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MtB versus VAIC in measuring intellectual capital:

Empirical evidence from Italian listed companies

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ABSTRACT

*Purpose –* Grounded in the extant theoretical and empirical literature, the purpose of this paper is to compare two of the most employed methods measuring IC value in order to find the most suitable in the context of Italian listed firms. Moreover, this paper also investigates the relationship between Intellectual Capital (IC), measured in terms of the Market to Book (MTB) ratio, and the Value Added Intellectual Coefficient (VAIC), and potential key determinants of IC value including intangible assets (IA) and a range of other factors.

*Design/methodology/approach –* The study is conducted for a sample of Italian listed firms over the period 2011-2015. Applying a holistic market-based approach and the Value Added approach, the relationship between IC value, as obtained by these two different approaches, is tested in relation to selected determinants from the extant literature.

*Findings –*  The results show that in the Italian listed firm context, MtB is a better estimator of IC value than VAIC. Further, theresults show for MtB that IA, profitability, leverage, growth and age are significant positive and determinants, while size is a significant negative determinant. For VAIC, the results show that only profitability and leverage are statistically significant positive and negative determinants, respectively, , while the other model variables are insignificant.

*Research limitations/implications -* The validity of the findings is somewhat limited to the Italian context, as the study focuses on a sample of companies listed on the Milan Stock Exchange, all of which prepare their individual financial statements according to IFRS. Further limitations are related to the use of only two alternative IC measurement approaches, along with their own limitations. The study allows academic researchers to compare the two different methods of measuring IC in order to find the most suitable IC measurement tool for other European contexts.

*Practical implications -* This paper also has implications for managers and practitioners. The findings suggest that managers should manage the risk that firm growth (an increase in firm size) could lead to a decrease in IC value, in the absence of a consistent IC-oriented investment strategy. In other words, managers should, avoid smoothing their IC investment as the company grows, in order to maintain a stable MTB ratio. Further, practitioners, such as financial analysts should be aware of the different ways of measuring performance, as the results show a high correlation between indicators such as VAIC and ROA. It is worth exploring, from a non-shareholder perspective, the many facets of corporate performance, in order to take account of wider stakeholders.

*Originality/value –* This paper contributes to the IC literature as it is the first study which compares two alternative IC measurement methods, Market to Book (MtB) and Value Added Intellectual Coefficient (VAIC), in order to find the most suitable method to capture IC value in an Italian context, and within the framework of IFRS. Moreover, it investigates the potential determinants of IC value calculated using the two methods.

Keywords: Intellectual capital; Intangible assets; Market-to-book ratio; VAIC; Italian listed firms

**MTB versus VAIC in measuring intellectual capital: Empirical evidence from Italian listed companies**

1. **Introduction**

Recent years have been marked by the emergence of a knowledge-based economy characterized by the globalization of markets, the dematerialization of processes, and the development of global financial markets (Guthrie et al., 2012; Dženopoljac et al., 2016; Osinski et al., 2017). In the modern economy, intangible assets have acquired pivotal importance compared to tangible assets, and represent a critical success factor for both achieving competitive advantage and generating economic wealth since they are knowledge-based, specific to each company, and are difficult to replicate and imitate (Chen et al., 2005; Khalique et al., 2015; Castilla-Polo and Ruiz-Rodriguez, 2017; Dumay and Guthrie, 2017).

Several authors recognize that the accounting term “intangible assets” and the management term “intellectual capital” are largely synonymous (Lev, 2001; Puntillo, 2009; Goebel et al., 2015; Osinski et al., 2017). Khalique et al. (2015, p.225) argue that “intellectual capital represents a combination of intangible assets or resources, such as knowledge, know-how, professional skills and expertise, customer relationships, information, databases, organizational structures, innovations, social values, faith, and honesty. These can be used to create organizational value and provide a competitive edge to an organization”.

Moreover, Dumay (2016, p.169), by emphasizing the concept of “value” rather than “wealth”, replace the definition of Stewart (1997) by defining IC as follows: “[IC] is the sum of everything everybody in a company knows that gives it a competitive edge […] Intellectual Capital is intellectual material, knowledge, experience, intellectual property, information […] that can be put to use to create [value]”.

Drawing upon the insights from these two definitions of IC, the relevance of Intellectual Capital emerges as a fundamental driver of firm value creation and sustainable competitive advantage, such that the identification and measurement of IC has become pivotal in this knowledge based economy, though it remains problematic (Sydler et al., 2014; Goebel, 2015).

