	(0.00314)	(0.00550)	(0.00381)
$VAIC_{i,t-1}$	-0.00597***	0.00988***	-0.01748***	-0.01446***
	(0.00200)	(0.00230)	(0.00338)	(0.00301)
$TobinQ_{i,t}$	0.03301**	0.03984**	0.02800***	0.07481***
	(0.01358)	(0.01658)	(0.00756)	(0.01252)
$TobinQ_{i,t}^2$	-0.00441**	-0.01294***	-0.00200**	-0.00747***
	(0.00174)	(0.00226)	(0.00093)	(0.00146)
$VAIC_{i,t} * TobinQ_{i,t}$	0.01018**	0.01345***	0.00556**	0.00669**
	(0.00425)	(0.00146)	(0.00231)	(0.00307)
$Tlev_{i,t}$	-0.08241***	-0.11513***	-0.09428***	-0.06738***
	(0.01102)	(0.02032)	(0.00988)	(0.00902)
$SIZE_{i,t}$	0.00335***	0.00446***	0.00190**	0.00384***
	(0.00108)	(0.00107)	(0.00075)	(0.00070)
$AGE_{i,t}$	0.00964***	0.00581**	0.00380***	0.00568***
	(0.00143)	(0.00269)	(0.00108)	(0.00108)
$Dcrisis_{08;09}$	-0.13775***	-0.13752***	-0.05634***	0.01430***
	(0.02263)	(0.02279)	(0.01549)	(0.00288)
Constant	0.00000	0.00000	0.00000	-0.13973***
	(0.00000)	(0.00000)	(0.00000)	(0.01851)
Observations	14,426	2,305	4,032	5,752
Number of ID	1,804	363	508	795
F	83.21***	68.29***	91.08***	568.7***
Hansen	41.47	84.36	75.38	45.08
m1 (N(0,1))	-8.046***	-3.505***	-6.053***	-5.780***
m2 (N(0,1))	1.563	1.190	0.430	1.799*

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

For high firms, the results show that ROA in the previous period, VAIC, VAIC in the previous period, Tobin's Q, VAIC*Tobin's Q, SIZE, AGE have a significant positive impact on firms' financial performance. The square of Tobin's Q, Tlev and Dcrisis have a negative and significant effect on firms' financial performance.

The results for medium-tech firms reveals that ROA in the previous period, VAIC, Tobin's Q, VAIC*Tobin's Q, SIZE and AGE have a significant positive effect on firms' financial performance, while VAIC in the previous period, the square of Tobin's Q, Tlev and Dcrisis have a significant negative impact on firms' financial performance.

In the case of low-tech firms, the results indicate that ROA in the previous period, VAIC, Tobin's Q, VAIC*Tobin's Q, SIZE, AGE and Dcrisis have a significant positive impact on firms' financial performance. For VAIC in the previous period, the square of Tobin's Q and Tlev, the results indicate a significant negative effect on firms' financial performance.

4.3. Intellectual Capital, Growth Opportunities and Ownership Concentration

The results obtained with the GMM system (1998) dynamic estimator for the estimated equation (2) are presented in Table 6.

Table 6 - Estimation results of equation (2)

Independent variables	*Dependent variable*: $TobinQ_{i,t}$	
	High-tech - GMM (1998)	Low-tech - GMM (1998)
$TobinQ_{i,t-1}$	0.64703***	0.65925***
	(0.02174)	(0.01790)
$VAIC_{i,t}$	0.02632**	-0.01321***
	(0.01092)	(0.00286)
$VAIC_{i,t-1}$	-0.02711***	0.00765***
	(0.00753)	(0.00247)
$OWNCONC_{i,t}$	0.00609**	-0.00600**
	(0.00301)	(0.00275)
$OWNCONC_{i,t}^2$	-0.00010**	0.00009**
	(0.00005)	(0.00004)
$CashFlow_{i,t}$	2.27479***	2.68236***
	(0.29829)	(0.12955)
$Tlev_{i,t}$	-0.11572**	0.09545***
	(0.05382)	(0.03478)
$SIZE_{i,t}$	0.00697	-0.00879**
	(0.00524)	(0.00402)
$AGE_{i,t}$	-0.02213*	-0.01640**
	(0.01239)	(0.00721)
Constant	0.00000	0.28305***
	(0.00000)	(0.09200)
Observations	3,246	4,43
Number of ID	503	657
F	2621.8***	991.6***
Hansen (N(0,1))	136.89	125.5
m1 (N(0,1))	-5.739***	-5.286***
m2 (N(0,1))	-1.619	-1.951*

Standard errors in parentheses

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

For high firms, it can be noticed that the results indicate that Tobin's Q in the previous period, VAIC, OWNCONC and Cash Flow have a significant positive impact on firms' growth opportunities, whereas, VAIC in the previous period, the square of OWNCONC, Tlev and AGE have a significant negative effect on firms' growth opportunities.

The results reveal that for low-tech firms, Tobin's Q in the previous period, VAIC in the previous period, the square of OWNCONC, Cash Flow and Tlev have a significant positive impact on firms' growth opportunities, while, VAIC in the current period, OWNCONC and SIZE have a significant negative association on firms' growth opportunities.

5. Discussion of the Empirical Results

The results from equation (1) suggest that IC enhances firms' financial performance. VAIC in the current period has a positive impact on financial performance in high, medium-tech and low-tech firms. Therefore, these results do not allow us to reject hypothesis H1. These results suggest that an efficient use of IC enhances firms' financial performance irrespective of the sector characteristics. The results obtained corroborate previous studies. (Chen et al., 2005; Janosevic and Dzenopoljac, 2012; Phusavat et al., 2011; Riahi-Belkaoui, 2003; Tan et al., 2007). However, when we observe the effect of VAIC in previous period on firms' financial performance, it can be noticed that VAIC only has a positive impact on the financial performance of high firms. This may be due to the fact that high firms are IC intensive. Therefore, the activities of those firms depend heavily on intangible resources, such as human capital, and apparently it takes time for these to impact on firm´s financial performance (Prahalad and Hamel, 1990; Seyoum, 2004).

Concerning the relationship between growth opportunities and firms' financial performance, the results indicate that growth opportunities positively impact on firms' financial performance. Therefore, we cannot reject the previously formulated hypothesis H2. Our results corroborate the results of Muniandy and Hillier (2015). However, when we test for the non-linearity of the relationship between growth opportunities and firms' financial performance, we find the non-linearity of that relationship, which does not allow us to reject hypothesis H3. Our results are in line with the previous findings of Serrasqueiro et al. (2007). The results suggest that, in the presence of growth opportunities, managers decide to implement, to a certain extent, projects with a positive NPV. However, the non-linearity of the relationship between growth opportunities and firms' financial performance suggests that from a certain level of growth opportunities, managers tend to select non-profitable projects. Therefore, this may increase agency problems and discretionary expenditure, even in the presence of high growth opportunities (Gaver and Gaver, 1993; Hutchinson and Gul, 2004; Muniandy and Hillier, 2015). This seems to have negative consequences for the relationship between growth opportunities and financial performance.

The results suggest that the positive relationship between growth opportunities and firms' financial performance is enhanced with the efficient use of firms' IC. Therefore, we cannot reject the previously formulated hypothesis H4. IC provides firms with innovative capacity (Chen et al., 2005; Lev and Sougiannis, 1996), which is recognized as a source of firms' values creation and growth. Therefore, firms can upgrade their technology skills and innovativeness, which is not easy to imitate by their competitors, and therefore, they are able to develop new products and/or services (Prahalad and Hamel, 1990; Seyoum, 2004). Thus, the results obtained here suggest a positive influence of IC, since it enhances the positive relationship between growth opportunities and firms' financial performance.

Concerning the impact of the 2008-2009 financial crisis on firms' financial performance, the results show for high-tech and medium-tech firms that the financial crisis had a negative impact on that performance. This period may have limited the access to external finance and accentuated the scarcity of financial resources as well as deteriorating terms of credit, mainly for funding investments in intangible assets, such as IC (Cincera et al., 2015; Hall et al., 2016). This is in line with our results regarding the negative relationship between leverage and firms' financial performance. The higher negative coefficient of leverage in the case of high-tech firms suggests greater difficulties for high-tech firms, namely unfavourable terms, in accessing credit than for medium-tech and low-tech firms.

According to the results obtained for the equation (2), the efficient use of IC in the current period has a positive impact on growth opportunities in high firms and negative impact on growth opportunities in low-tech firms. Therefore, we reject hypothesis H5. These results suggest that low-tech firms do not depend on IC efficiency as much as high firms do, given that advanced technology sectors need to invest in their human capital, as they are part of firms' core competencies, and therefore, upgrade firms' technology skills and innovativeness (Prahalad and Hamel, 1990; Seyoum, 2004).

Our results suggest that ownership concentration positively affects growth opportunities in high firms but not in low-tech firms. Therefore, we must partially reject hypothesis H6. After testing for the possibility of non-linear relationship between ownership concentration and growth opportunities, results show a non-linearity of the referred relationship. This being so, we cannot reject hypothesis H7. This result suggests that for greater levels of growth opportunities, a low ownership concentration brings benefits to the firm as a more dispersed ownership structure may be an incentive device for managers to act more efficiently due to delegate decision-making, which might be more appropriately for uncertain environments (Burkart et al., 1997; Prendergast, 2002). While for the case of low-tech firms, the greater level of ownership concentration seems to negatively impact on growth opportunities, in spite of high ownership concentration tends to assure that managers and shareholders converge interests. Furthermore, the higher the proportion of ownership, the higher the probability of managers to behave in order to increase firms' value due to the reduction of agency problems (Jensen and Meckling, 1976; Leland and Pyle, 1977).

Results from equation (2) also reveal a negative relationship between Tlev and growth opportunities for high firms and positive for low-tech firms. This result suggests that firms that strongly embodies intangible assets in their activities see the degrees of sunkness of their investments increase (Lev and Zambon, 2003) and as intangible assets do not have a physical or financial form (Lev, 2004), deteriorates terms for high firms to access credit. Therefore, high firms strongly rely on internally generated funds to finance their activities (Myers, 1984; Myers and Majluf, 1984), which is confirmed by the positive relationship between Cash Flow and growth opportunities from equation (2).

6. Conclusion

The efficient use of IC seems to positively impact firms' growth opportunities, and, consequently, both contribute to firms' financial performance. Additionally, the correct management of IC will increase firms' wealth and growth. The selection of an optimal ownership structure appears to influence the firms' innovativeness, technological capacity as well as the employees' creativity.

Based on a sample of non-financial listed firms in 14 Western European countries for the period between 2004 and 2015, we divided our sample according to R&D intensity sectors. Resorting to econometric modelling techniques, specifically, the GMM system (1998) estimator, we analysed dynamic model panel data. The findings show that IC efficiency in the current period has a positive impact on the financial performance of high, medium-tech and low-tech firms. However, when we test the impact of IC efficiency of the previous period on future financial performance, only financial performance of high firms benefits from IC efficiency. Our results reveal the non-linearity of the relationship between growth opportunities and firms' financial performance. This non-linearity relationship suggests that for a greater level of growth opportunities, managers tend to select non-profitable projects, which may be a consequence of the increase of agency problems and discretionary expenditures in firms with high growth opportunities investments. Also, the results suggest that the positive relationship between growth opportunities and firms' financial performance is enhanced with the efficient use of firms' IC. The financial crisis of 2008-2009 had a negative effect on financial performance in high and medium-tech firms. In the financial crisis period this type of firm may face restrictions in accessing to credit, suffer a scarcity of financial resources or unfavourable terms of credit, mainly for funding investments in intangible assets, such as IC. Our findings also reveal that the efficient use of IC in the current period has greater impact on growth opportunities in high firms. Our results reveal that the relationship between ownership concentration and firms' growth opportunities in non-linear. Regarding the ownership structure impact on fimrs' growth opportunities, results suggest that for high firms, a low ownership concentration brings benefits to the firm as a more dispersed ownership structure may be an incentive device for managers to act more efficiently due to delegate decision-making, which might be more appropriately for uncertain environments. While for the case of low-tech firms, the greater levels of growth opportunities seem to be associated with higher ownership concentration, which allows a convergence of the interests of shareholders and managers due to the reduction of agency problems.

The current study presents several contributions. To our knowledge, this is the first study exploring a sample of Western European countries. We applied panel data analysis resorting to econometric models, using the GMM system (1998) estimator. Our results suggest the importance of IC for firms' financial performance irrespective of being high, medium-tech or low-tech firms. This study shows that IC has a positive effect on the relationship between

growth opportunities and firms' financial performance. Moreover, we show that there is a non-linear relationship between growth opportunities and firms' financial performance. Results reveal that IC positively impacts on firms' growth opportunities. Our findings also contribute by analysing the relationship between the impact of ownership concentration on firms' growth opportunities as well as by showing the existence of a non-linear relationship between ownership concentration and firms' growth opportunities.

On the practical side, we encourage managers to pay more attention to the importance of firms' IC as this has a positive impact on firms' financial performance and exploitation of growth opportunities. Therefore, it is important to understand that the characteristics of firms may require different styles of IC management. For policy-makers, we suggest the creation and development of incentive programmes to help firms finance IC due to the fact that high-tech firms have much more difficulty in accessing credit.

The current study has the following limitations. As we use a sample of 14 Western European countries, we did not analyse the differences between high-tech and low-tech firms for individual countries, which limits our extrapolation of the results to a particular country. Therefore, it would be interesting to see if our results hold in individual countries. Countries' characteristics, such as legal aspects, accounting practices or industrial sectors, may influence results. For future research, we suggest longitudinal studies comparing Western European countries. Also, it is important to analyse firms' financial decisions regarding IC investment, as IC contributes to their financial performance and growth opportunities.

References

Abdolmohammadi, M. J. (2005). Intellectual capital disclosure and market capitalization. *Journal of Intellectual Capital*, 6(3), 397-416.

Aboody, D., and Lev, B. (2000). Information asymmetry, R&D and insider gains. *The Journal of Finance*, 55(6), 2747-2766.

Adam, T., and Goyal, V. K. (2008). The investment opportunity set and its proxy variables. *Journal of Financial Research*, 31, 41-63.

Aivazian, V. A., Ge, Y., and Qiu, J. (2005). The impact of leverage on firm investment: Canadian evidence. *Journal of Corporate Finance*, 11(1-2), 277-291.

Andriessen, D. (2004). *Making sense of Intellectual capital: Designing a Method for the Valuation of Intangibles*. Boston: Butterworth-Heinemann.

Arellano, M., and Bond, S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and Application to Employment Equations. *Review of Economic Studies*, 58(277-97).

Arellano, M., and Bover, O. (1995). Another Look at the Instrumental Variable Estimation of Error-Components Models. *Journal of Econometrics*, 68, 29-52.

Baber, W. R., Janakiraman, S. N., and Kang, S. H. (1996). Investment opportunities and the structure of executive compensation. *Journal of Accounting and Economics*, 21(4), 297-318.

Baker, G. P. (1993). Growth, corporate policies, and the investment opportunity set. *Journal of Accounting and Economics*, 16, 161–165.

Barth, M. E., and Kasznik, R. (1999). Share repurchase and intangible assets. *Journal of Accounting and Economics*, 28(2), 211-241.

Berle, A., and Means, G. (1932). *The Modern Corporation and Private Property*. New York: Commerce Clearing House.

Blundell, R., and Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87, 115-143.

Bond, S., Elston, J., Mairesse, J., and Mulkay, B. (2003). Financial factors and investment in Belgium, France, Germany, and the United Kingdom: A comparison using company panel data. *Review of Economics and Statistics*, 85, 153-165.

Bontis, N. (1998). Intellectual capital: an exploratory study that develops measures and models. *Management Decision*, 36(2), 63-76.

Bontis, N. (1999). Managing organizational knowledge by diagnosing intellectual capital: Framing and advancing the state of the field. *International Journal of Technology Management, 18*(5-8), 433–462.

Bontis, N. (2001). Assessing knowledge assets: a review of the models used to measure intellectual capital. *International Journal of Management Reviews*, 3(1), 41-60.

Bontis, N., Dragonetti, N. C., Jacobsen, K., and Roos, G. (1999). The knowledge toolbox: a review of the tools available to measure and to manage intangible resources. *European Management Journal, 17*(4), 391-402.

Bontis, N., Janosevic, S., and Dzenopoljac, V. (2015). Intellectual capital in Serbia's hotel industry. *International Journal of Contemporary Hospitality Management*, 27(6), 1365-1384.

Burkart, M., Gromb, D., and Panunzi, F. (1997). Large shareholders monitoring, and the value of the firm. *Quarterly Journal of Economics*, 112, 693-728.

Cabrita, M. d. R., and Bontis, N. (2008). Intellectual capital and business performance in the Portuguese banking industry. *International Journal of Technology Management, 43*(1-3), 212-237.

Carlin, W., and Mayer, C. (2003). Finance, investment and growth. *Journal of Financial Economics*, 69(1), 191-226.

Chang, W. S., and Hsieh, J. (2011). The dynamics of intellectual capital in organizational development. *African Journal of Business Management, 5*(6), 2345-2355.

Chauvin, K. W., and Hirschey, M. (1993). Advertising, R&D expenditures and the market value of the firm. *Financial Management*, 22(4), 128-140.

Chen, F.-C., Liu, Z. J., and Kweh, Q. L. (2014). Intellectual capital and productivity of Malaysian general insurers. *Economic Modelling, 36*, 413-420.

Chen, M., Cheng, S., and Hwang, Y. (2005). An empirical investigation of the relationship between intellectual capital and firms' market value and financial performance. *Journal of Intellectual Capital*, 6(2), 159-176.

Cincera, M., Ravet, J., and Veugelers, R. (2015). The sensitivity of R&D investments to cash flows: comparing young and old EU and US leading innovators. *Economics of Innovation and New Technology*, 25(3), 1-17.

Clarke, M., Seng, D., and Whiting, R. H. (2011). Intellectual capital and firm performance in Australia. *Journal of Intellectual Capital, 12*(4), 505-530.

Cummins, J., Hasset, K., and Oliner, S. (2006). Investment behavior, observable expectations, and internal funds. *American Economic Review*, 96, 796-810.

Curado, C., Henriques, L., and Bontis, N. (2011). Intellectual capital disclosure payback. *Management Decision*, 49(7-8), 1080-1098.

Demsetz, H., and Lehn, K. (1985). The structure of corporate ownership: causes and consequences. *Journal of Political Economy*, 93(6), 1155-1177.

Denicolai, S., Ramusino, E. C., and Sotti, F. (2015). The impact of intangibles on firm growth. *Technology Analysis & Strategic Management*, 27(2), 219-236.

DTI (2006), The Value Added Scoreboard, Commentary and Analysis (Volume 1), Company Data (Volume 2), Department of Trade and Industry, London.

Edvinsson, L., and Malone, M. (1997). *Intellectual Capital: Realizing Your Company's True Value by Finding its Hidden Roots*. New York, NY: Harper Collins.

Edvinsson, L., and Malone, M. (1997). *Intellectual Capital: Realizing Your Company's True Value by Finding its Hidden Roots*. New York, NY: Harper Collins.

Firer, S., and Williams, M. (2003). Intellectual Capital and Traditional Measures of Corporate Performance. *Journal of Intellectual Capital, 4*, 348-360.

Fama, E. F. (1980). Agency problems and the theory of the firm. *Journal of Political Economy*, 88, 288-307.

Gaver, J., and Gaver, K. (1993). Additional evidence on the association between investment opportunity set and corporate financing, dividend and compensation policies. *Journal of Accounting and Economics*, 16, 125-160.

Greco, G., Ferramosca, S., and Allegrini, M. (2014). Exploring intellectual capital in family firms. An empirical investigation. *International Journal of Learning and Intellectual Capital*, 11(2), 91-106.

Guariglia, A. (2008). Internal financial constraints, external financial constraints, and investment choice: Evidence from a panel of UK firms. *Journal of Banking & Finance*, 32(9), 1795-1809.

Gujarati, D., and Porter, D. (Eds.). (2010). *Essentials of Econometrics* (4th ed ed.). New York: McGraw – Hill International.

Hall, B. H., Moncada-Paternò-Castello, P., Montresor, S., and Vezzani, A. (2016). Financing constraints, R&D investments and innovative performances: new empirical evidence at

the firm level for Europe. *Economics of Innovation and New Technology*, 25(3), 183-196.

Hejazi, R., Ghanbari, M., and Alipour, M. (2016). Intellectual, Human and Structural Capital Effects on Firm Performance as Measured by Tobin's Q. *Knowledge and Process Management, 23*(4), 259-273.

Holland, J. (2006). Fund management, intellectual capital, intangibles and private disclosure. *Managerial Finance*, 32(4), 281.

Hutchinson, M. R. (2002). An analysis of the association between firms' investment opportunities, board composition, and firm performance. *Asia-Pacific Journal of Accounting and Economics*, 9(1), 17-38.

Hutchinson, M. R., and Gul, F. A. (2004). Investment opportunity set, corporate governance practices and firm performance. *Journal of Corporate Finance*, 10(4), 595-614.

Iazzolino, G., and Laise, D. (2013). Value added intellectual coefficient (VAIC): A methodological and critical review. *Journal of Intellectual Capital*, 14(4), 547-563.

Ilyin, D. S. (2014). The Impact Of Intellectual Capital On Companies' Performance: Evidence From Emerging Markets. *Korporativnye finansy*(4), 46-66.

Janosevic, S., and Dzenopoljac, V. (2012). Impact of intellectual capital on financial performance of serbian companies. *Actual Problems of Economics, 133*(7), 554-564.

Jensen, M., and Meckling, W. (1976). Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. *Journal of Financial Economics*, 3, 305-360.

Johnson, W. H. A. (1999). An integrative taxonomy of intellectual capital: measuring the stock and flow of intellectual capital components in the firm. *International Journal of Technology Management*, 18(5-8), 562-575.

Kweh, Q. L., Lu, W.-M., and Wang, W.-K. (2014). Dynamic efficiency: intellectual capital in the Chinese non-life insurance firms. *Journal of Knowledge Management*, 18(5), 937-951.

Leland, H. E., and Pyle, D. H. (1977). Informational asymmetries, financial structure and financial intermediation. *The Journal of Finance*, 32(2), 371-387.

Lemmon, M. L., and Lins, K. V. (2003). Ownership Structure, Corporate Governance and Firm Value: Evidence from the East Asian Financial Crisis. *The Journal of Finance*, 58(4), 1445-1468.

Lev, B. (2001). *Intangibles: Management, Measurement, and Reporting*. Washington D.C.: Brookings Institution Press.

Lev, B. (2004). Sharpening the intangibles edge. *Harvard Business Review*, 82(6), 109-116.

Lev, B. (2005). *Intangible Assets: Concepts and Measurements*. New York: Elsevier Inc.

Lev, B., and Radhakrishnan, S. (2003). The measurement of firm-specific organization capital. Paper presented at the NBER Working Paper, No. 9581. http://www.nber.org/papers/w9581

Lev, B., and Sougiannis, T. (1996). The capitalization, amortization, and value-relevance of R&D. *Journal of Accounting and Economics*, 21, 107-138.

Lev, B., and Zambon, S. (2003). Intangibles and intellectual capital: an introduction to a special issue. *European Accounting Review*, 12(4), 597-603.

Liu, Q., and Wong, K. P. (2011). Intellectual Capital and Financing Decisions: Evidence from the US Patent Data. *Management Science*, 57(10), 1861-1878.

Maditinos, D., Chatzoudes, D., Tsairidis, C., and Theriou, G. (2011). The impact of intellectual capital on firms' market value and financial performance. *Journal of Intellectual Capital*, 12(1), 132-151.

Marr, B. (2007). What is intellectual capital? In L. A. Jaia (Ed.), *Strategies for Information Technology and Intellectual Capital: Challenges and Opportunities*. Hershey, PA: IGI Global.

Marr, B., and Chatzkel, J. (2004). Intellectual capital at the crossroads: managing, measuring, and reporting of IC. *Journal of Intellectual Capital*, 5(2), 224-229.

Mason, S. P., and Merton, R. C. (1985). *The role of contingent claims analysis in corporate finance*. IL: Irwin, Homewood.

Miller, D., and Le Breton-Miller, I. (2006). Family governance and firm performance: agency, stewardship, and capabilities. *Family Business Review*, 19(1), 73-87.

Molodchik, M. A., Shakina, E. A., and Barajas, A. (2014). Metrics for the elements of intellectual capital in an economy driven by knowledge. *Journal of Intellectual Capital*, 15(2), 206-226.

Moncada-Paternò-Castello, P. (2016). EU corporate R&D intensity gap: What has changed over the last decade? JRC Working Papers on Corporate R&D and Innovation No. 05/2016, JRC102148, Growth and Innovation Directorate, Joint Research Centre –European Commission. Seville (Spain), July 2016.

Mondal, A., and Ghosh, S. K. (2012). Intellectual capital and financial performance of Indian banks. *Journal of Intellectual Capital*, 13(4), 515-530.

Morariu, C. M. (2014). Intellectual capital performance in the case of Romanian public companies. *Journal of Intellectual Capital*, 15(3), 392-410.

Morris, C. (2015). An industry analysis of the power of human capital for corporate performance: evidence from South Africa. *South African Journal of Economic and Management Sciences*, 18(4), 486-499.

Muniandy, B., and Hillier, J. (2015). Board independence, investment opportunity set and performance of South African firms. Pacific-Basin Finance Journal, 35, 108-124.

Myers, S. (1977). Determinants of corporate borrowing. *Journal of Financial Economics*, 5, 147-175.

Myers, S. (1984). The Capital Structure Puzzle. *The Journal of Finance*, 39(3), 575-592.

Myers, S., and Majluf, N. (1984). Corporate Financing and Investment Decisions when Firms Have Information That Investors Do Not Have. *Journal of Financial Economics*, 13, 187-221.

Nahapiet, J., and Ghoshal, S. (1998). Social Capital, Intellectual Capital, and the Organizational Advantage. *Academy of Management Review*, 23, 242-266.

Nimtrakoon, S. (2015). The relationship between intellectual capital, firms' market value and financial performance Empirical evidence from the ASEAN. *Journal of Intellectual Capital*, 16(3), 587-618.

OECD. (2013). Supporting Investment in Knowledge Capital, Growth and Innovation.

Ordoñez de Pablos, P. (2005). Intellectual capital reports in India: Lessons from a case study. *Journal of Intellectual Capital*, 6(1), 141-149.

Ortega-Arguiles, M., Potters, L., and Vivarelli, M. (2009). R&D and Productivity: Testing Sectoral Peculiarities Using Micro. Luxembourg: Office.

Phusavat, K., Comepa, N., Sitko-Lutek, A., and Ooi, K. B. (2011). Interrelationships between intellectual capital and performance: empirical examination. *Industrial Management & Data Systems*, 111(6), 810-829.

Prahalad, C. K., and Hamel, G. (1990). The core competence of the corporation. *Harvard Business Review*, 68, 79-91.

Prendergast, C. (2002). The tenous trade-off between risk and incentives. *Journal of Political Economy*, 110(5), 1071-1102.

Pulic, A. (1998). *Measuring the Performance of intellectual potential in Knowledge Economy*. Paper presented at the paper presented at the 2nd McMaster World Congress on Measuring and Managing Intellectual Capital, 21-23 January 1998, Hamilton, Ontario.

Pulic, A. (2000). VAIC (TM) - an accounting tool for IC management. *International Journal of Technology Management*, 20(5-8), 702-714.

Pulic, A. (2004). Intellectual capital – does it create or destroy value? *Measuring Business Excellence, 8*(1), 62-68.

Rahman, S. (2012). The role of intellectual capital in determining differences between stock market and financial performance. *International Research Journal of Finance and Economics*, 89, 46-77.

Riahi-Belkaoui, A. (2003). Intellectual capital and firm performance of US multinational firms: a study of the resource-based and stakeholder views. *Journal of Intellectual Capital*, 4(2), 215-226.

Roodman, D. M. (2006). How to do Xtabond2: An Introduction to Difference and System GMM in Stata. Paper presented at the Center for Global Development, Working Paper 103.

Roodman, D. M. (2009). A note on the theme of too many instruments. *Oxford Bulletin of Economics and Statistics*, 71(1), 135-158.

Schiuma, G., and Lerro, A. (2008). Intellectual capital and company's performance improvement. *Measuring Business Excellence*, 12(2), 3-9.

Serenko, A., and Bontis, N. (2004). Meta review of knowledge management and intellectual capital literature: citation impact and research productivity rankings. *Knowledge and Process Management*, 11(3), 185-198.

Serrasqueiro, Z., Nunes, P. M., and Sequeira, S. T. N. (2007). Firms' growth opportunities and profitability: a nonlinear relationship. *Applied Financial Economics Letters*, 3(6), 373-379.

Seyoum, B. (2004). The role of factor conditions in high-technology exports: An empirical examination. *The Journal of High Technology Management Research*, 15(1), 145-162.

Shleifer, A., and Vishny, R. V. (1997). A survey of corporate governance. *The Journal of Finance*, 52, 737-783.

Ståhle, P., Ståhle, S., and Aho, S. (2011). Value added intellectual coefficient (VAIC): a critical analysis. Journal of Intellectual Capital, 12(4), 531-551.

Stewart, T. A. (1997). *Intellectual capital: the new wealth of organizations*. New York, N.Y.: Doubleday & Co.

Sudarsanam, S., Sorwar, G., and Marr, B. (2006). Real options and the impact of intellectual capital on corporate value. *Journal of Intellectual Capital*, 7(3), 291-308.

Sveiby, K. E. (1997). *The New Organizational Wealth: Managing and Measuring Knowledge-Based Assets*. New York: Berrett-Koehler.

Sydler, R., Haefliger, S., and Pruksa, R. (2014). Measuring intellectual capital with financial figures: Can we predict firm profitability? *European Management Journal*, 32(2), 244-259.

Tan, H. P., Plowman, D., and Hancock, P. (2007). Intellectual capital and financial returns of companies. *Journal of Intellectual Capital*, 8(1), 76-95.

Ting, I. W. K., and Lean, H. H. (2009). Intellectual capital performance of financial institutions in Malaysia. *Journal of Intellectual Capital*, 10(4), 588-599.

Tseng, K.-A., Lan, Y.-W., Lu, H.-C., and Chen, P.-Y. (2013). Mediation of strategy on intellectual capital and performance. *Management Decision*, 51(7), 1488-1509.

ul Rehman, W., Ilyas, M., and ur Rehman, H. (2011). Intellectual capital performance and its impact on financial returns of companies: An empirical study from insurance sector of Pakistan. *African Journal of Business Management*, 5(20), 8041-8049.

Veugelers, R., Cincera, M., Frietsch, R., Rammer, C., Schubert, T., Pelle, A., Renda, A., Montalvo, C., and Leijten, J. (2015). The Impact of Horizon 2020 on Innovation in Europe. *Intereconomics*, 50(1), 4-30.

Wang, Z., Wang, N., and Liang, H. (2014). Knowledge sharing, intellectual capital and firm performance. *Management Decision*, 52(2), 230-258.

Westhead, P., and Howorth, C. (2006). Ownership and management issues associated with family performance and company objectives. *Family Business Review*, 19(4), 301-316.

Windmeijer, F. (2005). A finite sample correction for the variance of linear efficient two-step GMM estimators. *Journal of Econometrics*, 126, 25–51.

Wooldridge, J. M. (2007). *Econometric analysis of cross section and panel data*. Cambridge: The MIT Press.

Youndt, M. A., Subramaniam, M., and Snell, S. A. (2004). Intellectual capital profiles: an examination of investments and returns. *Journal of Management Studies*, 41(2), 335-361.

Yu, H.-C., Wang, W.-Y., and Chang, C. (2015). The stock market valuation of intellectual capital in the IT industry. *Review of Quantitative Finance and Accounting*, 45(2), 279-304.

Zéghal, D., and Maaloul, A. (2010). Analysing value added as an indicator of intellectual capital and its consequences on company performance. *Journal of Intellectual Capital*, 11(1), 39-60.

CHAPTER 7

Intellectual Capital and High-tech Firms' Financing Choices in the European Context: A Panel Data Analysis

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Abstract

Purpose - The aim of the current study is to analyse the impact of intellectual capital (IC) on firms' financing choices. **Design/methodology/approach -** This study uses a sample of high-tech listed firms across 14 Western European countries for the period between 2004 and 2015. The data set was gathered from the DATASTREAM database by Thomson Reuters. The data set has an unbalanced panel structure, where the number of years' firms presented in the research sample varies between 3 and 12. The estimation method used is the GMM system (1998) estimator, a dynamic panel estimator. **Findings -** Results suggest that IC investments in high-tech firms have a negative impact on debt, but a positive effect on internal finance and equity issues. High-tech firms seem to rely on equity issues to finance their activities once internal finance is exhausted, avoiding debt to finance innovative projects. High-tech firms face considerable transactions costs, given the moderated adjustment of the long-term debt ratio towards the target ratio. Low ownership concentration brings a higher diversification of financing sources. The financial crisis had a negative effect on internal finance and a positive effect on long-term debt for high-tech firms. **Originality/value -** To the authors' knowledge, this is the first study exploring the impact of IC on high-tech firms 'financing choices, which here refer to internal finance, short and long-term debt, equity issues as financing options. Findings also contribute to the literature by analysing the impact of ownership concentration on high-tech firms' financing decisions.

Keywords

Dynamic panel data; Financing choices; High-Tech firms; Intellectual capital.

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1. Introduction

In a knowledge-based economy, intellectual capital (IC) is considered an important resource for firms' value creation, growth and innovative capacity (Chen, Cheng, and Hwang, 2005; Lev, 2004; Lev and Sougiannis, 1996). Recognition of the positive impact of IC on firms' financial performance and market value (Bontis, 1998; Denicolai, Ramusino, and Sotti, 2015; Nimtrakoon, 2015; Tseng, Lan, Lu, and Chen, 2013; ul Rehman, Ilyas, and ur Rehman, 2011), leads to the assumption that IC positively influences firms' cash flow dynamics. The innovation environment in the European Union remains weak (Cincera, Ravet, and Veugelers, 2015). The recent financial crisis accentuated the scarcity of financial resources as well as the difficulty of access to external finance, specifically to fund investments in intangible assets such as IC (Cincera *et al.*, 2015; Hall, Moncada-Paternò-Castello, Montresor, and Vezzani, 2016). Without physical or financial form, IC investments, often referred to as intangible assets, seek future benefits (Lev, 2004) and strongly contribute to value creation through employees' knowledge, organizational processes, innovation and relationships (Serenko and Bontis, 2004; Wang, Wang, and Liang, 2014; Youndt, Subramaniam, and Snell, 2004).

Highly innovative firms may face problems in financing their projects due to the risk associated with their activities that are based on a high level of intangible assets lacking collateral value (Brown, Fazzari, and Petersen, 2009; Hall and Lerner, 2010). Aboody and Lev (2000) suggest that information asymmetry between firms' insiders and outsiders is more pronounced in firms with high IC investments. The specificity of IC investments may create adverse selection, moral hazard and opportunistic behavior by managers (Aboody and Lev, 2000; Brown *et al.*, 2009; Holland, 2006). The influence of IC on firms' financing choices can be modelled by the limited benefit period and non-negotiability of intangible assets (Lev, 2005), which may lead to higher agency costs and a lower liquidation value due to the inherent liquidity risk. These problems may impact on the financing policy of intangible-intensive firms. Despite the risk associated with intangible assets, this type of asset provides high rewards, i.e., "in a sense, intangibles are high-risk/high-reward assets" (Lev, 2005).

In the real world, due to the imperfections of financial markets, decisions on how to finance projects become extremely important as they impact on firms' market value (Almeida, Campello, and Weisbach, 2011; Fazzari, Hubbard, and Petersen, 1988; Myers, 1977).

The opacity of this type of asset to outsiders leads to information asymmetry, which is pointed out as one of the reasons why firms tend to rely on internal funds to finance innovative projects (Carpenter and Petersen, 2002; Hall and Lerner, 2010; Magri, 2014). High-tech firms are affected by this type of capital market imperfections, given that the asymmetry information and the specificity of their assets prevent to obtain credit in favourable conditions (Carpenter and Petersen, 2002). According to Myers (1984) and Myers and Majluf (1984), the problems of asymmetric information are greater for firms with high levels of intangible assets due to their

specificity and this also increases the costs of issuing debt and equity. Furthermore, in accordance with those authors, after exhausting internal finance, firms tend to use external debt and, only as a last option they issue equity. However, Gatchev, Spindt, and Tarhan (2009) and Hogan and Hutson (2005) found that high-tech firms, undertaking intangible projects, prefer to rely more on external equity than on debt. These findings reverse the Pecking Order Theory (POT, hereafter). The balance of agency costs and information may lead to a combination of equity and debt (Boot and Thakor, 1993).

In the literature, IC investments of high-tech firms have received little attention. The current study aims to analyse the impact of IC on high-tech firms' financing choices. Taking into consideration the impact of IC on firms' financial performance and market value, and on the other hand firms' difficulties in funding this kind of investment, this paper provides innovative research by testing the effect of IC on high-tech firms' financing choices. Therefore, we use a sample of non-financial listed firms across 14 Western European countries for the period between 2004 and 2015. We consider as financing choices internal finance, short-term debt, long-term debt and equity issues. Following Moncada-Paternò-Castello (2016), who followed the European Commission (2006-2014) and OECD (1997) approach, we consider a sample of high-tech firms, in an attempt to capture how IC influences financing choices in this type of firms. In order to reach our main objective, we resort to the GMM system (1998) estimator to analyse dynamic panel data.

Results suggest that IC investments in high-tech firms have a negative impact on debt, but a positive effect on internal finance and equity issues. Our findings provide empirical evidence that internal finance negatively impacts on the use of debt and equity issues. Therefore, in the presence of internal finance, firms may tend not to rely on debt or on issuing equity. However, the results suggest that high-tech firms tend to avoid resorting to debt, but they prefer to rely on equity issues to fund their activities once internal finance is exhausted. These results suggest a modified version of POT. Also, findings suggest that in high-tech firms, a low ownership concentration seems to incentivize managers to diversify the financing sources, which may allow managing more efficiently the financial resources matching with the needs for funding investments, namely the IC investments. Concerning the impact of the financial crisis of 2008-2009 on firms' financing choices, the results show a negative effect on the use of internal finance to fund firms 'activities. Moreover, the findings indicate that the financial crisis period had a positive effect on firms' choice of external debt, specifically long-term debt.

Our study makes several contributions to the literature. To our knowledge, this is the first study exploring the impact of IC on high-tech firms' financing choices. In order to get a wide perspective of firms' financing choices, we use internal finance, short and long-term debt, equity issues as financing options. Our findings also contribute to the literature by analysing the impact of ownership concentration on those decisions. We apply panel data analysis resorting to econometric models, specifically the GMM system (1998) estimator.

The current paper is structured as follows. In Section 2, we present the theoretical framework and hypothesis formulation; Section 3 presents the methodology; in Section 4, we present the results; the results are discussed in Section 5; and finally, we conclude in Section 6.

2. Intellectual Capital and High-techs Firms' Financing Choices

Until now, there is no universal definition of IC. IC is an interdisciplinary and multidisciplinary concept (Bontis, 1999; Marr and Chatzkel, 2004) and, consequently, it is difficult to find one generally accepted definition (Choong, 2008; Scafarto, Ricci, and Scafarto, 2016). Some authors define IC as the gap between firm's book value and market value (e.g., Edvinsson and Malone, 1997, p. 367; Ordoñez de Pablos, 2005, p. 142). Stewart (1997, p. 11) defines IC as "intellectual material – knowledge, information, intellectual property, experience – that can be used to create wealth. It is a collective brainpower". According to Lev (2001, p. 5), IC can be defined as an "intangible asset is a claim to future benefit that does not have a physical or financial (a stock or a bond) embodiment".

In this study, we consider IC as the knowledge-based activities and processes that contribute to firms' innovation, value creation, competitive advantages and future benefits by adding value for firms' stakeholders.