Thus, the identification, management, and measurement of intellectual capital (IC) have become a subject of significant researcher and practitioner interest (Dumay, 2009; Gogan, 2014; Sydler et al., 2014; Goebel, 2015; Osinski et al., 2017). In particular, the correct identification and measurement of IC present some benefits to those both internal and external to the firm.

The internal benefits conferred upon the management of the firm extend to better strategy formulation and evaluation, coupled with better business performance (Dumay, 2009; Jahanian and Salehi, 2013; Lal Bhasin, 2012; Dženopoljac et al., 2016). The external benefits relate to the provision of more detailed and useful information to investors about the sources of firm value creation, whereby information asymmetry and thus the cost of equity are reduced and the decision-making process of investors in the firm is improved (Lal Bhasin, 2012; Cronje and Moolman, 2013; Dumay, 2016; Osinski et al., 2017).

However, many difficulties arise when attempting to identify and measure IC. First, accounting principles are inadequate in terms of providing a correct representation of intangible assets on the balance sheet due to the overly-conservative standpoint of standard setters, thereby giving rise to an absence of the necessary data (Lev et al., 2005; Cronje and Moolman, 2013; Ferchichi and Paturel, 2013; Goebel, 2015). Second, some managers are unwilling to disclose sensitive information about the firm’s valuable resources as this may give rise to a loss of competitive advantage (Dumay, 2016). Finally, the idiosyncratic nature of IC resources, linked to specific features of the individual enterprise (e.g. business activities and model), does not allow for the development of an universal measurement model (Paździor and Paździor, 2012).

Due to IC relevance, coupled with issues of correct IC identification and measurement, more recently there has been a proliferation of frameworks and models for measuring IC, each with its own strengths and weaknesses, though no commonly accepted model for IC measurement has emerged to date (Guthrie and Petty, 2000; Anghel, 2008; Khalique et al., 2015; Osinski et al., 2017), thereby creating a lack of synthesis in the academic literature.

Thus, several IC scholars (Anghel, 2008; Paździor and Paździor, 2012; Gogan, 2014; Goebel, 2015; Osinski et al., 2017) have attempted to systematize and classify the different models employed in the literature.

Osinski et al. (2017), in their extensive literature survey, present 44 methods for evaluating intangible assets which are grouped according to their corporate, economic or strategic management taxonomies, while Sydler et al. (2014, p. 247) applies a matrix developed by Sveiby (2001) by distinguishing IC valuation models in terms of their valuation level (organizational or component level) and their method (non-monetary and monetary). Moreover, Paździor and Paździor (2012) distinguish between synthetic and analytical methods.

Goebel (2015) divides IC value measurement approaches into investment-based, component-based, and holistic market-based approaches.

Finally, Gogan (2014, p.195) focuses on the following non-financial measurement methods: *Balanced Scorecard*, *Skandia Navigator,* and *Intangible Assets Monitor*.

Thus, based on the extant literature, a gap emerges since there is no a single model recognized as superior to the others and universally applicable to any country. Further, there is a scarcity of studies which compare the different models in order to find which is most suitable in a given context and thus help practitioners, investors and researchers in IC evaluation.

In the context of German listed companies, and excluding financial firms, Goebel (2015) compares three different IC measurement models, Long-run value-to-book (LRVTB), MtB and Tobin’s q, and finds that LRVTB is the best estimator for IC value, while other authors focus on a single method (e.g. MtB, VAIC) in their studies. Underpinned by the existing theoretical and empirical literature (e.g. Goebel, 2015), the purpose of this paper is to compare different methods for measuring IC value in order to find which is the most suitable approach in the context of Italian private sector listed firms.

Moreover, this research also investigates the explanatory factors which determine IC values determined using two different methods. In particular, this research, is based on Sveiby’s classification (2001), as revised by Sydler et al. (2014), and employs two methods which classify by organizational level and monetary quantification: the Market to book Ratio (MtB) based on the *Market capitalization approach* and the Valued Added Intellectual Coefficient (VAIC) based on the *Return on assets approach*.