IC can be decomposed into three components which are widely accepted among researchers (Edvinsson and Malone, 1997; Sveiby, 1997; Sydler, Haefliger, and Pruksa, 2014), i.e., human capital (HC), structural (or organizational) capital (SC), and relational (or customer) capital (RC) (Bontis, Janosevic, and Dzenopoljac, 2015; Nimtrakoon, 2015; ul Rehman *et al.*, 2011; Wang *et al.*, 2014). Therefore, IC comprises employees' knowledge, organizational processes, innovation capabilities, research and development projects, brand and relationships (Johnson, 1999; Serenko and Bontis, 2004; Wang *et al.*, 2014; Youndt *et al.*, 2004).

The strong embodiment of intangibles increases the degree of sunkness of firms' investments (Lev and Zambon, 2003). This fact makes it difficult to identify and measure the value of IC (Lev, 2004; Nimtrakoon, 2015). Despite the existence of several IC valuation models (Bontis, 2001; Sveiby, 1997; Sydler et al., 2014), Pulic (1998) developed one of the most commonly used models which is the Value Added Intellectual Coefficient model (VAIC™). Despite the limitations pointed by several authors to VAIC™ model (c.f., Iazzolino and Laise, 2013; Ståhle, Ståhle, and Aho, 2011), VAIC™ has been widely accepted among researchers (Bontis et al., 2015; Nimtrakoon, 2015; Ramandeep and Narwal, 2016; C. Y. Tseng and Goo, 2005). Several advantages are pointed out regarding the adoption of VAIC™. First, VAIC™ treats human capital has the foundation stone of IC (Greco, Ferramosca, and Allegrini, 2014; Mondal and Ghosh, 2012). Second, all the values used in the computation of VAICTM derive from firms' income statements and, therefore, VAICTM uses authentic and audited information (Clarke, Seng, and

Whiting, 2011; Firer and Williams, 2003; Pulic, 1998, 2000). Thus, VAICTM is more objective, verifiable and quantitative, providing a standardized and consistent measure, which makes it more informative regarding the value creation through IC for stakeholders (Clarke et al., 2011; El-Bannany, 2015; Firer and Williams, 2003; Greco et al., 2014; Maditinos, Chatzoudes, Tsairidis, and Theriou, 2011; Mondal and Ghosh, 2012; Nimtrakoon, 2015; Pulic, 1998, 2000). Furthermore, VAIC™ is better for statistical analysis (Andriessen, 2004) and is less subjective than other models of IC measurement, allowing comparability (Firer and Williams, 2003).

The traditional financing hierarchy assumed in POT (Myers, 1984; Myers and Majluf, 1984) has influenced theoretical models on capital market imperfections. Internal finance is the cheapest finance source for funding firms' activities (Magri, 2014). Once internal finance is exhausted, firms rely on external debt and as a last option, external equity. This can be explained by the existence of asymmetric information, which may lead to adverse selection problems (Stiglitz and Weiss, 1981) and the increase the costs of issuing equity. Consequently, firms may see their equity sold for a cheap price. However, in the case of high-tech firms, several studies show a reverted POT. Several authors suggest that high-tech firms prefer to finance their innovative activities using internal funds (Carpenter and Petersen, 2002; Hall and Lerner, 2010; Magri, 2014; Myers, 1984; Myers and Majluf, 1984), and when internal finance is exhausted they prefer to rely on external equity. Use of internal finance is especially important in high-tech firms due to the fact that (1) investment in IC presents a lack of collateral (Hall and Lerner, 2010; Magri, 2014), and (2) the high risk of high-tech firms due to the uncertainty regarding their innovative activities (Amit, Glosten, and Muller, 1990; Carpenter and Petersen, 2002), which prevents them from accessing credit on favourable terms (Carpenter and Petersen, 2002; Jensen and Meckling, 1976; Magri, 2014). Moreover, the redeployability of intangible assets such as IC is low and, therefore, confers a low debt capacity (Williamson, 1988).

According to Trade-Off Theory (hereafter TOT), firms tend to adjust their current level of debt towards a target debt ratio (Fischer, Heinkel, and Zechner, 1989; Taggart, 1977) and the speed of adjustment depends on transaction costs. Considering that high-tech firms have higher transactions costs due to greater problems of asymmetric information and agency, we may argue that high-tech firms have higher adjustment costs.

Firms with high levels of IC may face higher human costs of bankruptcy due to the costs of wages and salaries for highly trained human resources, like scientists and engineers (Berk, Stanton, and Zechner, 2010; Porter and Ketels, 2003). Furthermore, future earnings will depend on the human resources applicability of their knowledge. However, potential earnings will be lost once they are dismissed or leave the firm. In addition, innovative firms face problems of asymmetric information and, therefore, after internal finance is exhausted, this type of firm may choose to finance activities by issuing equity rather than debt (Gatchev *et al.*, 2009; Hogan and Hutson, 2005; Magri, 2014). Prior empirical evidence (Hovakimian, Opler, and Titman, 2001; MacKie-Mason, 1990; Rajan and Zingales, 1995; Titman and Wessels, 1988) showed a

negative relationship between firms' intangible assets and leverage. Moreover, studies such as Gatchev *et al*. (2009), Hogan and Hutson (2005), Magri (2014), Blass and Yosha (2003) and Brown and Petersen (2009) found that high-tech firms, undertaking innovative projects, prefer to rely more on external equity than on debt. In fact, considering Carpenter and Petersen (2002), there are various reasons for high-tech firms to present lower level of indebtedness: i) the uncertainty about the return associated with high-tech investments prevents high level of debt for avoiding the negative expectations of the investors; ii) problems of adverse selection in credit markets seem to be more frequent for high-tech firms, thus the credit rationing can be a measure used the creditors instead the increasing interest rates; iii) debt also creates problems of moral hazard, i.e., the substitution of high-risk investment projects for low-risk investment projects, implying credit rationing for these firms; iv) the majority of assets in high-tech firms are intangible assets with low value as collateral. This low level of assets that may be pledged as collateral prevents the reduction of moral hazard problems in high-techs firms, and limiting these firms in obtaining debt; v) the marginal bankruptcy costs may increase quickly for higher levels of debt. This situation may occur in high-tech firms due to their activities based on intangible assets which generate valuable growth opportunities but losing value when firms face financial distress.

Taking the previous arguments referring to, on one the hand, that high-tech firms with high investments in IC may follow a modified version of POT in their financing choices and, on the other hand, that these firms seem to face accurately the consequences of capital market imperfections due to a great level of investments in intangible assets, namely IC investments, the current paper seeks to analyse the impact of IC on high-tech firms´ financing choices regarding internal finance, short-term debt, long-term debt, and equity issues.

3. Data, Variables and Method

3.1. Database

Based on 14 Western European countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Spain, Sweden and the United Kingdom (UK)) for the period between 2004 and 2015, our data set consists 821 non-financial listed high-tech firms. The data set was gathered from the DATASTREAM database by Thomson Reuters. We excluded financial firms from our sample. Therefore, our data set has an unbalanced panel structure, where the number of years of firms' presence in the research sample varies between 3 and 12.

In order to mitigate potential survivor bias by allowing the entry and exit of firms, we follow Guariglia (2008), Bond, Elston, Mairesse, and Mulkay (2003) and Cummins, Hasset, and Oliner (2006). The data was trimmed at one percent tails in order to control for the potential effects

of outliers, which may derive from particular events, such as large mergers, errors in coding or firms' extraordinary shocks (Guariglia, 2008).

3.2. Estimation Method and Variable Measurement

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, due to the dynamic character of the main research variables in study. Therefore, we will use the Generalized Method of Moments (GMM), a dynamic estimator proposed by Blundell and Bond (1998) which allows us to control the endogeneity problem and avoids significant bias in estimates (Wooldridge, 2007). The efficiency of this estimator lies in the possibility of controlling correlation errors over time and heteroscedasticity across firms. The results of the GMM system (1998) estimator can only be valid on the following conditions: (1) validity of the restrictions created by the use of instruments; and (2) there should be no second-order autocorrelation. In order to test the first condition, i.e., validity of the restrictions created by the instruments used, we use the Hansen test where the null hypothesis is validity of the restrictions created by the instruments used. For the second condition, we test for second-order autocorrelation, where the null hypothesis indicates there is no second-order autocorrelation. In the case of not rejecting the null hypothesis for the Hansen and second-order autocorrelation tests, we conclude that the GMM system (1998) estimator is valid and robust. By using a high number of instruments, the GMM system (1998) estimator leads to major improvements in efficiency compared with the first difference GMM estimator (Arellano and Bover, 1995; Blundell and Bond, 1998). Arellano and Bond (1991), Windmeijer (2005) and Roodman (2006) showed the reliability of the one-step GMM estimator, asymptotically 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 especially for the GMM system (1998) estimator (Roodman, 2009). Therefore, we used the two-step procedure with the correction proposed by Windmeijer (2005).

Our estimation models are presented as follows:

Equation (1):

$$CF_{i,t} = \propto_0 + \beta_1 CF_{i,t-1} + \beta_2 VAIC_{i,t} + \beta_3 OWNCONC_{i,t} + \beta_4 AGE_{i,t} + \beta_5 SIZE_{i,t} + \beta_6 Dcrisis_{08;09} + d_s + \eta_i + \varepsilon_{i,t}$$

Equation (2):

$$SDEBT_{i,t} = \propto_0 + \beta_1 SDEBT_{i,t-1} + \beta_2 VAIC_{i,t} + \beta_3 OWNCONC_{i,t} + \beta_4 CF_{i,t} + \beta_5 AGE_{i,t} + \beta_6 SIZE_{i,t} + \beta_7 Dcrisis_{08;09} + d_s + \eta_i + \varepsilon_{i,t}$$

Equation (3):

$$LDEBT_{i,t} = \propto_0 + \beta_1 LDEBT_{i,t-1} + \beta_2 VAIC_{i,t} + \beta_3 OWNCONC_{i,t} + \beta_4 CF_{i,t} + \beta_5 AGE_{i,t} + \beta_6 SIZE_{i,t} + \beta_7 Dcrisis_{08;09} + d_s + \eta_i + \varepsilon_{i,t}$$

Equation (4):

$$EqIssue_{i,t} = \propto_0 + \beta_1 EqIssue_{i,t-1} + \beta_2 VAIC_{i,t} + \beta_3 OWNCONC_{i,t} + \beta_4 CF_{i,t} + \beta_5 AGE_{i,t} + \beta_6 SIZE_{i,t} + \beta_7 Dcrisis_{08;09} + d_s + \eta_i + \varepsilon_{i,t}$$

Where: d_s is industry dummy variable, η_i are non-observable individual effects and $\varepsilon_{i,t}$ is the error. The dependent variables used in this study were measured as follows: $CF_{i,t}$ is cash flow in the current period, given by the ratio of income plus depreciations and amortization in the current period to total assets in the current period; $SDEBT_{i,t}$ is short-term debt in the current period, given by the ratio of short-term debt in the current period to total assets in the current period; $LDEBT_{i,t}$ is long-term debt in the current period, given by the ratio of long-term debt in the current period to total assets in the current period; $EqIssue_{i,t}$is net equity issues in the current period, given by the ratio of net equity issues in the current period to total assets in the current period.

The independent variable measures are as follows:$CF_{i,t-1}$ is cash flow in the previous period, given by the ratio of income plus depreciations and amortization in the previous period to total assets in the previous period; $SDEBT_{i,t-1}$ is short-term debt in the previous period, given by the ratio of short-term debt in the previous period to total assets in the previous period; $LDEBT_{i,t-1}$ is long-term debt in the previous period, given by the ratio of long-term debt in the previous period to total assets in the previous period; $EqIssue_{i,t-1}$ is net equity issues in the previous period, given by the ratio of net equity issues 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 the sum of HCE plus SCE plus CEE, where: HCE is human capital efficiency (HCE) = value added (VA) / human capital (HC); SCE structural capital efficiency

(SCE) = structural capital (SC) / value added (VA); and CEE is capital employed efficiency = value added (VA) / capital employed (CE). Where VA is given by sales – operational expenses except employee costs. $OWNCONC_{i,t}$ is ownership concentration, given by the variable NOSHEM (source: DATASTREAM database), which aggregates the percentage of holdings of 5% or more by employees or family members.

Finally, the measurement of control variables is as follows:$SIZE_{i,t}$ is size in the current period, given by the natural logarithm of total assets in the current period; $AGE_{i,t}$ is firm age in the current period, given by the natural logarithm of the number of years of the firm's existence in the current period; and $Dcrisis_{08;09}$ is a dummy representing the financial crisis for the years 2008 and 2009. It assumes the value of 1 if the year is 2008 or 2009, and the value of 0 for the remaining years in study.

4. Empirical Results

4.1. Descriptive Statistics and Correlation Matrix

Table 1 summarizes the descriptive statistics of dependent and independent variables.

Table 1 – Descriptive statistics

Variables	High-tech firms			
	Observations	Mean	Median	SD
$CF_{i,t}$	9158	.028	.077	.56
$SDEBT_{i,t}$	9390	.1	.044	0.7
$LDEBT_{i,t}$	9471	.13	.091	.22
$EqIssue_{i,t}$	8682	.046	0	.25
$VAIC_{i,t}$	7507	2.1	2	1.1
$AGE_{i,t}$	10221	3.2	3.1	1
$SIZE_{i,t}$	9258	12	12	2.1

From the descriptive statistics, it can be noticed that there some volatility of the research variables, given that their averages values are inferior to the respective standard deviations: cash flow, short-term debt, long-term debt, and equity issues. The high-tech firms present an average of 25 years old and an average of 163 million euros of total assets. Furthermore, the mean score of VAIC is 2.1, suggesting that high –tech firms in Western Europe created an average of 2.1 for every 1 monetary unity utilized of IC.

The correlation matrix, presented in Table 2, shows the correlation and magnitude of the variables in study.

Table 2 - Correlation matrix

Variables	$CF_{i,t}$	$CF_{i,t-1}$	$SDEBT_{i,t}$	$SDEBT_{i,t-1}$	$LDEBT_{i,t}$	$LDEBT_{i,t-1}$	$EqIssue_{i,t}$	$EqIssue_{i,t-1}$	$VAIC_{i,t}$
$CF_{i,t}$	1.0000								
$CF_{i,t-1}$	0.5092**	1.0000							
$SDEBT_{i,t}$	-0.5842**	-0.3818**	1.0000						
$SDEBT_{i,t-1}$	-0.3625**	-0.6199**	0.2343**	1.0000					
$LDEBT_{i,t}$	-0.0652**	-0.0325**	0.6024**	0.1078**	1.0000				
$LDEBT_{i,t-1}$	-0.0327**	-0.0635**	0.7062**	0.7492**	0.9182**	1.0000			
$EqIssue_{i,t}$	-0.1405**	-0.1158**	-0.0002	0.0132	-0.0018	-0.0013	1.0000		
$EqIssue_{i,t-1}$	-0.1624**	-0.1730**	0.0020	0.0016	-0.0022	-0.0022	0.2302**	1.0000	
$VAIC_{i,t}$	0.0636**	0.0830**	-0.0981**	-0.0964**	0.1002**	0.0501**	-0.0032	0.0058	1.0000

Notes: ** p<0.01, * p<0.05

There are significant correlations between most pairs of variables and cash flow. Short-term debt and long-term debt have no significant correlation with equity issues and share repurchases. Also, net equity issues present no significant correlation with firms' IC efficiency.

According to Gujarati and Porter (2010), problems of endogeneity between independent variables are relevant for correlation coefficients above 30%. We found five correlations above 30% among independent variables, which are CF from the current period with SDEBT from the current and previous periods, between CF from the previous period and SDEBT from the previous period, between SDEBT from the previous period and LDEBT from the previous period and between VAIC from the current and previous periods. Therefore, to overcome the problem of endogeneity, we applied the GMM system (1998) dynamic estimator as we can use the instrumental variables to reduce the endogeneity problem. We also found high persistence in the correlation of dependent variables, such as CF and LDEBT between the current and previous periods, due to the high correlation coefficients. This being so, we follow the suggestion of Blundell and Bond (1998) and in our study, we applied the GMM system (1998) dynamic estimator, which is more appropriate in this study than the GMM (1991) estimator.

Next, we present the GMM system (1998) results. The results of the Hansen and second-order autocorrelation tests indicate that 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 the existence of second-order autocorrelation for the estimated models. This being so, the results of the GMM system (1998) dynamic estimator are robust and can be used to support our interpretation of the empirical results.

4.2 Intellectual Capital and High-techs Firms' Financing Choices

The results of the estimated equation (1) using the GMM system (1998) dynamic estimator are presented in Table 3.

Table 3 - Estimation results – GMM system (1998)

Variables	High-tech firms			
	$CF_{i,t}$	$SDEBT_{i,t}$	$LDEBT_{i,t}$	$EqIssue_{i,t}$
$CF_{i,t-1}$	0.42721***			
	(0.10564)			
$SDEBT_{i,t-1}$		0.26008***		
		(0.02514)		
$LDEBT_{i,t-1}$			0.57890***	
			(0.01271)	
$EqIssue_{i,t-1}$				-0.06773***
				(0.02159)
$SHRep_{i,t-1}$				
$VAIC_{i,t}$	0.04402**	-0.00314*	-0.00326**	0.00963***
	(0.01950)	(0.00160)	(0.00158)	(0.00354)
$OWNCONC_{i,t}$	-0.01111***	0.00436***	-0.00810***	-0.00260**
	(0.00395)	(0.00109)	(0.00182)	(0.00114)
$CF_{i,t}$		-0.02513***	-0.08338***	-0.31245***
		(0.00866)	(0.01671)	(0.01698)
$AGE_{i,t}$	-0.04385**	0.00554**	0.03619**	-0.00020
	(0.01871)	(0.00250)	(0.01692)	(0.00187)
$SIZE_{i,t}$	0.01707*	0.00419***	-0.00369	-0.00571***
	(0.01015)	(0.00142)	(0.00375)	(0.00145)
$Dcrisis_{08;09}$	-0.01731***	0.00959***	0.01310***	-0.00766***
	(0.00408)	(0.00222)	(0.00355)	(0.00209)
Constant	0.00136	-0.04290*	0.00312	0.10944***
	(0.12638)	(0.02202)	(0.03797)	(0.02797)
Observations	5,936	2,479	2,436	2,304
Number of Firms	773	494	489	488
F (N(0,1))	18.00***	20.84***	481.91***	61.97***
Hansen	29.58	106.38*	59.06	64.82
m1 (N(0,1))	-4.806***	-2.990***	-7.332***	-1.188
m2 (N(0,1))	0.805	1.280	1.844*	0.923

Notes: 1. Standard errors in parentheses. 2. ***, ** and * are statistical significance at 1%, 5% and 10% level, respectively. 3. Industry dummy variables are included in estimations, but not shown.

The results are as follow:

- CF in the current period is positively and significantly influenced by: CF in the previous period, VAIC, and SIZE; while, OWNCONC, AGE and Dcrisis have a significant negative effect on CF in the current period.
- SDEBT in the previous period, OWNCONC, AGE, SIZE and Dcrisis have a significant positive impact on SDEBT in the current period, whereas VAIC and CF in the current period have a significant negative effect on SDEBT in the current period.
- LDEBT in the previous period, AGE and Dcrisis have a significant positive effect on LDEBT in the current period, while VAIC, OWNCONC and CF in the current period have a significant negative effect on LDEBT in the current period.

- VAIC has a significant and positive impact on EqIssue in the current period, whereas EqIssue in the previous period, OWNCONC, CF in the current period, SIZE and Dcrisis have a significant and negative effect on EqIssue in the current period.