The choice of methods is based on the following rationale. Firstly, consistent with the findings of Ramanauskaitė and Rudžionienė (2013), the methods are among the most utilized and discussed in the literature (Pulic, 1998; Cazavan-Jeny, 2004; Mavridis, 2004; Chen et al., 2005; Bramhandkar et al., 2007; Gan and Saleh, 2008; Maditinos et al., 2011; Morariu, 2014; Tseng et al., 2015; Dženopoljac et al., 2016; Noradiva et al., 2016) and in particular in the Italian context (Puntillo, 2009; Gigante, 2013; Iazzolino and Laise, 2013; Forte et al., 2017).

Secondly, as the methods are based mainly on established accounting rules they are therefore more transparent, comparable and reliable than alternative approaches (Jurczak, 2008; Paździor and Paździor, 2012; Sydler et al., 2014).

The empirical analysis of the paper therefore focuses on a sample of Italian listed firms over the period 2009-2014 and tests two of the most commonly employed IC measurement methods in order to judge which captures IC value best.

1. **The context of MtB versus VAIC**

In the extant literature, scholars propose different classifications of IC value measurement models. In this paper, the classification of Sydler et al. (2014, p. 247), as revised by Sveiby (2001) is used as our reference, as detailed in Figure I.

The figure shows a two-dimensional matrix in which the IC value measurement models are classified by their valuation level (organizational or components level) and by the means size of the method (non-monetary or monetary).

**[Insert Figure I here]**

Since the aim of this paper is to compare IC value measurements which are widely employed in the IC literature, and particularly in the Italian context which allow reliable comparisons, two methods are selected which are monetary based and belonging to the family of “organizational level”: the MtB (Market Capitalization Method) and the VAIC (Return on Assets Method). Both of the indicators lead to a quantitative measure and are based on accounting and market data which are easily obtainable and verifiable, thus allowing simple comparisons (Pulic, 1998, 2000; Firer and Williams; 2003; Ghosh and Wu, 2007; Jurczak, 2008; Paździor and Paździor, 2012; Godyn, 2013; Sydler et al. 2014). Moreover, they are among the most utilized by IC scholars (Bramhandkar et al., 2007; Morariu, 2014; Noradiva et al., 2016).

On the contrary, the “Scorecard Approach” is based on multifarious and somewhat eclectic information sources (quantitative/qualitative, financial/non-financial), which are typically chosen according to the goals of the firm’s management, and thus to satisfy the information needs of internal users. This approach in general does not lead to a definite or quantitative measure of IC and is based on a subjective/qualitative measure that may entail some problems of reliability and transparency, thereby preventing easy comparison (Jurczak, 2008; Paździor and Paździor, 2012; Gogan, 2014; Sydler, 2014).

In the same vein, “Direct Intellectual Capital Methods”, while more detailed and aiming to determine the monetary values of the single components of intangible assets, are difficult to employ due to the problem of obtaining quantitative/monetary information on IC assets (Sydler et al. 2014; Goebel, 2015), rendering them more suitable for not-for-profit organizations (Jurczak, 2008).

In the family of the “Market Capitalization Approach”, the predominant measure is the MtB ratio. This approach is based on the assumption that IC may be considered a significant “hidden value” of intangible resources that are not reported as “assets” in the financial statements (Edvinsson and Malone, 1997, Sveiby, 2001; Brennan, 2001; Whiting and Miller, 2008; Forte et al., 2017). This approach is based on the holistic effects of interactions between IC components which typically generate an overall value greater than the aggregate value of the individual estimates (Van der Meer-Kooistra and Zijlstra, 2001). It measures the value of a company’s IC as the difference between the company’s market capitalization and its book value. Thus, a positive IC value arises where the market-to-book ratio is above unity (Stewart, 1997; Luthy, 1998).

In recent years, several studies have exploited the MtB ratio in order to estimate IC value according to the *Market Capitalization Approach* (Brennan, 2001; Cazavan-Jeny, 2004; Bramhandkar et al., 2007; Kok, 2007; Whiting and Miller, 2008; Tseng et al., 2015; Goebel, 2015). These studies assume that financial markets are efficient and accurate in their valuation of listed companies beyond their financial statements, drawing upon all relevant information from other sources, and that any excess value over a company’s book value depends on a correct valuation of the company’s visible (e.g. protected brands) and invisible (e.g. “overall reputation”) intangible assets (Lal Bhasin, 2012). Bramhandkar et al. (2007, p.359) argue that the MtB ratio measure is “well established in the literature and, although broad, readily identify(s) those organizations doing a better job with their knowledge assets”. Moreover, Ramanauskaitė and Rudžionienė (2013) in their literature review on IC valuation methods, find that MtB based methods are most evident in IC scientific works.