5. Discussion of the Empirical Results

The results from estimation (Table 3) suggest that firms' IC influences financing choices in high-tech firms. VAIC has a positive impact on that cash flow and equity issues in the current period in high-tech firms. However, VAIC has a negative impact on that short-term debt and long-term debt flow in the current period in high-tech firms. These results suggest that in high-tech firms, the greater the investments in IC, firms will prefer internally generated funds and equity issues, when necessary, comparing to debt. Furthermore, the results indicate that cash flow has a negative impact on the use of debt and equity issues. These results suggest that in the presence of internal finance, firms may tend not to rely on debt or resort to issuing equity. Therefore, the results suggest that high-tech firms tend to avoid resorting to debt to finance their innovative projects. This may be due to the lack of collateral which hinders access to credit on favourable terms (Hall and Lerner, 2010; Magri, 2014), and therefore leads to increasing the cost of finance. Additionally, the results suggest that high-tech firms rely on equity issues to finance their activities, once internal finance is exhausted that are according to various studies (Gatchev *et al.*, 2009; Hogan and Hutson, 2005; Magri, 2014). These results reverse the POT traditional finance hierarchy suggested by Myers (1984) and Myers and Majluf (1984).

The results provide empirical evidence of the influence of ownership concentration on financing choices in high-tech firms. In general, the results show that ownership concentration affects high-tech firms' financing choices somewhat negatively. This suggests that low ownership concentration brings benefits to the firm, as a more dispersed ownership structure may encourage managers to act more efficiently (Burkart, Gromb, and Panunzi, 1997; Prendergast, 2002). It seems that firms with less concentrated ownership present a higher level of diversification of financing sources, thus high-tech firms search for alternative financing sources to fund their activities and investments, namely those on IC.

Concerning the impact of the 2008-2009 financial crisis on firms' financial choices, the results show a negative effect on the use of internal finance to fund activities. This may be a consequence of the 2008-2009 financial crisis may have adversely affected the firm´s capacity to generate positive cash flows, making firms more dependent on external financing sources. In fact, the findings indicate that the financial crisis period had a positive effect on firms' choice regarding external debt, specifically long-term debt. Therefore, in the period of global financial crisis, high-tech firms became more dependent on long-term debt.

High-tech firms seem to adjust faster the short-term debt ratio (speed of adjustment is about 74 per cent) towards the target short-term debt ratio in comparison to the adjustment of the long-term ratio (speed of adjustment is about 42 per cent) towards the target long-term debt ratio. Therefore, high-tech firms seem to face high transactions costs that negatively affect the adjustment of the current long-term debt ratio towards the target ratio. It is worth to enhance this result, given that, besides the high-tech firms in the analysis are quoted firms, it seems that they do not perform capital market transactions in order to adjust faster towards the long-term target debt ratio. The results show that the speed of short-term debt adjustment is higher than the speed of the long-term debt towards the respective target debt ratios. Therefore, high-tech firms seem to face higher adjustment costs related to capital market transactions that involve long-term debt. These high adjustment costs associated with long-term debt may be a consequence of the problems of asymmetric information, the uncertainty of investments as well as low level of tangible assets to be pledged as collateral, contributing to unfavourable credit terms and decelerating the adjustment towards target ratio.

6. Conclusion

Based on a sample of non-financial listed firms in 14 European countries, we analyse a sample of high-tech firms for the period between 2004 and 2015. Resorting to the GMM system (1998) estimator, we analysed a dynamic panel data set.

Results suggest that high-tech firms' IC investments have a negative impact on debt, but a positive effect on internal finance and equity issues. Additionally, our findings provide empirical evidence that cash flow has a negative impact on the use of external debt and equity issues. Therefore, in the presence of internal finance firms may tend not to rely on external debt or on issuing equity. Also, the results obtained suggest that high-tech firms tend to avoid resorting to external debt to finance their innovative projects. They also suggest that high-tech firms rely on equity issues to finance their activities, once internal finance is exhausted. These results suggest a modified version of pecking order theory. Probably, the problems of asymmetric information and agency impose unfavourable credit terms to high-tech firms in obtaining debt. Therefore, when internal finance is exhausted, these firms choose equity issue for funding their activities. The results suggest that in high-tech firms, low ownership concentration brings benefits as a more dispersed ownership structure is associated with a greater diversification of financing sources, which contribute for matching the financial resources with the investment opportunities, namely IC investments.

Concerning the impact of the 2008-2009 financial crisis on firms' financing choices, the results show a negative effect on using internal finance to fund activities. Moreover, the findings indicate that the financial crisis period had a positive effect on high-tech firms' choice regarding external debt, specifically long-term debt. Finally, high-tech firms face costs of

adjustment, since these firms present a moderated speed of long-term debt adjustment towards target ratio. This suggests the high adjustments costs faced by high-tech firms associated with the transactions in the capital market. On one hand, high-tech firms to face difficulties in obtaining debt and, on the other hand, these firms probably face relatively high transactions costs associated with equity issues, which explains the moderated adjustment towards target debt ratios. These results are interesting, since, besides the high-tech firms are listed on the stock market and having alternative financing sources and probably facing less accurately the effects of capital market imperfections, they face relevant costs of adjustment of long term debt ratio towards the target ratio.

The current study presents several contributions. To our knowledge, this is the first study exploring the impact of IC on quoted high-tech firms financing choices. In order to have a wide perspective of firms' financing choices, we consider internal finance, short and long-term debt, and equity issues as high-tech firms´ financing options. Our findings also contribute to the literature by analysing the impact of ownership concentration on high-tech firms' financing choices. We applied to panel data analysis resorting to econometric models, specifically the GMM system (1998) estimator. Our results suggest the importance of IC for high-tech firms' financing choices: the preference is for internal finance, which insufficiency implies to issue equity. Additionally, the results of the current study suggest that high-tech face high costs of adjustment given that they adjust moderately towards the target debt ratio.

Considering that IC investment in employees' knowledge impacts on innovative capacity and processes and products development, we suggest managers pay more attention to the contribution of IC for high-tech firms to increase the financial resources generated internally to the firm. For policy-makers, we suggest the need to develop programmes to promote firms' investment in IC since projects requiring strong investment in intangibles may suffer through lack of access to credit on favourable terms.

The current study has the following limitations. Countries' characteristics, such as legal aspects or accounting practices, may influence the results. For future research, we suggest testing the impact of IC on financing choices by comparing results among different European countries. Also, in future research, we suggest including in the analysis corporate governance variables and different measures of IC for results comparison purpose.

References

Aboody, D., and Lev, B. (2000). Information asymmetry, R&D and insider gains. The Journal of Finance, 55(6), 2747-2766.

Almeida, H., Campello, M., and Weisbach, M. S. (2011). Corporate financial and investment policies when future financing is not frictionless. Journal of Corporate Finance, 17(3), 675-693.

Amit, R., Glosten, L., and Muller, E. (1990). Entrepreneurial Ability, Venture Investments, and Risk Sharing. Management Science, 36(10), 1233-1246.

Andriessen, D. (2004). Making sense of Intellectual capital: Designing a Method for the Valuation of Intangibles. Boston: Butterworth-Heinemann.

Arellano, M., and Bond, S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and Application to Employment Equations. Review of Economic Studies, 58(2), 277-297.

Arellano, M., and Bover, O. (1995). Another Look at the Instrumental Variable Estimation of Error-Components Models. Journal of Econometrics, 68, 29-52.

Berk, J. B., Stanton, R., and Zechner, J. (2010). Human Capital, Bankruptcy and Capital Structure. The Journal of Finance, 65(3), 891-926.

Blass, A. A., and Yosha, O. (2003). Financing R&D in Mature Companies: An Empirical Analysis. Economics of Innovation and New Technology, 12(5), 425–447.

Blundell, R., and Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. Journal of Econometrics, 87(1), 115-143.

Bond, S., Elston, J., Mairesse, J., and Mulkay, B. (2003). Financial factors and investment in Belgium, France, Germany, and the United Kingdom: A comparison using company panel data. Review of Economics and Statistics, 85, 153-165.

Bontis, N. (1998). Intellectual capital: an exploratory study that develops measures and models. Management Decision, 36(2), 63-76.

Bontis, N. (1999). Managing organizational knowledge by diagnosing intellectual capital: Framing and advancing the state of the field. International Journal of Technology Management, 18(5-8), 433–462.

Bontis, N. (2001). Assessing knowledge assets: a review of the models used to measure intellectual capital. International Journal of Management Reviews, 3(1), 41-60.

Bontis, N., Janosevic, S., and Dzenopoljac, V. (2015). Intellectual capital in Serbia's hotel industry. International Journal of Contemporary Hospitality Management, 27(6), 1365-1384.

Boot, A. W. A., and Thakor, A. V. (1993). Security design. The Journal of Finance, 48, 1349–1378.

Brown, J. R., Fazzari, S. M., and Petersen, B. C. (2009). Financing Innovation and Growth: Cash Flow, External Equity, and the 1990s R&D Boom. The Journal of Finance, 64(1), 151-185.

Brown, J. R., and Petersen, B. C. (2009). Why has the Investment-Cash Flow Sensitivity Declined so

Sharply? Rising R&D and Equity Market Developments. Journal of Banking and Finance, 33, 971–984.

Burkart, M., Gromb, D., and Panunzi, F. (1997). Large shareholders monitoring, and the value of the firm. Quarterly Journal of Economics, 112, 693-728.

Carpenter, R. E., and Petersen, B. C. (2002). Capital Market Imperfections, High-Tech Investment, and New Equity Financing. The Economic Journal, 112(477), 54-72.

Chen, M., Cheng, S., and Hwang, Y. (2005). An empirical investigation of the relationship between intellectual capital and firms' market value and financial performance. Journal of Intellectual Capital, 6(2), 159-176.

Choong, K. K. (2008). Intellectual capital: definitions, categorization and reporting models. Journal of Intellectual Capital, 9(4), 609-638.

Cincera, M., Ravet, J., and Veugelers, R. (2015). The sensitivity of R&D investments to cash flows: comparing young and old EU and US leading innovators. Economics of Innovation and New Technology, 25(3), 1-17.

Clarke, M., Seng, D., and Whiting, R. H. (2011). Intellectual capital and firm performance in Australia. Journal of Intellectual Capital, 12(4), 505-530.

Cummins, J., Hasset, K., and Oliner, S. (2006). Investment behavior, observable expectations, and internal funds. American Economic Review, 96, 796-810.

Denicolai, S., Ramusino, E. C., and Sotti, F. (2015). The impact of intangibles on firm growth. Technology Analysis & Strategic Management, 27(2), 219-236.

Edvinsson, L., and Malone, M. (1997). Intellectual Capital: Realizing Your Company's True Value by Finding its Hidden Roots. New York, NY: Harper Collins.

El-Bannany, M. (2015). Explanatory study about the intellectual capital performance of banks in Egypt. International Journal of Learning and Intellectual Capital, 12(3), 270-286.

European Commission. (2006-2014). The EU Industrial R&D Investment Scoreboard. Joint Research Centre, Institute for Prospective Technological Studies and Directorate General Research, Scientific and Technical Research series. Seville (Spain).

Fazzari, S. M., Hubbard, R. G., and Petersen, B. C. (1988). Financing Constraints and Corporate Investment. Brookings Papers on Economic Activity, 1, 141-195.

Firer, S., and Williams, M. (2003). Intellectual capital and traditional measures of corporate performance. Journal of Intellectual Capital, 4(3), 348-360.

Fischer, E. O., Heinkel, R., and Zechner, J. (1989). Dynamic capital structure choice: Theory and tests. The Journal of Finance, 44, 19-40.

Gatchev, V. A., Spindt, P. A., and Tarhan, V. (2009). How do firms finance their investments? The relative importance of equity issuance and debt contracting costs. Journal of Corporate Finance, 15(2), 179-195.

Greco, G., Ferramosca, S., and Allegrini, M. (2014). Exploring intellectual capital in family firms. An empirical investigation. International Journal of Learning and Intellectual Capital, 11(2), 91-106.

Guariglia, A. (2008). Internal financial constraints, external financial constraints, and investment choice: Evidence from a panel of UK firms. Journal of Banking & Finance, 32(9), 1795-1809.

Gujarati, D., and Porter, D. (Eds.). (2010). Essentials of Econometrics (4th ed ed.). New York: McGraw – Hill International.

Hall, B. H., and Lerner, J. (2010). The Financing of R&D and Innovation. In B. H. Hall and N. Rosenberg (Eds.), Handbook of the Economics of Innovation. North Holland: Elsevier.

Hall, B. H., Moncada-Paternò-Castello, P., Montresor, S., and Vezzani, A. (2016). Financing constraints, R&D investments and innovative performances: new empirical evidence at the firm level for Europe. Economics of Innovation and New Technology, 25(3), 183-196.

Hogan, T., and Hutson, E. (2005). Information Asymmetry and Capital Structure in SMEs: New Technology-Based Firms in the Irish Software Sector. Journal of Global Finance, 15(3), 369–387.

Holland, J. (2006). Fund management, intellectual capital, intangibles and private disclosure. Managerial Finance, 32(4), 281.

Hovakimian, A., Opler, T., and Titman, S. (2001). The Debt-Equity Choice. The Journal of Financial and Quantitative Analysis, 36(1), 1-24.

Iazzolino, G., and Laise, D. (2013). Value added intellectual coefficient (VAIC): A methodological and critical review. Journal of Intellectual Capital, 14(4), 547-563.

Jensen, M., and Meckling, W. (1976). Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. Journal of Financial Economics, 3(4), 305-360.

Johnson, W. H. A. (1999). An integrative taxonomy of intellectual capital: measuring the stock and flow of intellectual capital components in the firm. International Journal of Technology Management, 18(5-8), 562-575.

Lev, B. (2001). Intangibles: Management, Measurement, and Reporting. Washington D.C.: Brookings Institution Press.

Lev, B. (2004). Sharpening the intangibles edge. Harvard Business Review, 82(6), 109-116.

Lev, B. (2005). Intangible Assets: Concepts and Measurements: Elsevier Inc.

Lev, B., and Sougiannis, T. (1996). The capitalization, amortization, and value-relevance of R&D. Journal of Accounting and Economics, 21(1), 107-138.

Lev, B., and Zambon, S. (2003). Intangibles and intellectual capital: an introduction to a special issue. European Accounting Review, 12(4), 597-603.

MacKie-Mason, J. K. (1990). Do Taxes Affect Corporate Financing Decisions? The Journal of Finance, 45(5), 1471-1493.

Maditinos, D., Chatzoudes, D., Tsairidis, C., and Theriou, G. (2011). The impact of intellectual capital on firms' market value and financial performance. Journal of Intellectual Capital, 12(1), 132-151.

Magri, S. (2014). Does issuing equity help R&D activity? Evidence from unlisted Italian high-tech manufacturing firms. Economics of Innovation and New Technology, 23(8), 825-854.

Marr, B., and Chatzkel, J. (2004). Intellectual capital at the crossroads: managing, measuring, and reporting of IC. Journal of Intellectual Capital, 5(2), 224-229.

Moncada-Paternò-Castello, P. (2016). EU corporate R&D intensity gap: What has changed over the last decade? Seville (Spain): JRC Working Papers on Corporate R&D and Innovation No. 05/2016, JRC102148, Growth and Innovation Directorate, Joint Research Centre – European Commission.

Mondal, A., and Ghosh, S. K. (2012). Intellectual capital and financial performance of Indian banks. Journal of Intellectual Capital, 13(4), 515-530.

Myers, S. (1977). Determinants of Corporate Borrowing. Journal of Financial Economics, 5, 147-175.

Myers, S. (1984). The Capital Structure Puzzle. The Journal of Finance, 39(3), 575-592.

Myers, S., and Majluf, N. (1984). Corporate Financing and Investment Decisions when Firms Have Information That Investors Do Not Have. Journal of Financial Economics, 13(2), 187-221.

Nimtrakoon, S. (2015). The relationship between intellectual capital, firms' market value and financial performance Empirical evidence from the ASEAN. Journal of Intellectual Capital, 16(3), 587-618.

OECD. (1997). Revision of the High-Technology Sector and Product Classification, by Hatzichronoglou, T. OECD Science, Technology and Industry Working Papers, 1997/2, OECD Publishing, Paris (France).

Ordoñez de Pablos, P. (2005). Intellectual capital reports in India: Lessons from a case study. Journal of Intellectual Capital, 6(1), 141-149.

Porter, M. E., and Ketels, C. H. M. (2003). UK Competitiveness: Moving to the Next Stage. DTI Economics Paper, May.

Prendergast, C. (2002). The tenous trade-off between risk and incentives. Journal of Political Economy, 110(5), 1071-1102.

Pulic, A. (1998). Measuring the Performance of intellectual potential in Knowledge Economy. Paper presented at the paper presented at the 2nd McMaster World Congress on Measuring and Managing Intellectual Capital, 21-23 January 1998, Hamilton, Ontario.

Pulic, A. (2000). VAIC (TM) - an accounting tool for IC management. International Journal of Technology Management, 20(5-8), 702-714.

Rajan, R. G., and Zingales, L. (1995). What Do We Know about Capital Structure? Some Evidence from International Data. The Journal of Finance, 50(5), 1421-1460.

Ramandeep, and Narwal, K. P. (2016). Investigating the impact of intellectual capital on financial performance in indian manufacturing sector. Jims8m-the Journal of Indian Management & Strategy, 21(4), 28-32.

Roodman, D. M. (2006). How to do Xtabond2: An Introduction to Difference and System GMM in Stata. Paper presented at the Center for Global Development, Working Paper 103.

Roodman, D. M. (2009). A note on the theme of too many instruments. Oxford Bulletin of Economics and Statistics, 71(1), 135-158.

Scafarto, V., Ricci, F., and Scafarto, F. (2016). Intellectual capital and firm performance in the global agribusiness industry The moderating role of human capital. Journal of Intellectual Capital, 17(3), 530-552.

Serenko, A., and Bontis, N. (2004). Meta-review of knowledge management and intellectual capital literature: citation impact and research productivity rankings. Knowledge and Process Management, 11(3), 185-198.

Ståhle, P., Ståhle, S., and Aho, S. (2011). Value added intellectual coefficient (VAIC): a critical analysis. Journal of Intellectual Capital, 12(4), 531-551.

Stewart, T. A. (1997). Intellectual capital: the new wealth of organizations. New York, N.Y.: Doubleday & Co.

Stiglitz, J. E., and Weiss, A. (1981). Credit Rationing in Markets with Imperfect Information. American Economic Review, 71(3), 393–409.

Sveiby, K. E. (1997). The New Organizational Wealth: Managing and Measuring Knowledge-Based Assets. New York: Berrett-Koehler.

Sydler, R., Haefliger, S., and Pruksa, R. (2014). Measuring intellectual capital with financial figures: Can we predict firm profitability? European Management Journal, 32(2), 244-259.

Taggart, R. (1977). A Model of Corporate Financing Decisions. The Journal of Finance, 32(5), 1467-1484.

Titman, S., and Wessels, R. (1988). The determinants of capital structure choice. Journal of Finance, 43(1), 1-19.

Tseng, C. Y., and Goo, Y. J. J. (2005). Intellectual capital and corporate value in an emerging economy: empirical study of Taiwanese manufacturers. R & D Management, 35(2), 187-201.

Tseng, K.-A., Lan, Y.-W., Lu, H.-C., and Chen, P.-Y. (2013). Mediation of strategy on intellectual capital and performance. Management Decision, 51(7), 1488-1509.

ul Rehman, W., Ilyas, M., and ur Rehman, H. (2011). Intellectual capital performance and its impact on financial returns of companies: An empirical study from insurance sector of Pakistan. African Journal of Business Management, 5(20), 8041-8049.

Wang, Z., Wang, N., and Liang, H. (2014). Knowledge sharing, intellectual capital and firm performance. Management Decision, 52(2), 230-258.

Williamson, O. E. (1988). Corporate finance and corporate governance. The Journal of Finance, 43(3), 567–592.

Windmeijer, F. (2005). A finite sample correction for the variance of linear efficient two-step GMM estimators. Journal of Econometrics, 126(1), 25–51.

Wooldridge, J. M. (2007). Econometric analysis of cross section and panel data. Cambridge: The MIT Press.

Youndt, M. A., Subramaniam, M., and Snell, S. A. (2004). Intellectual capital profiles: an examination of investments and returns. *Journal of Management Studies, 41*(2), 335-361.