Several scholars (Bramhandkar et al., 2007; Ghosh and Wu, 2007; Jurczak, 2008; Whiting and Miller, 2008; Paździor and Paździor, 2012; Forte et al., 2017) find that besides its information value, the method is simple to apply, it uses publicly available data, and enables simple comparisons. Nevertheless, two main issues arise from the application of the MtB ratio: (i) the distortion of data generated by historical cost accounting; and (ii) the influence, especially in short-term analysis, of “unpredictable” market fluctuations (Dumay, 2012; Paździor and Paździor, 2012; Goebel, 2015).

In summary, the MtB ratio enables a measurement of the specific contribution of intangibles (assumed to be equivalent to IC) to the creation of additional value, as recognized by the market as exceeding the book value of a company’s net assets.

The VAIC method is one application of the Return on Assets approach, as proposed by Pulic (1998, 2000, 2004). It aims to provide objective and verifiable information about the efficiency of both tangible and intangible assets in the creation of “value added” (). is usually calculated as either the difference between outputs and Inputs:

Where P is operating profits; is employee costs (salaries plus social expenses) and and are the depreciation and amortization of assets, respectively).

In Pulic’s model, salaries and wages are not considered as costs, but as investments in Human Capital (). Pulic derives a primary efficiency indicator, Human Capital Efficiency –(), by dividing value added () by human capital ():

A further efficiency indicator, which is not present in Pulic’s first version of VAIC, is Structural Capital Efficiency (). Despite its definition as “capital”, structural capital here is calculated as the difference between and and thus it is not a “stock”, but a “flow” broadly corresponding to EBITDA (earnings before interest, taxes, depreciation and amortization).

It is interesting to note that may be expressed as:

In other words, the first indicator () is directly proportional to , while the second indicator is inversely proportional to , and both are inversely proportional to HC. It is also interesting to note that is itself a “flow”, as it is a negative component of net income.

Finally, there is the third indicator, Capital employed efficiency (), which is calculated by dividing by the book value of the company’s net assets ( or alternatively ):

It is not clearly defined whether (or ) also includes intangible assets as reported in financial statements or (as more likely) it is restricted solely to tangible (physical) assets.

The adopted approach varies from one version of the model to another in Public’s work and other authors’ applications.

In Pulic (1998) “physical capital” is defined as “all necessary funds” such as equity, after tax profits, open reserves, and so on, and does not provide a clear explanation about the content of CE.

The three indicators discussed are summarized by Pulic in a single indicator: VAIC or Value Added Intellectual Coefficient, the specification of which reveals Pulic’s assumption that the critical factor in the value-creation process is the intellectual “potential” expressed by employees. In analytical terms:

Various authors (Firer and Williams; 2003; Jurczak, 2008; Puntillo, 2009; Maditinos et al., 2011; Paździor and Paździor, 2012) outline the main advantages of this indicator: (i) the model requires only a simple calculation; (ii) VAIC and its components may be derived from accounting data which are generated entirely from the firm’s operations and verified by the firm’s auditors; (iii) as it based on objective data, VAIC may be used for effective comparison between different firms; and (iv) VAIC is based conceptually on Value Added, a widely accepted measure of value creation through business activity. Moreover, Iazzolino and Laise (2013, p. 549) argue that “in a multidimensional logic, VAIC could be included in the set of indicators of the financial perspective or in those of the learning and growth perspective, in the BSC (Kaplan and Norton, 1996)”.

However, various scholars have discussed the limitations of VAIC (Stahle et al., 2011; Iazzolino and Laise, 2013; Goebel, 2015; Dzenopoljac et al., 2016). Firstly, it focuses mainly on the Value-Added Income Statement, so it utilizes a traditional accounting procedure and, therefore cannot be considered a true alternative to other more traditional methodologies (e.g. EVA), as Pulic argues in his early work. Secondly, if human capital is considered to be an investment, it should therefore be added to capital employed. Thirdly, VAIC assumes that all labor expenses reported in the income statement are related to IC, while a proportion of such expenses might reasonably be considered as mere operating expenses incurred in the period. In particular, it may be argued that the VAIC method does not concern IC at all, as it only measures the operational efficiency of a company and, as in terms of human capital, it considers only annual salaries, neglecting the firm’s investment in training employees, which may bring with it motivation, new experience and augmented skills and thus additional knowledge for the organization as a whole. Finally, the model does not take in account the synergies that exist between the various components of VAIC, which may be seen as the “holistic” aspects of IC, and the approach and does not consider extensively the innovation capacity and the “relational capital” of a firm.