CHAPTER 8

Intellectual Capital and Firms' Financing Decisions in the European Context: A Panel Data Analysis

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Abstract

This study analyses the impact of IC on firms' financing decisions, specifically if intensive IC firms follow the predictions of the main finance theories, i.e., TOT and POT in their capital structure decisions. Based on a sample of 1400 non-financial listed firms across 14 countries in Western Europe for the period between 2004 and 2015, we created two subsamples containing High IC Efficiency Firms and Low IC Efficiency firms. Our findings show that IC components, such as human capital and structural capital negatively impact on firms' book leverage in both samples of firms, while relational capital positively impacts book leverage in high IC efficiency firms. However, the results show that the interaction between the IC components reduces the negative impact of human capital and structural capital on book leverage. Regarding the remaining determinants of capital structure, the findings indicate a positive effect of collateral on book leverage, which suggests the presence of information asymmetry problems as in the case of high IC efficiency firms that face higher capital costs and therefore prefer internal financing due to the lower costs. The negative relationship between profitability and book leverage suggests that both types of firms prefer to resort firstly to internal financing. The negative effect of growth opportunities on book leverage represents a potential risk and, therefore, firms reduce their debt levels. The speed of adjustment of debt towards target debt ratio is greater in high IC efficiency firms than in low IC efficiency firms. The current study makes several contributions to the IC literature. To our knowledge this is the first study to analyse the impact of IC components on firms' book leverage. Furthermore, this study also analyses the effect of IC components' interaction on firms' book leverage to capture the synergetic effect of IC components. Another contribution is the study of firms according to their IC efficiency.

Keywords

Dynamic panel data; Intellectual capital; Financing decisions; High IC efficiency firms; Low IC efficiency firms.

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1. Introduction

With the rise of the innovation-driven era, knowledge has become the most important feature in the firm's value creating process (Bontis, Dragonetti, Jacobsen, and Roos, 1999; Cabrita and Bontis, 2008; Joshi, Cahill, Sidhu, and Kansal, 2013; Stewart, 1997; Sveiby, 1997).

The shift from a manufacturing-based or traditional economy towards a knowledge-based economy, i.e., production based on tangible assets, such as land, machinery and capital, to intangible assets such as knowledge, skills and creativity (Clarke, Seng, and Whiting, 2011; Gho, 2005; Haji, 2016; Labra and Sánchez, 2013), brought to light the importance of intellectual capital (IC) as a new source of competitive advantage (Bontis, 1998; Bontis, Janosevic, and Dzenopoljac, 2015; Dzenopoljac, Janosevic, and Bontis, 2016) since it is difficult to replicate or to use it as efficiently (FitzPatrick, Davey, Muller, and Davey, 2013; Zéghal and Maaloul, 2010).

Furthermore, IC enhances the firm's innovativeness (Bontis, 1999; Bontis *et al.*, 2015; Chi, Lieu, Hung, and Cheng, 2016; Curado, 2008; Lev, 2001; Yu, Wang, and Chang, 2015), influences the firm's capacity to obtain earnings (Harrison and Sullivan, 2000; Liu and Wong, 2011; Maaloul, Ben Amar, and Zeghal, 2016; Zavertiaeva, 2016), affects a firm's value (Bontis *et al.*, 1999; Bontis *et al.*, 2015; Dzenopoljac *et al.*, 2016; Edvinsson, 1997; El-Bannany, 2015; Hall, 1992; Stewart, 1997; Yalama and Coskun, 2007) and contributes to firms' growth opportunities (Liu and Wong, 2011) and wealth (Edvinsson, 1997; Guerrini, Romano, and Leardini, 2014; Stewart, 1997; Yang and Lin, 2009).

The recent global financial crisis, beginning at the end of 2007, accentuated the scarcity of financial resources as well as the difficulty in accessing credit, specifically to fund investment in intangible assets such as IC (Cincera, Ravet, and Veugelers, 2015; Hall, Moncada-Paternò-Castello, Montresor, and Vezzani, 2016).

Asymmetric information problems associated with intangible assets are more pronounced in firms with high IC investment. The specificity of IC investments may create problems of moral hazard, and consequently opportunistic behaviour in managers (Aboody and Lev, 2000; Brown, Fazzari, and Petersen, 2009; Holland, 2006). Therefore, firms with high levels of IC investment may need to raise debt financing to avoid opportunistic behaviour by managers. However, IC investments have a limited benefit period and are based on intangible assets that are non-negotiable (Lev, 2005), which may lead to higher agency costs and a lower liquidation value due to the inherent liquidity risk. Greater agency costs and lower liquidation value may increase the bankruptcy costs associated with debt. Thus, the bankruptcy costs associated with debt become greater, making debt less attractive for firms with an intensity of intangible assets. This type of firm, namely firms with high levels of intellectual capital investments, may present lower debt ratios (Hall, 2010). Moreover, debt tax-shields may lose importance for these firms'

financing decisions. Consequently, the relatively lower importance of debt tax-shields and the relatively higher potential bankruptcy costs may reduce the importance of the predictions of Trade-off Theory (TOT, hereafter) for the financing decisions of firms with major investment in intangible assets.

The specificity of intangible assets leads to information asymmetry and risk for creditors, who impose severe restrictions on intellectual capital intensive firms, which is pointed out as one of the reasons why firms tend to rely on internal funds to fund their innovative projects (Carpenter and Petersen, 2002; Hall and Lerner, 2010; Magri, 2014). Gatchev, Spindt, and Tarhan (2009) and Hogan and Hutson (2005) found that firms with high levels of intangible assets prefer to rely on external equity instead of debt. These findings reverse Pecking Order Theory (POT, hereafter).

The current study seeks to analyse the impact of IC on firms' financing decisions in Western European countries, specifically if intensive IC firms follow the predictions of the main finance theories, i.e., TOT and POT in their capital structure decisions. Based on a sample of non-financial listed firms across 14 Western European countries for the period between 2004 and 2015, two subsamples were created to differentiate High IC Efficiency Firms and Low IC Efficiency firms. Our findings show that IC components, such as human capital and structural capital negatively impact firms' book leverage in both samples of firms, while relational capital positively impacts book leverage in high IC efficiency firms. However, the results show that the interaction between IC components reduces the negative impact of human capital and structural capital on book leverage. Regarding the remaining determinants of capital structure, the findings indicate a positive relationship between collateral and book leverage, which provides evidence of information asymmetry problems, as in the case of high IC efficiency firms which face higher capital costs and therefore prefer internal financing due to its lower costs. The negative relationship between profitability and book leverage suggests that both types of firms prefer to resort firstly to internal financing. The negative effect of growth opportunities on book leverage represents higher risk and, therefore, firms reduce their debt levels. The speed of adjustment of debt towards target debt ratio is greater in high IC efficiency firms than in low IC efficiency firms.

The current study makes several contributions to the IC literature. To our knowledge this is the first study to analyse the impact of IC components on firms' book leverage. Furthermore, it also analyses the effect of IC components' interaction on firms' book leverage to capture the synergetic effect of IC components. Another contribution is the analysis of firms' financing decisions according to their IC efficiency.

The paper is structured as follows. In Section 2, we present the theoretical framework and hypothesis formulation; the methodology is described in Section 3; Section 4 presents the

results; Section 5 discusses the results; and finally, in Section 6 we outline the conclusions and implications of the study.

2. Literature Review and Hypothesis Development

2.1. Intellectual Capital and Financial Markets' Imperfections

IC is a multidisciplinary and interdisciplinary concept (Bontis, 1999; Marr and Chatzkel, 2004; Morariu, 2014), which covers disciplines such as finance (e.g., Bose and Thomas, 2007; Dzenopoljac *et al.*, 2016; Scafarto, Ricci, and Scafarto, 2016; Sydler, Haefliger, and Pruksa, 2014), strategy (e.g., Iazzolino and Laise, 2016; Massaro, Dumay, and Bagnoli, 2015; Wudhikarn, 2016), accounting (e.g., Cleary, 2015; Curado, Henriques, and Bontis, 2011; Haji, 2015; Liao, Chan, and Seng, 2013), economics (e.g., Bontis, 2004; Ståhle, Ståhle, and Lin, 2015), marketing (e.g., Baxter and Matear, 2004; FitzPatrick *et al.*, 2013), and human resources (e.g.,Donate, Pena, and Sanchez de Pablo, 2016; Olander, Hurmelinna-Laukkanen, and Heilmann, 2015), among others.

Edvinsson (1997), following the three-dimensional categorization of IC proposed by Sveiby (1997), renamed the IC dimensions as human capital, organizational capital and customer capital, which was accepted by Bontis (1998), Edvinsson and Malone (1997) and Stewart (1997). They later renamed organizational capital as structural capital. This categorization of IC is widely accepted and extensively used by researchers, sometimes renaming customer capital as relational capital (e.g., Cabrita and Bontis, 2008; Chang, Chen, and Lai, 2008; Curado *et al.*, 2011; Ilyin, 2014), which is a broader term that considers all the firm's stakeholders (Ordoñez de Pablos, 2002). Considering these studies, we will follow the three-dimensional categorization of IC, i.e., human capital, structure capital and relational capital, as it provides the clearest and least ambiguous categorization (Sydler *et al.*, 2014). Furthermore, the synergetic value of IC is rooted in the interaction between its different dimensions (Bontis *et al.*, 2015; Cabrita and Bontis, 2008; Sydler *et al.*, 2014).

Human capital represents the tacit knowledge embedded in the minds of employees (Chang *et al.*, 2008; Hejazi, Ghanbari, and Alipour, 2016; Sydler *et al.*, 2014), providing firms with the collective ability to find innovative solutions (Bontis, 1999, 2001; Díez, Ochoa, Prieto, and Santidrián, 2010) and enhancing their problem-solving ability (Ilyin, 2014; Meles, Porzio, Sampagnaro, and Verdoliva, 2016; Phusavat, Comepa, Sitko-Lutek, and Ooi, 2011; Tsakalerou, 2015; Yu *et al.*, 2015).

Rooted in the employees' talents, skills and expertise (Ilyin, 2014; Meles *et al.*, 2016; Phusavat *et al.*, 2011; Tsakalerou, 2015; Yu *et al.*, 2015), human capital makes firms unique (O'Sullivan and Schulte Jr, 2007) in the development of added value goods, services and solutions for their

customers' needs, thereby achieving customers' satisfaction and loyalty (Bontis, Seleim, and Ashour, 2007; Cabrita and Bontis, 2008; Ghosh and Mondal, 2009).

The value of structural capital is undeniable. This intellectual and strategic asset remains in the firm after employees have left (Bontis *et al.*, 2015; Cabrita and Bontis, 2008; Curado, 2008; Nazari and Herremans, 2007; St-Pierre and Audet, 2011; Stewart, 1997). This means that structural capital is independent of employees and is generally explicit (Chen, Lin, and Chang, 2006; Sydler *et al.*, 2014). Within structural capital there are two main elements, namely intellectual property and infrastructure assets. Intellectual property refers to the elements of IC protected by law (e.g., commercial rights and intellectual property rights) and infrastructure refers to IC elements, such as processes, corporate culture, information and networking systems and research projects, which can be generated within the firm or acquired from the outside (Bozzolan, 2003; Curado *et al.*, 2011; Díez *et al.*, 2010). Furthermore, in the literature, structural capital includes organisational and management processes, strategies, databases, software, information systems, routines, patents, copyrights, trademarks, brands, hardware, licenses, organisational culture, know-how, creativity and innovations (Bontis *et al.*, 2015; Bontis, Keow, and Richardson, 2000; Janosevic and Dzenopoljac, 2012; Meles *et al.*, 2016; Phusavat *et al.*, 2011; St-Pierre and Audet, 2011; Sydler *et al.*, 2014; Ting and Lean, 2009; Tsakalerou, 2015). Even though structural capital and human capital are two independent IC dimensions (Chen, Zhu, and Xie, 2004; Nazari and Herremans, 2007), they are interdependent and interact in the creation of IC (Cabrita and Bontis, 2008). To some degree, structural capital can be reported, shared and traded (Edvinsson, 1997; Hejazi *et al.*, 2016; Lee and Mohammed, 2014; Sydler *et al.*, 2014), and become intellectual property rights (e.g., patents, copyrights, trademarks and brands) legally owned by firms (Saeed, Rasid, and Basiruddin, 2016; Scafarto *et al.*, 2016; Ting and Lean, 2009). Structural capital is also pointed out as the supporting infrastructure for establishing external relationships (Saeed *et al.*, 2016; Scafarto *et al.*, 2016; Ting and Lean, 2009).

Relational Capital is the firm's ability to create value from the complex relationships with external stakeholders. It is the most difficult IC dimension to develop since, to some extent, it is outside the heart of the firm (Bontis, 1998; Scafarto *et al.*, 2016). It enhances human and structural capital's interaction with external stakeholders and influences the firm's wealth as well as external stakeholders' perceptions of the firm (Bontis *et al.*, 2015; Cabrita and Bontis, 2008; Meles *et al.*, 2016; Ting and Lean, 2009). Examples of this are brand loyalty, customer and supplier loyalty, market image, commercial power, customer satisfaction, links with suppliers, negotiating capacity with financial entities, reputation, and environmental activities (Janosevic and Dzenopoljac, 2012; Joshi *et al.*, 2013; Ting and Lean, 2009). Therefore, this capital should be properly managed and measured (Baxter and Matear, 2004; Chu, Hsiung, Huang, and Yang, 2008), as it forms the link between the conversion of IC into the firm's market value and financial performance (Chen *et al.*, 2004; Scafarto *et al.*, 2016).

High intensive IC firms face greater problems of information asymmetry due to the lack of information available with regard to IC investments and the probability of their success (Hall, 2010). Therefore, as part of the shift to a knowledge-based economy, several authors have focused their research on the importance of disclosing IC in financial statements (e.g., Arvidsson, 2011; Ibadin and Oladipupo, 2015; Orens, Aerts, and Lybaert, 2009; Petty and Guthrie, 2000). This is because traditional accounting methods fail to disclose IC (Arvidsson, 2011; Ibadin and Oladipupo, 2015; Nimtrakoon, 2015), and, thus, the hidden value omitted from financial statements is pointed out as the explanation for the difference between a firm's market and book value (Edvinsson, 1997; Firer and Williams, 2003; Haji, 2016; Lev, 2001; Pulic, 1998). Moreover, several studies concluded that the voluntary disclosure of IC enhances a firm's market value (Abdolmohammadi, 2005; Haji, 2016; Orens *et al.*, 2009), reduces the cost of capital (Arvidsson, 2011; Orens *et al.*, 2009; Zavertiaeva, 2016), and mitigates information asymmetry and agency problems (Abdolmohammadi, 2005; Arvidsson, 2011; Zavertiaeva, 2016), thereby enhancing the efficient allocation of resources in the stock market.

Firms with greater levels of investments in intangibles may face moral hazard problems, created by the separation of capital ownership and management, due to the divergent interests of managers and shareholders (Hall, 2010). These conflicts can generate overinvestment or underinvestment problems. In overinvestment problems, managers make decisions that benefit their own personal interests but that can harm those of the firm. On the other hand, underinvestment's problems are related to the IC investments that are not implemented by managers to avoid the transfer of wealth to debtors. Although increased debt might control the problems of overinvestment, this strategy may bring financing costs that are beyond the firm's limits in financing IC investment (Hall, 2010). Empirically, there seem to be limits to use of the leveraging strategy in R&D-intensive sectors (Hall, 2010).

The debt costs associated with financing investment in intangible assets are greater due to the probability of divergence between return values and the initial expected return of these investments, which makes the financing of these assets through debt inappropriate, despite the benefits of debt tax shields. Therefore, firms prefer to resort to internal finance to fund investment in intangible assets (Hall, 2010).

According to Falato, Kadyrzhanova, and Sim (2013), the imperfections of intangible assets to serve as collateral and the cost of capital to fund these assets result in financial market frictions with consequences for firms' financing decisions. According to the literature, firms with higher levels of collateral have greater debt capacity. The nature of intangible assets makes it difficult to evaluate their quality and quantity. Frequently, intangible assets are represented by human capital and cannot be traded. Therefore, intangible assets are rarely seen as collateral in contracts with creditors (Falato *et al.*, 2013).

In frictional capital markets, debt and equity financing present high costs, which makes firms with greater investments in intangible assets keep free cash flows in order to maintain the capacity to use internally generated funds to face adverse market shocks and take advantage of investment opportunities (Falato *et al.*, 2013). Falato *et al.* (2013) identified a negative relationship between investment in intangible assets and debt. Nevertheless, firms with greater growth opportunities present higher levels of cash flow to avoid costs of external financing.

2.2. Intellectual Capital and Financing Decisions

Firms with high levels of IC investment, i.e., investment in intangible assets, may face problems in funding their projects due to the risk associated with their activities based on a high level of intangible assets and therefore lacking collateral value (Brown *et al.*, 2009; Hall and Lerner, 2010).

Information asymmetry between firms' insiders and outsiders is more pronounced in firms with high IC investment. The specificity of IC investment may create adverse selection, moral hazard and opportunistic behaviour by managers (Aboody and Lev, 2000; Brown *et al.*, 2009; Holland, 2006). Therefore, firms with high levels of intellectual capital investment may need to resort to debt financing to avoid the opportunistic behaviour of managers. However, IC investments have a limited benefit period and are based on intangible assets that are non-negotiable (Lev, 2005), which may lead to higher agency costs and a lower liquidation value due to the inherent liquidity risk. Greater agency costs and lower liquidation value may increase the bankruptcy costs associated with debt. Consequently, based on a trade-off between bankruptcy costs and tax-shields of debt, intellectual capital intensive firms may choose lower debt levels. Therefore, the predictions of TOT may lose importance for high IC intensive firms, given the relatively lesser importance of debt-tax shields and relatively greater bankruptcy and agency costs in comparison to firms in traditional industry sectors.

In fact, several studies conclude on the positive effect of IC on firms' productivity and market value (Bloom and Van Reenen, 2002; Darby, Liu, and Zucker, 2004; Griliches, 1990; Hall, Jaffe, and Tratjenberg, 2005; Liu and Wong, 2011). Investment in IC can influence a firm's earnings dynamics and consequently increase its internal financing capacity (Liu and Wong, 2011).

Firms with high levels of intangible assets prefer to finance their innovative activities using internal funds (Carpenter and Petersen, 2002; Hall and Lerner, 2010; Magri, 2014; Myers, 1984; Myers and Majluf, 1984). The use of internal financing is especially important in firms with high levels of IC due to the high risk of their innovative activities (Amit, Glosten, and Muller, 1990; Carpenter and Petersen, 2002), which prevents them from accessing credit on favourable terms (Carpenter and Petersen, 2002; Jensen and Meckling, 1976; Magri, 2014). Additionally, those firms with high levels of IC may face higher human costs of bankruptcy due to the costs of wages and salaries for highly qualified scientists and engineers (Berk, Stanton, and Zechner,

2010; Porter and Ketels, 2003). Furthermore, future earnings will depend on applying their knowledge. However, potential earnings will be lost once they are dismissed or leave the firm.

Financial constraints in firms with greater levels of IC investments, namely in terms of amount and cost, could lead them to depend on internal financing. Once internal financing is exhausted, firms exposed to these problems may resort to external equity due to the barriers to accessing credit.

Gatchev *et al*. (2009) and Hogan and Hutson (2005) found that high tech firms, which are intellectual capital intensive firms, prefer to rely on external equity instead of debt. These findings reverse POT, whose predictions are that firms choose financing sources according to the following hierarchical order: after exhausting internal finance, firms tend to use external debt and only as a last option do they issue equity (Myers, 1984; Myers and Majluf, 1984).

Nevertheless, the recognition of growth opportunities by creditors, in firms with greater levels of intangible assets, may lead to firms obtaining debt on favourable terms (Serrasqueiro and Nunes, 2010). The results of Liu (2000) show a positive relationship between IC investment, growth opportunities and leverage and, therefore, firms with greater investment in IC give the market a promising signal of growth opportunities. Also, Lim, Macias, and Moeller (2016) found that intangible assets have a positive and significant relationship with leverage. According to the authors, in firms with limited tangible assets, intangible assets may be a substitute for tangible assets in supporting debt financing.

According to the above-mentioned arguments and studies, on the one hand, there seem to be arguments supporting the predictions of a modified POT in firms that invest intensively in IC: these firms seems to prefer internal financing to fund their activities and once these funds are exhausted, they rely on equity financing. On the other hand, there are arguments supporting the importance of debt for IC intensive firms to fund their activities.

3. Data, Variables and Method

3.1. Database

Based on 14 countries in Western Europe (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden and United Kingdom) for the period between 2004 and 2015, our data set consists of 1400 non-financial listed firms. The data set was gathered from the DATASTREAM database by Thomson Reuters. We excluded financial firms from our sample. Therefore, our data set has an unbalanced panel structure, where the number of firm years present in the research sample varies between 3 and 12. In order to mitigate potential survivor bias by allowing the entry and exit of firms, we follow Guariglia (2008), Bond, Elston, Mairesse, and Mulkay (2003) and Cummins, Hasset, and Oliner (2006). The data was trimmed 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 firms' extraordinary shocks (Guariglia, 2008).

Based on the median of the Value Added Intellectual Coefficient – VAIC™ model developed by Pulic (1998, 2000), we divided our sample into two subsamples. If the value of firms' VAIC™ is higher than the median, firms belong to the subsample of High IC Efficiency Firms, otherwise they belong to the subsample of Low IC Efficiency Firms.

The VAIC™ model is derived from accounting information based on balance sheets and income statements (Pulic, 1998, 2000, 2004). The first step of VAIC™ calculation seeks to evaluate the firm's ability to create value added (VA). As such, $VA_{i,t}$, for firm i in the year t, is calculated as the difference between outputs (OUT) and inputs (IN), as shown in equation (1):

$$VA_{i,t} = OUT_{i,t} - IN_{i,t} \qquad (1)$$

Where $OUT_{i,t}$ is the total revenues generated from all products and services sold on the market for firm i in the year t. $IN_{i,t}$ is the operating expenses in generating the revenues excluding employee costs for firm i in the year t. Employee costs are treated as investments, not as expenses, due to the important role that human capital has in the value creation process. The value added can also be calculated as indicated in equation (2).

$$VA_{i,t} = OP_{i,t} + EC_{i,t} + D_{i,t} + A_{i,t} \qquad (2)$$

Where $OP_{i,t}$ is the operating profit for firm i in the year t, $EC_{i,t}$ is employee costs for firm i in the year t, $D_{i,t}$ is the depreciation for firm i in the year t and $A_{i,t}$ is the amortization for firm i in the year t.

The second step involves the calculation of VAIC™ components HCE, SCE and CEE. The VAIC™ components are obtained as shown in equations (3), (4) and (5).

$$HCE_{i,t} = \frac{VA_{i,t}}{HC_{i,t}} \quad (3)$$

Where $HC_{i,t}$ refers to total employee salary and wage costs for firm i in the year t. The model focuses on human capital's contribution to firms' value creation. This is coherent with the context of the knowledge-based economy since human capital is the key factor of value creation (Pulic, 2004). Structural capital includes organisational and management processes, strategies, databases, software, information systems, and so on. Structural capital supports and empowers human capital (Bontis, 1998; Curado *et al.*, 2011; Díez *et al.*, 2010; Edvinsson, 1997; Ilyin, 2014; Lee and Mohammed, 2014; Tsakalerou, 2015), which is a vital factor in structural capital development (Nazari and Herremans, 2007). Equation (4) shows the calculation of structural capital efficiency, $SCE_{i,t}$ for firm i in the year t.

$$SCE_{i,t} = \frac{SC_{i,t}}{VA_{i,t}} \quad (4)$$

Where $SC_{i,t}$ is structural capital for firm i in the year t, and can be obtained by subtracting human capital costs from value added: $SC_{i,t} = VA_{i,t} - HC_{i,t}$. The capital employed efficiency, $CEE_{i,t}$ for firm i in the year t, can be obtained through the ratio between value added and capital employed as shown in equation (5).

$$CEE_{i,t} = \frac{VA_{i,t}}{CE_{i,t}} \quad (5)$$

Where $CE_{i,t}$ is the book value of the net assets of firm i in the year t.

The third step involves the calculation of IC efficiency, $ICE_{i,t}$ for firm i in year t, which is obtained by summing human capital efficiency and structural capital efficiency, as can be seen in equation (6).

$$ICE_{i,t} = HCE_{i,t} + SCE_{i,t} \quad (6)$$

Finally, the VAIC™ is the sum of intellectual capital efficiency and capital employed efficiency as shown in equation (7).

$$VAIC_{i,t} = ICE_{i,t} + CEE_{i,t} \quad (7)$$

Where $VAIC_{i,t}$ is the value added intellectual coefficient for firm i in the year t. This indicator reveals intellectual ability.

The popularity of VAIC™ among researchers is notable (Bontis *et al.*, 2015). Nevertheless, there has been some criticism of VAIC™. Despite the criticism of VAIC™, several advantages are pointed out by researchers. VAIC™ treats human capital as the most important source of IC (Greco, Ferramosca, and Allegrini, 2014; Mondal and Ghosh, 2012). All the values used in

calculating VAIC™ derive from firms' income statements (Joshi *et al.*, 2013; Mondal and Ghosh, 2012; Nimtrakoon, 2015; Saeed *et al.*, 2016; Tan, Plowman, and Hancock, 2007), and therefore, it uses authentic and audited information (Clarke *et al.*, 2011; El-Bannany, 2015; Firer and Williams, 2003; Greco *et al.*, 2014; Kujansivu and Lönnqvist, 2007; Maditinos, Chatzoudes, Tsairidis, and Theriou, 2011; Pulic, 1998, 2000; Tan *et al.*, 2007; Young, Su, Fang, and Fang, 2009).

As our purpose is to differentiate firms with high IC efficiency and low IC efficiency, VAIC™ appears to be the appropriate measure. Besides the fact that VAIC™ has been widely adopted by researchers, according to Zéghal and Maaloul (2010) VAIC™ is used by organizations, e.g., the UK's Department for Business, Innovation and Skills (BIS), as the indicator of IC measurement of firms, which contributes to validating the VAIC™ model.

3.2. Estimation Method and Variable Measurement

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, due to the dynamic character of the main research variables in study. Therefore, we will use the Generalized Method of Moments (GMM), which is a dynamic estimator proposed by Blundell and Bond (1998), allows us to control the endogeneity problem and avoids significant bias in estimates (Wooldridge, 2007). The efficiency of this estimator lies in the possibility to control correlation errors over time and heteroscedasticity across firms. The results of the 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) absence of second-order autocorrelation.

In order to test the first condition, i.e., the validity of the restrictions created by the instruments used, we use the Hansen test, where the null hypothesis is validity of the restrictions created by the instruments used. For the second condition, we test the existence of second-order autocorrelation, where the null hypothesis indicates there is no second-order autocorrelation. In the case of not rejecting the null hypothesis for the Hansen and second-order autocorrelation tests, we conclude that the GMM system (1998) estimator is valid and robust.

By using a high number of instruments, the GMM system (1998) estimator leads to dramatic improvements in efficiency compared with the first difference GMM estimator (Arellano and Bover, 1995; Blundell and Bond, 1998). Arellano and Bond (1991), Windmeijer (2005) and Roodman (2006) showed the reliability of the one-step GMM estimator, asymptotically 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 especially for the GMM system

(1998) estimator (Roodman, 2009). Therefore, we used the two-step procedure with the correction proposed by Windmeijer (2005).

Our estimation models are presented as follows:

$$BLEV_{i,t} = \beta_0 + \delta_1 BLEV_{i,t-1} + \sum_{K=1}^{12} \beta_K Z_{K,i,t} + \theta_1 D_{08:09} + \eta_i + \varepsilon_{i,t} \quad (1)$$

Where: $BLEV_{i,t-1}$ is the Book Leverage of the previous period; $Z_{K,i,t}$ is the vector of the *K* leverage determinants considered in this study; η_i are non-observable individual effects and $\varepsilon_{i,t}$ is the error. The variables used in this study and their measurement are shown in Table 1.

Table 1- Variables and measurement

Variable	***Measurement***
Dependent variables	
Book Leverage ($BLEV_{i,t}$)	Ratio of total debt to total assets
Independent variables	
Intellectual Capital Dimensions	
Human Capital ($HCap_{i,t}$)	Ratio of staff costs to total assets
Structural Capital ($SCap_{i,t}$)	Ratio of research and development expenses to total assets
Relational Capital ($RCap_{i,t}$)	Ratio of selling, general and administrative expenses to total assets
Interaction Between Intellectual Capital Dimensions	
Human Capital * Structural Capital ($HCap_{i,t}$ * $SCap_{i,t}$)	Human capital multiplied by structural capital
Human Capital * Relational Capital ($HCap_{i,t}$ * $RCap_{i,t}$)	Human capital multiplied by relational capital
Structural Capital * Relational Capital ($SCap_{i,t}$* $RCap_{i,t}$)	Structural capital multiplied by relational capital
Control Variables	
Collaterals ($Collaterals_{i,t}$)	Ratio of fixed assets to total assets
Profitability ($PROF_{i,t}$)	Ratio of operating income before depreciation to total assets
Size ($SIZE_{i,t}$)	Logarithm of total assets
Growth Opportunities ($GO_{i,t}$)	Ratio of equity market value to equity book value
Non-Debt Tax Shields ($NDTS_{i,t}$)	Ratio of depreciations to total assets
Business Risk ($RISK_{i,t}$)	Standard deviation of the ratio of earnings before interest and taxes to total assets
Dummy Crisis ($D_{08:09}$)	Dummy representing financial crisis period. It assumes the value of 1 if the year is equal to 2008 or 2009, and the value of 0 for the remaining years in study

The interaction between human capital, structural capital and relational capital has been considered in this study, since several authors (e.g., Bontis *et al.*, 2015; Cabrita and Bontis, 2008; Sydler *et al.*, 2014) argue that the synergetic value of IC is rooted in the interaction of its different dimensions. Structural capital supports and empowers human capital (Bontis, 1998;

Curado *et al.*, 2011; Díez *et al.*, 2010; Edvinsson, 1997; Ilyin, 2014; Lee and Mohammed, 2014; Tsakalerou, 2015), which is a vital factor in structural capital development (Nazari and Herremans, 2007) and in reaching its full potential in the firm's value creation and performance (Bontis, 1998; Lee and Mohammed, 2014; St-Pierre and Audet, 2011; Sveiby, 1997). Even though structural capital and human capital are two independent IC dimensions (Chen *et al.*, 2004; Nazari and Herremans, 2007), they are interdependent and interact in the creation of IC (Cabrita and Bontis, 2008). Structural capital is also pointed out as the supporting infrastructure for establishing external relationships (Molodchik, Shakina, and Barajas, 2014; Schiuma and Lerro, 2008). Relational Capital is firms' value creation ability from the complex relationships with external stakeholders (Cabrita and Bontis, 2008; Joshi *et al.*, 2013; Meles *et al.*, 2016; Sydler *et al.*, 2014; Tsakalerou, 2015). Therefore, relational capital enhances human and structural capital's interaction with external stakeholders and influences external stakeholders' perceptions of the firm (Bontis *et al.*, 2015; Cabrita and Bontis, 2008; Meles *et al.*, 2016; Ting and Lean, 2009).

4. Empirical Results

4.1. Descriptive Statistics and Correlation Matrix

The descriptive statistics for High IC Efficiency firms and Low IC Efficiency firms, respectively, are presented in Table 2. We find that on average Low IC Efficiency Firms have greater book leverage than High IC Efficiency firms. This evidence may be an indicator that Low IC Efficiency firms resort more to external debt than High IC Efficiency firms. This fact may be explained by the greater average collateral presented by Low IC Efficiency, which may indicate they can access credit on better terms. As expected, High IC Efficiency firms present greater average profitability than Low IC Efficiency firms. We also find that High IC Efficiency firms present on average greater levels of human capital, structural capital and relational capital. This evidence may contribute to High IC Efficiency firms presenting on average greater growth opportunities than Low IC Efficiency firms, and therefore, High IC Efficiency firms have on average greater business risk than Low IC Efficiency firms. We also find that on average, Low IC Efficiency firms have: (i) greater non-debt tax shields and (ii) greater size, compared to what is found in High IC Efficiency firms.

Table 2 - Summary statistics

Full Sample										
	$BLEV_{i,t}$	$HCap_{i,t}$	$SCap_{i,t}$	$RCap_{i,t}$	$RISK_{i,t}$	$Collaterals_{i,t}$	$PROF_{i,t}$	$SIZE_{i,t}$	$GO_{i,t}$	$NDTS_{i,t}$
Observations	21390	19295	8774	14117	19465	20652	18735	20580	19821	19489
Mean	.2293722	.2620241	.0501809	.263053	4.027959	.2881532	.0178862	13.05106	1.577066	.0334465
Median	.2136849	.2077939	.0204806	.2008214	1.416967	.2476389	.0325788	12.909	1.300432	.0278289
SD	.1761224	.2130275	.0798933	.2205244	5.717165	.2179897	.1236926	2.068628	.8679115	.0255755
High Intellectual Capital Efficiency Firms										
	$BLEV_{i,t}$	$HCap_{i,t}$	$SCap_{i,t}$	$RCap_{i,t}$	$RISK_{i,t}$	$Collaterals_{i,t}$	$PROF_{i,t}$	$SIZE_{i,t}$	$GO_{i,t}$	$NDTS_{i,t}$
Observations	12463	10497	5205	8357	11162	11870	10758	11873	11442	11305
Mean	.2225726	.2711496	.0520002	.2649329	4.066381	.2718781	.0453606	13.04409	1.791064	.0316528
Median	.2019735	.191049	.0211497	.1995395	1.288498	.2142771	.0595822	12.94669	1.495525	.0255468
SD	.1825001	.2530282	.0808032	.231079	5.861009	.2258766	.129137	2.135491	.9681941	.0253045
Low Intellectual Capital Efficiency Firms										
	$BLEV_{i,t}$	$HCap_{i,t}$	$SCap_{i,t}$	$RCap_{i,t}$	$RISK_{i,t}$	$Collaterals_{i,t}$	$PROF_{i,t}$	$SIZE_{i,t}$	$GO_{i,t}$	$NDTS_{i,t}$
Observations	8927	8798	3569	5760	8303	8782	7977	8707	8379	8184
Mean	.2388652	.2511363	.0475277	.2603256	3.976307	.310151	-.0191667	13.06057	1.284838	.0359242
Median	.2298435	.2231786	.0193538	.2028389	1.6421	.2842937	.007585	12.85195	1.127198	.0308139
SD	.166357	.1514098	.078483	.2042327	5.517813	.2048196	.1051386	1.973887	.5949473	.0257421

To test if there are significant differences between High IC Efficiency firms and Low IC Efficiency firms, we run the mean difference t-test (see Table 3).

Table 3 - Mean differences (t-test)

Variables	High IC Efficiency Firms		Low IC Efficiency Firms		Mean Difference(t-test)
	Observations	Mean	Observations	Mean	
$BLEV_{i,t}$	12463	0.223	8927	0.239	0.016***
$HCap_{i,t}$	10497	0.271	8798	0.251	-0.020***
$SCap_{i,t}$	5205	0.052	3569	0.048	-0.004***
$RCap_{i,t}$	8357	0.265	5760	0.260	-0.005
$RISK_{i,t}$	11162	4.066	8303	3.976	-0.090
$Collaterals_{i,t}$	11870	0.272	8782	0.310	0.038***
$PROF_{i,t}$	10758	0.045	7977	-0.019	-0.065***
$SIZE_{i,t}$	11873	13.044	8707	13.061	0.016
$GO_{i,t}$	11442	1.791	8379	1.285	-0.506***
$NDTS_{i,t}$	11305	0.032	8184	0.036	0.004***

***Statistical significance at 1% level

The results show significant differences between High IC Efficiency firms and Low IC Efficiency firms in relation to book leverage, human capital, structural capital, collateral, profitability, growth opportunities and non-debt tax shields. However, we do not find significant differences between High IC Efficiency firms and Low IC Efficiency firms for relational capital, business risk and size.

According to Gujarati and Porter (2010), the problems of endogeneity between independent variables are relevant when correlation coefficients are above 30%. The correlation matrix (see Table 4 and Table 5) indicates several variable pairs in this condition for High IC Efficiency firms, e.g., (i) human capital and relational capital, (ii) structural capital and relational capital and (iii) business risk and size, and for Low IC Efficiency firms, e.g., (i) human capital and relational capital, (ii) structural capital and relational capital and (iii) business risk and size. Therefore, to overcome the problem of endogeneity, the GMM system (1998) dynamic estimator was applied as it allows the use of instrumental variables to reduce this problem. Also, the high magnitude of the correlation coefficients between the variables of Book Leverage in the current and previous periods indicates high persistence. Consequently, according to Blundell and Bond (1998), it is more appropriate to use the GMM system (1998) estimator than the GMM (1991) estimator.

Table 4 - Correlation Matrix: High IC Efficiency Firms

Variables	$BLEV_{i,t}$	$BLEV_{i,t-1}$	$HCap_{i,t}$	$SCap_{i,t}$	$RCap_{i,t}$	$RISK_{i,t}$	$Collaterals_{i,t}$	$PROF_{i,t}$	$SIZE_{i,t}$	$GO_{i,t}$	$NDTS_{i,t}$
$BLEV_{i,t}$	1.0000										
$BLEV_{i,t-1}$	0.8814**	1.0000									
$HCap_{i,t}$	-0.2509**	-0.2389**	1.0000								
$SCap_{i,t}$	-0.2677**	-0.2462**	0.2138**	1.0000							
$RCap_{i,t}$	-0.2289**	-0.2113**	0.5359**	0.5508**	1.0000						
$RISK_{i,t}$	-0.2102**	-0.2063**	0.2077**	0.3481**	0.2343**	1.0000					
$Collaterals_{i,t}$	0.3086**	0.2998**	-0.3486**	-0.3083**	-0.2868**	-0.2325**	1.0000				
$PROF_{i,t}$	-0.1336**	-0.1185**	0.0207	-0.3849**	-0.0339	-0.2513**	-0.0358*	1.0000			
$SIZE_{i,t}$	0.3137**	0.3046**	-0.3262**	-0.3927**	-0.2915**	-0.5293**	0.3315**	0.1958**	1.0000		
$GO_{i,t}$	-0.2499**	-0.2312**	0.0754**	0.3481**	0.2695**	0.1398**	-0.1394**	0.2386**	-0.0993**	1.0000	
$NDTS_{i,t}$	0.1327**	0.1495**	0.0377	-0.0566**	0.0413	-0.0799**	0.4287**	-0.1580**	0.0987**	0.0037	1.0000

**Statistical significance at 1% level; *Statistical significance at 5% level

Table 5 - Correlation Matrix: Low IC Efficiency Firms

Variables	$BLEV_{i,t}$	$BLEV_{i,t-1}$	$HCap_{i,t}$	$SCap_{i,t}$	$RCap_{i,t}$	$RISK_{i,t}$	$Collaterals_{i,t}$	$PROF_{i,t}$	$SIZE_{i,t}$	$GO_{i,t}$	$NDTS_{i,t}$
$BLEV_{i,t}$	1.0000										
$BLEV_{i,t-1}$	0.8915**	1.0000									
$HCap_{i,t}$	-0.1780**	-0.1787**	1.0000								
$SCap_{i,t}$	-0.2679**	-0.2758**	0.1443**	1.0000							
$RCap_{i,t}$	-0.1340**	-0.1383**	0.4740**	0.4661**	1.0000						
$RISK_{i,t}$	-0.1813**	-0.1837**	0.2292**	0.3041**	0.2622**	1.0000					
$Collaterals_{i,t}$	0.2977**	0.2967**	-0.1939**	-0.3278**	-0.2415**	-0.2131**	1.0000				
$PROF_{i,t}$	-0.0136	0.0215	-0.0721**	-0.4789**	-0.1866**	-0.3184**	0.0291	1.0000			
$SIZE_{i,t}$	0.2067**	0.1997**	-0.3154**	-0.3473**	-0.3271**	-0.5164**	0.2793**	0.2996**	1.0000		
$GO_{i,t}$	-0.2129**	-0.2039**	0.0920**	0.4211**	0.2171**	0.2269**	-0.1637**	-0.1526**	-0.2086**	1.0000	
$NDTS_{i,t}$	0.1789**	0.1835**	0.2112**	-0.0869**	0.0892**	-0.0221	0.3824**	-0.2483**	-0.0128	-0.0715**	1.0000

**Statistical significance at 1% level; *Statistical significance at 5% level

4.2 Intellectual Capital and Firms' Financing Decisions

The results of the estimated equation (1) using the GMM system (1998) dynamic estimator are presented in Table 6. According to the results of the Hansen and second-order autocorrelation tests, the null hypothesis cannot be rejected in either test for all estimations in this study. Therefore, the validity of the restrictions of the instruments is not rejected and the hypothesis of the existence of second-order autocorrelation in the estimated models is not rejected. This being so, the results of the GMM system (1998) dynamic estimator are robust, and therefore, the estimations presented in Table 6 are open to interpretation.