1. **Previous empirical research on VAIC and MtB**

In the extant empirical research, different VAIC formulations are used, including the “Decomposed VAIC”, whereby the indicator is divided into its three components in order to appreciate their individual impact on the dependent variable, and the “Modified VAIC” which also considers the investments in workers’ training activities as a component of HC.

The VAIC model is increasingly used in several areas of empirical research. Firer and Williams (2003) used Pulic’s indicator to measure the effect of IC on ROA and the market value of Southern African companies. They find that the association between VAIC and firm profitability and valuation is in general limited, suggesting that physical capital is the predominant success factor for corporate performance in a South African context. Chen et al. (2005) apply VAIC to explore the relation between the joint efficiency measure of capital employed and IC and Taiwanese listed company current and future financial performance, as expressed by the MtB ratio. They find that investors place different value on the three components of VAIC (physical, human and structural capital). In particular, they find that while VAIC provides an adequate measure of intellectual capital, its measure for structural capital may be incomplete, mainly as R&D expenditure and advertising expenses are expensed as incurred, and therefore subtracted from the calculation of value added. PewTan et al. (2007) use Pulic’s approach to measure the association between IC and financial performance for Singaporean publicly listed companies and find that IC and company performance are positively related.

Furthermore, VAIC has been tested in the banking sector, though with mixed results. Puntillo (2009) finds no association, except for the relation between CEE and some measures of company’s performance, while Gigante (2013) finds a short-term correlation between VAIC and the financial performance, but did not find a correlation between VAIC and market value. El Bannany (2008) investigates a sample of UK banks over the period 1999-2005, and finds that investment in information technology systems, bank efficiency, barriers to entry, and the efficiency of investment in intellectual capital, have a significant impact on intellectual capital performance as measured by VAIC.

Maditinos et al. (2011) find for Greek listed companies a significant association between a component of VAIC (HC) and ROA, but find no such relation between ROA and the other components of the VAIC (physical and structural). Morariu (2014) studies a sample of Romanian companies and finds a negative association between VAIC and MtB, though finds no association between VAIC, company size and company profitability, as measured in terms of ROE. Dzenopoljac et al. (2016) use VAIC to measure the contribution of IC to value creation in Serbian ICT companies, and find that only one component of VAIC, capital-employed efficiency, has a significant effect on financial performance as measured by indicators such as ROE and ROA.

With regard to MtB, while the VAIC based studies of IC typically use the MtB ratio as a proxy for market value (Chen et al., 2005; Maditinos et al., 2011; Morariu, 2014), other studies use MtB as a proxy for IC value (Brennan, 2001; Cazavan-Jeny, 2004; Bramhandkar et al., 2007; Kok, 2007; Whiting and Miller, 2008; Lal Bhasin, 2012; Goebel, 2015). Some authors study the relationship between IC value, calculated in terms of the MtB ratio, and the level of IC disclosure (Brennan, 2001; Whiting and Miller, 2008). Cazavan-Jeny (2004) investigates the drivers of differences between market value and book value for French firms, and finds a positive and statistically significant relationship between the MtB ratio and goodwill, growth, risk, profitability. However, Cazavan-Jeny (2004, p. 21) finds no association between the MtB ratio and either expensed intangible intensity or the capitalized intangible intensity.

Bramhandkar et al. (2007) study a sample of 139 drugs industry firms , focusing on the impact of intellectual capital management, measured as the difference between market value and book value, on organizational performance. They find that firms with the highest level of intangible assets clearly perform better than those with lower levels, and that the former have significantly better returns and significantly less variability in stock prices. Lal Bhasin (2012) examine a small sample of Indian pharmaceutical companies in which the market value added (MVA) approach is applied for measuring IC, and they find a negative correlation between IC and net operating profit. He also finds that 41.25% of market value in the is contributed by IC, while the remainder is contributed by tangible assets. In an Italian context, Forte et al. (2017), analyzed a sample of 140 Italian listed firms over the period 2009-2013 in order to test the relationship between IC value and other factors influencing IC value. They find that intangible assets, auditor quality, profitability, family ownership, and leverage positively affect IC value. Finally, Goebel (2015) conducts a study of German non-financial companies, comparing three IC value measures, MtB, LRVTB and Tobin’s q, and finds that LRVTB is the best estimator for IC value. However, she does not find a significant relationship between LRVTB and intangible assets, but only a positive relationship with payments and leverage, and a negative relationship with size.