Table 6 – GMM system (1998) - Estimation results: Book Leverage

Independent variables	Dependent variable: $BLEV_{i,t}$	
	High IC Efficiency Firms	Low IC Efficiency Firms
$BLEV_{i,t-1}$	0.49834***	0.53452***
	(0.04081)	(0.04165)
$HCap_{i,t}$	-0.18920***	-0.20425**
	(0.06897)	(0.08680)
$SCap_{i,t}$	-0.56646**	-0.92439***
	(0.23914)	(0.23317)
$RCap_{i,t}$	0.25325***	-0.01174
	(0.09763)	(0.08594)
$Collaterals_{i,t}$	0.11788**	0.08019**
	(0.05158)	(0.03545)
$PROF_{i,t}$	-0.10082**	-0.08240***
	(0.04872)	(0.02763)
$SIZE_{i,t}$	0.00746	0.02178***
	(0.00890)	(0.00783)
$GO_{i,t}$	-0.01133***	-0.02598***
	(0.00389)	(0.00646)
$NDTS_{i,t}$	-0.05409	0.25337
	(0.31669)	(0.23340)
$RISK_{i,t}$	-0.00243	-0.00176
	(0.00122)	(0.00144)
$D_{08:09}$	0.01132***	0.00923***
	(0.00329)	(0.00303)
$SCap_{i,t} * HCap_{i,t}$	1.59149***	1.73330***
	(0.46969)	(0.59695)
$RCap_{i,t} * HCap_{i,t}$	-0.21374	0.13922
	(0.12767)	(0.18554)
$SCap_{i,t} * RCap_{i,t}$	-0.18722	0.87912***
	(0.31717)	(0.27722)
Constant	0.01405	-0.15275
	(0.13509)	(0.11869)
Observations	2,342	2,018
Number of firms	521	490
F (N(0,1))	53.64***	49.05***
Hansen	107.99	124.4
m1 (N(0,1))	-5.767***	-2.903***
m2 (N(0,1))	-0.0840	0.766

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

The results from estimation of high IC efficiency firms show that human capital, structural capital, profitability and growth opportunities have a negative and significant relationship with book leverage, whereas Relational capital, Structural Capital * Human Capital, tangibility, financial crisis and book leverage in the previous period have a positive and significant impact on book leverage. Also, the speed of adjustment of debt towards target debt ratio is 0,602.

The results from estimations of low IC efficiency firms show that human capital, structural capital, profitability and growth opportunities have a negative and significant effect on book leverage, while tangibility, size, financial crisis, book leverage in the previous period, Structural Capital * Human Capital and Structural Capital * Relational Capital have a positive and significant relationship with book leverage. Additionally, the speed of adjustment of debt towards the target debt ratio is 0,466.

5. Discussion of the Empirical Results

The relationships between the IC components of human capital and structural capital and levels of book debt are negative and statistically significant, for high and low IC efficiency firms. Nevertheless, the magnitude of the effect is greater in low IC efficiency firms. The other IC component, i.e., relational capital, has a positive and statistically significant impact on the level of book debt in high IC efficiency firms. In low IC efficiency firms, relational capital does not have a statistically significant effect. Therefore, the results indicate that firms with greater levels of human capital reduce their level of debt. Liu, van Jaarsveld, Batt, and Frost (2014) conclude that firms with greater levels of debt are more likely to respond to the external demand of profit maximization in the short term. In pursuing profit maximization in the short term, managers reduce investment in human capital, which would imply a reduction in salaries, but would increase human competencies and firm competitiveness (Liu *et al.*, 2014). Hovakimian and Li (2011) studied Chinese manufacturing firms with low average salaries, and found a negative relationship between debt and wages for the period between 1998 and 2006.

The risk of losing human capital to competitors increases the bankruptcy costs derived from human capital, which induces firms to avoid financing their investments in human capital through debt (Akyol and Verwijmeren, 2013). Therefore, human capital intensive firms are more exposed to the costs of bankruptcy caused by IC leakage, and therefore avoid resorting to debt. Pratt (2013) also found a negative relationship between firms with intensive human capital and debt.

Structural capital creates added value based on firms' processes and infrastructure, supporting the unique properties of their products and services, and thereby firms' competitiveness. Nevertheless, according to Titman (1984), the clients, employees and suppliers of firms that produce unique and specialized products suffer from higher costs in the case of firm

bankruptcy. On the one hand, firms with greater levels of structural capital develop products/services with unique characteristics. On the other hand, these firms have a greater risk of bankruptcy since investment in structural capital lacks a physical correspondence, and also, a certain percentage of the investment in structural capital is not expressed in the balance sheet. Therefore, firms with greater levels of structural capital may face worse conditions in accessing credit, and consequently present lower levels of debt. Several studies (Lim *et al.*, 2016; Loumioti, 2012), show that intellectual property rights serve as collateral and provide firms with better terms of credit. Nevertheless, on the one hand, investment in structural capital consists mostly of intangible assets that contribute to firms' competitive advantages and performance, and on the other hand, structural capital represents risks to creditors, who transfer them to firms by increasing interest rates or demanding collateral. In this context, the negative relationship between structural capital and debt appears to be a consequence of information asymmetry problems, suggesting that high IC efficiency firms avoid resorting to debt to finance this IC component due to the lack of collateral/cost of capital. This result is in line with Falato *et al.* (2013), although in that study, the authors analysed the effect of a broad definition of intangible assets on debt.

Relational capital enhances human and structural capital's interaction with external stakeholders and influences the firm's wealth as well as external stakeholders' perceptions of the firm (Bontis *et al.*, 2015; Cabrita and Bontis, 2008; Meles *et al.*, 2016; Ting and Lean, 2009). Examples of this are brand loyalty, customer and supplier loyalty, market image, commercial power, customer satisfaction, links with suppliers, negotiating capacity with financial entities, reputation, and environmental activities (Janosevic and Dzenopoljac, 2012; Joshi *et al.*, 2013; Ting and Lean, 2009). The positive relationship between relational capital and book debt level in high IC efficiency firms suggests that greater investment in this IC component increases the firm's reputation and credibility in the eyes of external creditors, allowing them to obtain better terms of credit. Furthermore, the interaction between Structural Capital*Human Capital has a positive impact on book debt level in high and low IC efficiency firms, although this impact has a greater relative magnitude in low IC efficiency firms. These results suggest a reduction of the negative impact of human and structural capital on the level of book debt for both types of firms, and might be due to the support that structural capital gives to human capital, and consequently, higher investment in structural capital can diminish the negative effect of human capital on the firm's debt levels.

The positive effect of the interaction between Structural Capital*Relational Capital on level of book debt in low IC efficiency firms suggests that relational capital contributes to reducing the negative effect of structural capital on firms' level of book debt. Therefore, low IC efficiency firms with more investment in relational capital appear to see positive effects of that investment and consequently find their reputation and credibility with creditors enhanced. This situation may provide better terms of credit for low IC efficiency firms. The interactive variable

of Structural Capital*Relational Capital does not have a statistically significant effect on book debt levels in high IC efficiency firms. Nor does the interactive variable of Relational Capital*Human Capital have a statistically significant impact on book debt level in high and low IC efficiency firms.

Generally, the results obtained from the estimations regarding the impact of IC components on debt indicate that greater investment in human capital and structural capital has a negative impact on firms' debt levels, while relational capital positively impacts on debt levels in high IC efficiency firms. Therefore, the negative effect of IC investment appears to be more expressive in low IC efficiency firms, probably due to their lower level of efficiency in managing their resources, namely concerning the use and acquisition of resources from IC investment. High and low IC efficiency firms adjust their level of debt towards optimal debt levels, but the speed of adjustment is greater in the former. This suggests their lower costs of adjustment, probably a consequence of the higher level of efficiency in this type of firm that bears lower costs of adjustment in financial market transactions to rebalance the firm's capital structure.

The effects of the remaining determinants of financing decisions are in line with the predictions of TOT and POT. In fact, the positive effect of collateral on debt seems to be in accordance with the principles of TOT and POT. According to POT, firms more exposed to information asymmetry problems, as is the case of high IC efficiency firms that face higher capital costs, prefer internal financing due to the lower costs. The positive effect of collateral on debt level is greater in high IC efficiency firms than in low IC efficiency firms suggesting that the former present creditors with a higher risk.

The relative magnitude of the negative impact of profitability on debt level is lower in low IC efficiency firms than in high IC efficiency firms. These results suggest that although both high and low IC efficiency firms follow POT principles in financing decisions, for the former internal financing seems to be more important to reduce debt levels.

The size variable has a positive relationship on debt in low IC efficiency firms, indicating that size is a relevant factor for reducing debt levels in these firms. This result is according to the predictions of TOT: larger firms are more diversified and present lower risk, and therefore have more debt capacity. Nevertheless, we found no statistical significance for the size variable in high IC efficiency firms, which indicates that for these firms, size is not relevant to the level of debt. The negative impact of growth opportunities in both high and low IC efficiency firms indicates that a higher level of growth opportunities represents greater risk, which makes firms reduce their debt levels. The variables of non-debt tax shields and business risk do not have a statistically significant effect on either high or low IC efficiency firms. The financial crisis variable has a positive effect on debt levels for both types of firm. These results suggest that these firms increase their debt levels in years of financial crisis, probably, because of the lesser availability of internal funds. Finally, high IC efficiency firms show a greater speed of

adjustment of current debt towards debt target ratio compared to low IC efficiency firms, suggesting lower costs of adjustment for the former.

6. Conclusion

Based on a sample of 1400 non-financial listed firms in 14 countries in Western Europe for the period between 2004 and 2015, this study analyses the impact of IC on firms' financing decisions, specifically if intensive IC firms follow the predictions of the main finance theories, i.e., TOT and POT, in their capital structure decisions. Two subsamples were created to differentiate High IC Efficiency Firms and Low IC Efficiency firms. Our findings show that IC components, such as human capital and structural capital, negatively impact on firms' book leverage in both samples, while relational capital positively impacts book leverage in high IC efficiency firms. However, interaction between the IC components reduces the negative impact of human capital and structural capital on book leverage. The remaining determinants of capital structure are in line with TOT and POT. According to POT, the positive relationship of collateral with book leverage provides evidence of information asymmetry problems in the case of high IC efficiency firms that face obstacles in obtaining credit. Thus, these firms prefer internal financing due to the lower costs. The negative relationship between profitability and book leverage suggests that both types of firms prefer internal finance to external sources of finance. The negative effect of growth opportunities on book leverage shows that growth opportunities represent risk, and therefore, firms reduce their debt levels. The speed of adjustment of debt towards the target debt ratio is greater in high IC efficiency firms than in low IC efficiency firms.

Human capital provides firms with knowledge, and so, on the practical side, we encourage managers to take into consideration human capital's remuneration to keep their employees motivated and avoid the leakage of knowledge and skills to competitors. This will help to minimize the risk of bankruptcy costs derived from human capital. For policy-makers, we suggest the development of support programmes to help firms invest in human capital since this is a determinant factor of firms' value creation.

The current study makes several contributions to the IC literature. To our knowledge this is the first study to analyse the impact of IC components on firms' book leverage. Furthermore, it analyses the effect of IC components' interaction on firms' book leverage to capture the synergetic effect of IC components. Another contribution is the study of firms according to their IC efficiency. For further research, we suggest the use of different proxies for IC, i.e., human capital, structural capital and relational capital, which would be useful to test if there are different findings from the ones obtained here.

References

Abdolmohammadi, M. J. (2005). Intellectual capital disclosure and market capitalization. *Journal of Intellectual Capital, 6*(3), 397-416.

Aboody, D., and Lev, B. (2000). Information asymmetry, R&D and insider gains. *The Journal of Finance, 55*(6), 2747-2766.

Akyol, A. C., and Verwijmeren, P. (2013). Human capital costs, firm leverage, and unemployment rates. *Journal of Financial Intermediation, 22*(3), 464-481.

Amit, R., Glosten, L., and Muller, E. (1990). Entrepreneurial Ability, Venture Investments, and Risk Sharing. *Management Science, 36*(10), 1233-1246.

Arellano, M., and Bond, S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and Application to Employment Equations. *Review of Economic Studies, 58*, 277-297.

Arellano, M., and Bover, O. (1995). Another Look at the Instrumental Variable Estimation of Error-Components Models. *Journal of Econometrics, 68*, 29-52.

Arvidsson, S. (2011). Disclosure of non-financial information in the annual report: A management-team perspective. *Journal of Intellectual Capital, 12*(2), 277-300.

Baxter, R., and Matear, S. (2004). Measuring intangible value in business-to-business buyer-seller relationships: An intellectual capital perspective. *Industrial Marketing Management, 33*(6), 491-500.

Berk, J. B., Stanton, R., and Zechner, J. (2010). Human Capital, Bankruptcy and Capital Structure. *The Journal of Finance, 65*(3), 891-926.

Bloom, N., and Van Reenen, J. (2002). Patents, Real Options and Firm Performance. *Economic Journal, 112*(478), C97–C116.

Blundell, R., and Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics, 87*(1), 115-143.

Bond, S., Elston, J., Mairesse, J., and Mulkay, B. (2003). Financial factors and investment in Belgium, France, Germany, and the United Kingdom: A comparison using company panel data. *Review of Economics and Statistics, 85*, 153-165.

Bontis, N. (1998). Intellectual capital: an exploratory study that develops measures and models. *Management Decision, 36*(2), 63-76.

Bontis, N. (1999). Managing organizational knowledge by diagnosing intellectual capital: Framing and advancing the state of the field. *International Journal of Technology Management, 18*(5-8), 433–462.

Bontis, N. (2001). Assessing knowledge assets: A review of the models used to measure intellectual capital. *International Journal of Management Reviews, 3*(1), 41-60.

Bontis, N. (2004). National intellectual capital index: a United Nations initiative for the Arab region. *Journal of Intellectual Capital, 5*(1), 13-39.

Bontis, N., Dragonetti, N. C., Jacobsen, K., and Roos, G. (1999). The knowledge toolbox: a review of the tools available to measure and to manage intangible resources. *European Management Journal, 17*(4), 391-402.

Bontis, N., Janosevic, S., and Dzenopoljac, V. (2015). Intellectual capital in Serbia's hotel industry. *International Journal of Contemporary Hospitality Management, 27*(6), 1365-1384.

Bontis, N., Seleim, A., and Ashour, A. (2007). Human capital and organizational performance: a study of Egyptian software companies. *Management Decision, 45*(4), 789-801.

Bontis, N., Keow, W. C. C., and Richardson, S. (2000). Intellectual capital and business performance in Malaysian industries. *Journal of Intellectual Capital, 1*(1), 85-100.

Bose, S., and Thomas, K. (2007). Valuation of intellectual capital in knowledge-based firms - The need for new methods in a changing economic paradigm. *Management Decision, 45*(9), 1484-1496.

Bozzolan, S. (2003). Italian annual intellectual capital disclosure: an empirical analysis. *Journal of Intellectual Capital, 4*(4), 543-558.

Brown, J. R., Fazzari, S. M., and Petersen, B. C. (2009). Financing Innovation and Growth: Cash Flow, External Equity, and the 1990s R&D Boom. *The Journal of Finance, 64*(1), 151-185.

Cabrita, M. d. R., and Bontis, N. (2008). Intelectual capital and business performance in the Portuguese banking industry. *International Journal of Technology Management, 43*(1-3), 212-237.

Carpenter, R. E., and Petersen, B. C. (2002). Capital Market Imperfections, High-Tech Investment, and New Equity Financing. *The Economic Journal, 112*(477), 54-72.

Chang, S. C., Chen, S.-S., and Lai, J.-H. (2008). The effect of alliance experience and intellectual capital on the value creation of international strategic alliances. *Omega-International Journal of Management Science, 36*(2), 298-316.

Chen, J., Zhu, Z., and Xie, H. Y. (2004). Measuring intellectual capital: a new model and empirical study. *Journal of Intellectual Capital, 5*(1), 195-212.

Chen, Y. S., Lin, M. J. J., and Chang, C. (2006). The influence of intellectual capital on new product development performance – the manufacturing companies of Taiwan as an example. *Total Quality Management & Business Excellence, 17*(10), 1323–1339.

Chi, C. W., Lieu, P. T., Hung, K., and Cheng, H. W. (2016). Do industry or firm effects drive performance in Taiwanese knowledge-intensive industries? *Asia Pacific Management Review, 21*(3), 170-179.

Chu, P. Y., Hsiung, H.-H., Huang, C.-H., and Yang, C.-Y. (2008). Determinants of the valuation of intangible assets - a contrast between Taiwanese and American IC design houses. *International Journal of Technology Management, 41*(3-4), 336-358.

Cincera, M., Ravet, J., and Veugelers, R. (2015). The sensitivity of R&D investments to cash flows: comparing young and old EU and US leading innovators. *Economics of Innovation and New Technology, 25*(3), 1-17.

Clarke, M., Seng, D., and Whiting, R. H. (2011). Intellectual capital and firm performance in Australia. *Journal of Intellectual Capital, 12*(4), 505-530.

Cleary, P. (2015). An empirical investigation of the impact of management accounting on structural capital and business performance. *Journal of Intellectual Capital, 16*(3), 566-586.

Cummins, J., Hasset, K., and Oliner, S. (2006). Investment behavior, observable expectations, and internal funds. *American Economic Review, 96*, 796-810.

Curado, C. (2008). Perceptions of knowledge management and intellectual capital in the banking industry. *Journal of Knowledge Management, 12*(3), 141–155.

Curado, C., Henriques, L., and Bontis, N. (2011). Intellectual capital disclosure payback. *Management Decision, 49*(7-8), 1080-1098.

Darby, M. R., Liu, Q., and Zucker, L. G. (2004). High stakes in high-technology: High-tech firm values as options. *Economic Inquiry, 42*(3), 351–369.

Díez, J. M., Ochoa, M. L., Prieto, M. B., and Santidrián, A. (2010). Intellectual capital and value creation in Spanish firms. *Journal of Intellectual Capital, 11*(3), 348-367.

Donate, M. J., Pena, I., and Sanchez de Pablo, J. D. (2016). HRM practices for human and social capital development: effects on innovation capabilities. *International Journal of Human Resource Management, 27*(9), 928-953.

Dzenopoljac, V., Janosevic, S., and Bontis, N. (2016). Intellectual capital and financial performance in the Serbian ICT industry. *Journal of Intellectual Capital, 17*(2), 373-396.

Edvinsson, L. (1997). Developing intellectual capital at Skandia. *Long Range Planning, 30*(3), 320-331.

Edvinsson, L., and Malone, M. (1997). *Intellectual Capital: Realizing Your Company's True Value by Finding its Hidden Roots*. New York, NY: Harper Collins.

El-Bannany, M. (2015). Explanatory study about the intellectual capital performance of banks in Egypt. *International Journal of Learning and Intellectual Capital, 12*(3), 270-286.

Falato, A., Kadyrzhanova, D., and Sim, J. (2013). Rising intangible capital, shrinking debt capacity, and the US corporate savings glut. *Federal Reserve Board Working Paper*.

Firer, S., and Williams, M. (2003). Intellectual capital and traditional measures of corporate performance. *Journal of Intellectual Capital, 4*(3), 348-360.

FitzPatrick, M., Davey, J., Muller, L., and Davey, H. (2013). Value-creating assets in tourism management: Applying marketing's service-dominant logic in the hotel industry. *Tourism Management, 36*, 86-98.