In summary, a review of the extant literature reveals that a gap exists as there are is plethora of empirical studies which employ only a method for IC measurement, while a paucity of studies compare different IC value measures. As each method has its relative merits, this paper, consistent with Goebel (2015), attempts to fill the gap by engaging in a comparison between two among the most commonly utilized IC measurement methods, the MtB and VAIC approaches, in the context of Italian listed companies, in order to gauge which is the more suitable for capturing IC value. Moreover, the paper tests potential explanatory factors of the level of IC as calculated using the two methods.

1. **Hypothesis development**
   1. Intangible assets

Intangible assets are considered in the literature as synonymous with IC (Guthrie and Petty, 2000; Lev et al., 2001; Osinski et al., 2017).

Edvinsson and Malone (1997) and Lev and Zambon (2003) argue that intangible assets are a relevant component of IC, and thus there is a substantial overlap between the two. Kok (2007, p.184) states that “intellectual assets are those knowledge-based items that the organization owns that will produce a future stream of benefits for the organization” and that “ideally, the total value of intellectual assets should be equal to the total intellectual capital”. As Cazavan-Jeny (2004) argues and finds, the intensity of intangible asset investments must be positively correlated with the MtB ratio as the market is capable of valuing those intangible assets which are not adequately recognized in the firm’s balance sheet.

Goebel (2015) investigates the relationship between IC, proxied by LRVTB, and intangible assets, though finds no relation. Villalonga (2004) measures IC using R&D, advertising expenditures (recognized in the income statement of the year) and (capitalized) intangible assets recognized on the balance sheet, and finds that R&D and advertising expenditures are important components of IC value as there is a positive association between IC value and these advertising expenses.

Thus, consistent with the existing literature (Edvinsson and Malone, 1997; Cazavan-Jeny, 2004; Kok, 2007; Lal Bhasin, 2012) the following hypothesis is stated:

*H1a: IC value, measured in terms of MtB, is positively associated with recognized (visible) intangible assets.*

Here we consider the relationship between VAIC and investment in intangible assets, that is, a proxy for IC. Pulic (2000) introduces VAIC with the purpose of providing information on value creation efficiency of a firm’s tangible and intangible assets. One drawback of this model is the use of basic financial information as intellectual capital is an intangible asset (El Bannany, 2008).

IC covers the knowledge and experience which skilled staff use to gain a competitive advantage for the company through applying creative strategies. Thus, both physical and intellectual capital are important for creating firm value. El Bannany (2008) argues that measuring IC performance assumes that the existence of physical capital is essential to allow human capital to contribute to creating added value. Human capital cannot act without physical capital, so this part of IC cannot be ignored when constructing an index of IC performance. Indeed, highly skilled employees are not able to demonstrate their ability to create value in the absence of certain facilities such as investments in technology or IT. In this sense, Pulic importantly creates a bridge between the concept of value added and that of value creation in a knowledge economy context. He argues that in knowledge companies there is no need to modify accounting principles in order to accommodate the existence of knowledge workers. Interpretation of the Value-Added Income Statement allows the productivity of knowledge workers and the creation of the new value generated from them to be measured. In this way, investments in knowledge to create value become a key competitive strategy (Pulic, 1998, 2000, 2008). Underpinned by these arguments, VAIC complements existing methods and thus can be usefully included as innovative indicator of IC efficiency. A review of the literature reveals the use of VAIC as both a dependent and an independent variable. However, it is included in this paper as an independent variable.