Gatchev, V. A., Spindt, P. A., and Tarhan, V. (2009). How do firms finance their investments? The relative importance of equity issuance and debt contracting costs. *Journal of Corporate Finance, 15*(2), 179-195.

Gho, P. C. (2005). Intellectual capital performance of commercial banks in Malaysia. *Journal of Intellectual Capital, 6*(3), 385-396.

Ghosh, S., and Mondal, A. (2009). Indian software and pharmaceutical sector IC and financial performance. *Journal of Intellectual Capital, 10*(3), 369-388.

Greco, G., Ferramosca, S., and Allegrini, M. (2014). Exploring intellectual capital in family firms. An empirical investigation. *International Journal of Learning and Intellectual Capital, 11*(2), 91-106.

Griliches, Z. (1990). Patent Statistics as Economic Indicators: A Survey. *Journal of Economic Literature, 28*, 1661-1707.

Guariglia, A. (2008). Internal financial constraints, external financial constraints, and investment choice: Evidence from a panel of UK firms. *Journal of Banking & Finance, 32*(9), 1795-1809.

Guerrini, A., Romano, G., and Leardini, C. (2014). Does intellectual capital efficiency affect financial performance the case of italian listed firms. *International Journal of Learning and Intellectual Capital, 11*(2), 127-148.

Gujarati, D., and Porter, D. (Eds.). (2010). *Essentials of Econometrics* (4th ed ed.). New York: McGraw – Hill International.

Haji, A. A. (2015). The role of audit committee attributes in intellectual capital disclosures Evidence from Malaysia. *Managerial Auditing Journal, 30*(8-9), 756-784.

Haji, A. A. (2016). Trend of hidden values and use of intellectual capital information Evidence from Malaysia. *Accounting Research Journal, 29*(1), 81-105.

Hall, B. H. (2010). The Financing of Innovative Firms. *Review of Economics and Institutions,, 1*(1), Article 4.

Hall, B. H., Jaffe, A., and Tratjenberg, M. (2005). Market value and petent citations. *Rand Journal of Economics, 36*(1), 16–38.

Hall, B. H., and Lerner, J. (2010). The Financing of R&D and Innovation. In B. H. Hall and N. Rosenberg (Eds.), *Handbook of the Economics of Innovation*. North Holland: Elsevier.

Hall, B. H., Moncada-Paternò-Castello, P., Montresor, S., and Vezzani, A. (2016). Financing constraints, R&D investments and innovative performances: new empirical evidence at the firm level for Europe. *Economics of Innovation and New Technology, 25*(3), 183-196.

Hall, R. (1992). The strategic analysis of intangible resources. *Strategic Management Journal,, 13*(2), 135–144.

Harrison, S., and Sullivan, P. H. (2000). Profiting from intellectual capital – learning from leading companies. *Journal of Intellectual Capital, 1*(1), 33-46.

Hejazi, R., Ghanbari, M., and Alipour, M. (2016). Intellectual, Human and Structural Capital Effects on Firm Performance as Measured by Tobin's Q. *Knowledge and Process Management, 23*(4), 259-273.

Hogan, T., and Hutson, E. (2005). Information Asymmetry and Capital Structure in SMEs: New Technology-Based Firms in the Irish Software Sector. *Journal of Global Finance, 15*(3), 369–387.

Holland, J. (2006). Fund management, intellectual capital, intangibles and private disclosure. *Managerial Finance, 32*(4), 281.

Hovakimian, A., and Li, G. (2011). Large Sample Evidence on Capital Structure and Employee Wages. Working Paper, Baruch College.

Iazzolino, G., and Laise, D. (2016). Value creation and sustainability in knowledge-based strategies. *Journal of Intellectual Capital, 17*(3), 457-470.

Ibadin, P. O., and Oladipupo, O. A. (2015). Determinants of Intangible Assets Disclosure in Quoted Companies in Nigeria. *Asian Journal of Accounting and Governance, 6*, 13-25.

Ilyin, D. S. (2014). The Impact Of Intellectual Capital On Companies` Performance: Evidence From Emerging Markets. *Korporativnye finansy*(4), 46-66.

Janosevic, S., and Dzenopoljac, V. (2012). Impact of intellectual capital on financial performance of serbian companies. *Actual Problems of Economics, 133*(7), 554-564.

Jensen, M., and Meckling, W. (1976). Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. *Journal of Financial Economics, 3*(4), 305-360.

Joshi, M., Cahill, D., Sidhu, J., and Kansal, M. (2013). Intellectual capital and financial performance: An evaluation of the Australian financial sector. *Journal of Intellectual Capital, 14*(2), 264-285.

Kujansivu, P., and Lönnqvist, A. (2007). Investigating the value and efficiency of intellectual capital. *Journal of Intellectual Capital, 8*(2), 272-287.

Labra, R., and Sánchez, M. P. (2013). National intellectual capital assessment models: A literature review. *Journal of Intellectual Capital, 14*(4), 582-607.

Lee, S. P., and Mohammed, S. I. (2014). Intellectual capital on listed agricultural firms' performance in Malaysia. *International Journal of Learning and Intellectual Capital, 11*(3), 202-221.

Lev, B. (2001). *Intangibles: Management, Measurement, and Reporting*. Washington D.C.: Brookings Institution Press.

Lev, B. (2005). *Intangible Assets: Concepts and Measurements*: Elsevier Inc.

Liao, P. C., Chan, A. L.-C., and Seng, J.-L. (2013). Intellectual capital disclosure and accounting standards. *Industrial Management & Data Systems, 113*(8), 1189-1205.

Lim, S. C., Macias, A. J., and Moeller, T. (2016). *Intangible Assets and Capital Structure*. Paper presented at the Finance Meeting EUROFIDAI - AFFI, Paris December 2016. https://ssrn.com/abstract=2514551

Liu, Q. (2000). *Knowledge Capital, Growth Opportunities, and Leverage: Evidence from U.S. Biotechnology Firms*. Retrieved from http://ssrn.com/abstract=248908

Liu, Q., and Wong, K. P. (2011). Intellectual Capital and Financing Decisions: Evidence from the US Patent Data. *Management Science, 57*(10), 1861-1878.

Liu, X., van Jaarsveld, D. D., Batt, R., and Frost, A. C. (2014). The Influence of Capital Structure on Strategic Human Capital: Evidence from U.S. and Canadian firms. *Journal of Management, 40*(2), 422-448.

Loumioti, M. (2012). The Use of Intangible Assets as Loan Collateral. Available at SSRN: https://ssrn.com/abstract=1748675

Maaloul, A., Ben Amar, W., and Zeghal, D. (2016). Voluntary disclosure of intangibles and analysts' earnings forecasts and recommendations. *Journal of Applied Accounting Research, 17*(4), 421-439.

Maditinos, D., Chatzoudes, D., Tsairidis, C., and Theriou, G. (2011). The impact of intellectual capital on firms' market value and financial performance. *Journal of Intellectual Capital, 12*(1), 132-151.

Magri, S. (2014). Does issuing equity help R&D activity? Evidence from unlisted Italian high-tech manufacturing firms. *Economics of Innovation and New Technology, 23*(8), 825-854.

Marr, B., and Chatzkel, J. (2004). Intellectual capital at the crossroads: managing, measuring, and reporting of IC. *Journal of Intellectual Capital, 5*(2), 224-229.

Massaro, M., Dumay, J., and Bagnoli, C. (2015). Where there is a will there is a way IC, strategic intent, diversification and firm performance. *Journal of Intellectual Capital, 16*(3), 490-517.

Meles, A., Porzio, C., Sampagnaro, G., and Verdoliva, V. (2016). The impact of the intellectual capital efficiency on commercial banks performance: Evidence from the US. *Journal of Multinational Financial Management, 36*, 64-74.

Molodchik, M. A., Shakina, E. A., and Barajas, A. (2014). Metrics for the elements of intellectual capital in an economy driven by knowledge. *Journal of Intellectual Capital, 15*(2), 206-226.

Mondal, A., and Ghosh, S. K. (2012). Intellectual capital and financial performance of Indian banks. *Journal of Intellectual Capital, 13*(4), 515-530.

Morariu, C. M. (2014). Intellectual capital performance in the case of Romanian public companies. *Journal of Intellectual Capital, 15*(3), 392-410.

Myers, S. (1984). The Capital Structure Puzzle. *The Journal of Finance, 39*(3), 575-592.

Myers, S., and Majluf, N. (1984). Corporate Financing and Investment Decisions when Firms Have Information That Investors Do Not Have. *Journal of Financial Economics, 13*(2), 187-221.

Nazari, J. A., and Herremans, I. M. (2007). Extended VAIC model: Measuring intellectual capital components. *Journal of Intellectual Capital, 8*(4), 595-609.

Nimtrakoon, S. (2015). The relationship between intellectual capital, firms' market value and financial performance Empirical evidence from the ASEAN. *Journal of Intellectual Capital, 16*(3), 587-618.

O'Sullivan, K. J., and Schulte Jr, W. D. (2007). Models for human capital management: Human resource management of intellectual capital. *International Journal of Learning and Intellectual Capital, 4*(4), 453-466.

Olander, H., Hurmelinna-Laukkanen, P., and Heilmann, P. (2015). Human resources - strength and weakness in protection of intellectual capital. *Journal of Intellectual Capital, 16*(4), 742-762.

Ordoñez de Pablos, P. (2002). Evidence of intellectual capital measurement from Asia, Europe and the Middle East. *Journal of Intellectual Capital, 3*(3), 287-302.

Orens, R., Aerts, W., and Lybaert, N. (2009). Intellectual capital disclosure, cost of finance and firm value. *Management Decision, 47*(10), 1536-1554.

Petty, R., and Guthrie, J. (2000). Intellectual capital literature review: Measurement, reporting and management. *Journal of Intellectual Capital, 1*(2), 155-176.

Phusavat, K., Comepa, N., Sitko-Lutek, A., and Ooi, K.-B. (2011). Interrelationships between intellectual capital and performance Empirical examination. *Industrial Management & Data Systems, 111*(5-6), 810-829.

Porter, M. E., and Ketels, C. H. M. (2003). *UK Competitiveness: Moving to the Next Stage*. DTI Economics Paper, May.

Pratt, R. (2013). A Structural Model of Human Capital and Leverage. Available at SSRN: https://ssrn.com/abstract=2784518

Pulic, A. (1998). *Measuring the Performance of intellectual potential in Knowledge Economy.* Paper presented at the paper presented at the 2nd McMaster World Congress on Measuring and Managing Intellectual Capital, 21-23 January 1998, Hamilton, Ontario.

Pulic, A. (2000). VAIC (TM) - an accounting tool for IC management. *International Journal of Technology Management, 20*(5-8), 702-714.

Pulic, A. (2004). Intellectual capital – does it create or destroy value? *Measuring Business Excellence, 8*(1), 62-68.

Roodman, D. M. (2006). *How to do Xtabond2: An Introduction to Difference and System GMM in Stata*. Paper presented at the Center for Global Development, Working Paper 103.

Roodman, D. M. (2009). A note on the theme of too many instruments. *Oxford Bulletin of Economics and Statistics, 71*(1), 135-158.

Saeed, S., Rasid, S. Z. A., and Basiruddin, R. (2016). Relationship between intellectual capital and corporate performance of top Pakistani companies: An empirical evidence. *International Journal of Learning and Intellectual Capital, 13*(4), 376-396.

Scafarto, V., Ricci, F., and Scafarto, F. (2016). Intellectual capital and firm performance in the global agribusiness industry The moderating role of human capital. *Journal of Intellectual Capital, 17*(3), 530-552.

Schiuma, G., and Lerro, A. (2008). Intellectual capital and company's performance improvement. *Measuring Business Excellence, 12*(2), 3-9.

Serrasqueiro, Z., and Nunes, P. M. (2010). Non-linear relationships between growth opportunities and debt: Evidence from quoted Portuguese companies. *Journal of Business Research, 63*(8), 870-878.

St-Pierre, J., and Audet, J. (2011). Intangible assets and performance: Analysis on manufacturing SMEs. *Journal of Intellectual Capital, 12*(2), 202-223.

Ståhle, P., Ståhle, S., and Lin, C. Y. Y. (2015). Intangibles and national economic wealth - a new perspective on how they are linked. *Journal of Intellectual Capital, 16*(1), 20-57.

Stewart, T. A. (1997). *Intellectual capital: the new wealth of organizations*. New York, N.Y.: Doubleday & Co.

Sveiby, K. E. (1997). *The New Organizational Wealth: Managing and Measuring Knowledge-Based Assets*. New York: Berrett-Koehler.

Sydler, R., Haefliger, S., and Pruksa, R. (2014). Measuring intellectual capital with financial figures: Can we predict firm profitability? *European Management Journal, 32*(2), 244-259.

Tan, H. P., Plowman, D., and Hancock, P. (2007). Intellectual capital and financial returns of companies. *Journal of Intellectual Capital, 8*(1), 76-95.

Ting, I. W. K., and Lean, H. H. (2009). Intellectual capital performance of financial institutions in Malaysia. *Journal of Intellectual Capital, 10*(4), 588-599.

Titman, S. (1984). The Effect of Capital Structure on a Firm's Liquidation Decision. *Journal of Financial Economics, 13*, 137-151.

Tsakalerou, M. (2015). A meta-study of intellectual capital and firm performance: When the whole is more than the sum of its parts. *International Journal of Learning and Intellectual Capital, 12*(3), 287-299.

Windmeijer, F. (2005). A finite sample correction for the variance of linear efficient two-step GMM estimators. *Journal of Econometrics, 126*(1), 25–51.

Wooldridge, J. M. (2007). *Econometric analysis of cross section and panel data*. Cambridge: The MIT Press.

Wudhikarn, R. (2016). An efficient resource allocation in strategic management using a novel hybrid method. *Management Decision, 54*(7), 1702-1731.

Yalama, A., and Coskun, M. (2007). Intellectual capital performance of quoted banks on the Istanbul stock exchange market. *Journal of Intellectual Capital, 8*(2), 256-271.

Yang, C.-C., and Lin, C. Y.-Y. (2009). Does intellectual capital mediate the relationship between HRM and organizational performance? Perspective of a healthcare industry in Taiwan. *International Journal of Human Resource Management, 20*(9), 1965-1984.

Young, C.-S., Su, H.-Y., Fang, S.-C., and Fang, S.-R. (2009). Cross-country comparison of intellectual capital performance of commercial banks in Asian economies. *Service Industries Journal, 29*(11), 1565-1579.

Yu, H.-C., Wang, W.-Y., and Chang, C. (2015). The stock market valuation of intellectual capital in the IT industry. *Review of Quantitative Finance and Accounting, 45*(2), 279-304.

Zavertiaeva, M. (2016). Portfolio forming decisions: the role of intellectual capital. *Journal of Intellectual Capital, 17*(3), 439-456.

Zéghal, D., and Maaloul, A. (2010). Analysing value added as an indicator of intellectual capital and its consequences on company performance. *Journal of Intellectual Capital, 11*(1), 39-60.

CHAPTER 9

Conclusions, Practical Implications, Limitations and Suggestions for Future research

1. Conclusions

Intellectual capital (IC) is a key resource for firms' value creation process and to create sustainable competitive advantages. The current doctoral thesis proposed to analyse the impact of IC on firm's financial performance, growth opportunities and financing decisions. Therefore, five empirical studies were performed and their main findings are exposed as follow.

Results from the first empirical paper (CHAPTER 3) reveal that IC is an important resource for firms' value creation and human capital is found to be a key factor of firms' wealth. Also, results indicate that ownership concentration and owners' management involvement constrain firms' IC performance.

According to the second empirical paper (CHAPTER 4), results suggest that IC investments have a positive impact on firms' financial performance in the short and long run. The human capital component is of greater importance in enhancing firms' financial performance in both previous and current periods. Also, the results reveal that firms with greater R&D intensity have better financial performance, while the recent financial crisis produced a negative effect on financial performance in 2008 and 2009.

The findings from the third empirical paper (CHAPTER 5) indicate that IC efficiency of the current period has a positive impact on the financial performance. The three components of VAIC™ Model – capital employed efficiency (CEE), human capital efficiency (HCE) and structural capital efficiency (SCE) of the current period have a positive impact on financial performance, except for SCE of that for the first group of countries has a negative impact on financial performance. Also, findings suggest that the financial crisis negatively affects financial performance on both groups of countries.

Results from the fourth empirical paper (CHAPTER 6) reveal that IC efficiency of the current period has a positive impact on firm's financial performance of high-tech, medium-tech and low-tech European firms and results indicate the non-linearity of the relationship between growth opportunities and firm's financial performance. Findings suggest that the positive relationship between growth opportunities and firm's financial performance is enhanced with

the efficient use of firms' IC. Finally, results indicate that the efficient use of IC in the current period has a greater impact on growth opportunities in high firms.

Findings from the fifth empirical paper (CHAPTER 7) show that IC investments in high-tech firms have a negative impact on debt, but a positive effect on internal finance and equity issues. High-tech firms seem to rely on equity issues to finance their activities once internal finance is exhausted, avoiding debt to finance innovative projects. High-tech firms face considerable transactions costs, given the moderated adjustment of the long-term debt ratio towards the target ratio. Low ownership concentration brings a higher diversification of financing sources. The financial crisis had a negative effect on internal finance and a positive effect on long-term debt for high-tech firms.

Finally, results from the sixth empirical paper (CHAPTER 8) show that IC components, such as human capital and structural capital, negatively impacts on firm's book leverage in high and low IC efficiency firms, while the relational capital positively impacts on book leverage in high IC efficiency firms. However, results show that the interaction between the IC components, reduce the negative impact of the human capital and structural capital on book leverage. Regarding the remaining determinants of capital structure, the findings indicate a positive effect of collaterals on book leverage, which suggests the presence of information asymmetry problems as it is the case of high IC efficiency firms that face higher costs of capital and, thereby prefer internal financing due to the lower costs. The negative relationship between profitability and book leverage suggests that high and low IC efficiency firms prefer to resort firstly to internal financing. The negative effect of growth opportunities on book leverage represents potential risk and, therefore, firms reduce their debt levels. The speed of adjustment of debt level towards the target debt ratio is greater in high IC efficiency firms than in low IC efficiency firms, suggesting lower costs of adjustment for the former. This may be a consequence of more favourable terms allowed by creditors to firms with greater level of IC efficiency.

2. Practical Implications, Limitations and Suggestions for Future Research

Several practical implications of results from this doctoral thesis can be addressed. It is important that managers pay more attention to intellectual capital and its positive impact on firms' value creation and growth. Managers should invest in human capital, particularly in firms, verifying higher ownership concentration and/or firms which owner' are management involved. Investing in human capital, employees contribute with the knowledge to the firm, therefore the firm benefits form innovative capacity and greater financial performance. Also, firms should invest in continuous training programs, because it increases human capital efficiency and the performance of managers and employees. However, it may occur that the outcomes of

intellectual capital are not immediate due to aspects, such as the style of management and internal processes of the firm. Regarding the policy-makers, it is suggested the creation of incentives for the investment on intellectual capital due to the difficulty that firms may have to finance this type of assets, which contributes to firms' value creation, country wealth, and human development.

The current study has the following limitations. Given that we use a large sample of Western Europe countries, the differences between countries were not analysed, which limits our extrapolation of the results to each country as well as to the type of industry. This being so, some of the direction of the relationships may change for individual countries due to the country characteristics, such as legal aspects, accounting practices or industrial sectors. This study used the VAIC model, which does not allow us to analyse the impact of relational capital on firms' financial performance.

For future research, it is suggested longitudinal studies comparing Western European countries and industries. To extend the analysis of the relationship between different corporate governance variables and intellectual capital further research could include corporate governance variables. We suggest analysing the impact of the 2008 financial crisis on firms' intellectual capital performance through a longitudinal study. It is suggested to analyse the relationship between intellectual capital and firm's financial performance considering the periods before and after the 2008 financial crisis. Also, we suggest the use of different proxies for intellectual capital, i.e., human capital, structural capital and relational capital, would be useful to test if there are different findings from the ones we obtained.