VAIC is tested by Pulic (2000) on UK companies for the period 1992-1998. The Scholar finds that the average values of VAIC and MtB exhibit a high degree of similarity. For UK firms, similar results are obtained by Zeghal and Maaloul (2010) who replicate the study using 2005 data. Chen et al. (2005) analyze the relationship between VAIC and MtB, as well as corporate performance, for Taiwanese listed companies over the period 1992-2002 and find that investors place a higher value on firms with better IC efficiency, and that such firms yield greater profitability and revenue growth. To the best our knowledge, no extant studies test the relation between VAIC and the investment in intangible assets (as a proxy for intellectual capital). Thus, it is argued that a relation between VAIC and investments in (recognized) intangible assets should not exist, even though investments in IA are associated with IC value. Thus, we hypothesize that there should be no relation between VAIC and investments in IA. Accordingly, our hypothesis is stated as follows:

*H1b: IC value, measured in terms of VAIC, is not associated with recognized (visible) intangible assets.*

* 1. Profitability

Keenan and Aggestam (2001) argue that focus of firms on IC is important as it transforms more tangible physical and financial capital into added value and improved performance. Nicholson and Kiel (2004) argue that firms must pay specific attention to IC when seeking to improve their performance. Cazavan-Jeny (2004) find in French firms that profitability positively affects the MtB ratio. Consistent with this result, Forte et al. (2017) analyze a sample of Italian listed companies for the period 2009-2013, and find that profitability positively influences the level of IC proxied by MtB. Thus, we hypothesize a positive relationship between the MtB ratio and the firm profitability.

Several studies investigate the relationship between IC value in terms of VAIC and firm profitability (Firer and Williams, 2003; Mavridis, 2004; Chen et al., 2005; Gan and Saleh, 2008; Puntillo, 2009; Maditinos et al., 2011; Gigante, 2013; Morariu, 2014; Dženopoljac et al., 2016; Noradiva et al., 2016), arguing that IC is a relevant strategic asset which if appropriately managed can lead to an improvement in firm performance. However, they specify VAIC as an independent rather than as a dependent variable in order to examine whether better IC management affects the firm profitability. The majority of empirical studies find a positive relationship between VAIC, or its components, and firm market value, productivity and profitability (Morariu, 2014). El-Bannany (2008) specify VAIC as the dependent variable in their model, and find that efficiency and profitability in banks have a positive impact on IC performance. Bramhandkar et al. (2007) study listed North American drugs industry firms and find that better IC management (calculated using the market capitalization approach) is correlated with better stock returns.

On the basis of the extant literature, we hypothesize a positive relationship between VAIC and firm profitability, establishing the hypothesis:

*H2: IC value is positively associated with firm profitability.*

* 1. Leverage

Some authors (Keenan and Aggestam, 2001; Goebel, 2015) argue that highly leveraged firms are subject to the influence of lenders, which through their bargaining position exert a strong influence on the firm’s management, motivating them to increase their investment in IC as well as encouraging them to better manage their IC resources given their importance to value creation.

Moreover, this influence is particularly present in countries with insider governance systems (Dignam and Galanis, 2009; Goebel, 2015). Italian firms are particularly affected by the presence of banks as key stakeholders so a positive relationship between leverage and IC value is expected.

Goebel (2015) investigates the relationship between leverage and IC value, calculated as LRVTB, in German firms and finds a positive relationship. Further, Forte et al. (2017), in the Italian context find a positive and significant relationship between firm leverage and IC value measured in terms of MtB. Thus, consistent with the extant literature, a positive relationshipship is expected between MtB and leverage:

*H3a: IC value, measured in terms of MtB, is positively associated with firm leverage.*

Leverage is the proportion of the firm’s assets that are financed by debt. Leverage results in interest costs that must be paid by the company. On one hand, leverage can increase the firm’s ability to invest in information systems that enhance the firm’s competitiveness and performance. On the other hand, the installments required in terms of the loan repayment and interest can also limit the funding available for human resources. Further, leverage measures the proportion of financing represented by debt that the company employs to finance its investment. The higher the degree of leverage, the greater the financial risk that it faces, and in return investors will ask for greater profits to compensate (Suhermin, 2014). To the authors best knowledge, there are no studies that investigate the effect of leverage on VAIC as a proxy for IC as the prior literature mainly specifies VAIC as an independent variable in empirical studies. We might reasonably expect a negative relation between leverage and VAIC as leverage implies an increased use of capital that, given a constant the level of value creation, should reduce the efficiency indicators that constitute VAIC. A negative relation may also be explained by a lower cost of debt than equity which may lead to reduced pressure for creating added value in order to compensate capital providers. Thus, we do not hypothesize any relation between the dependent variable VAIC and leverage.

*H3b: IC value, measured in terms of VAIC, is negatively associated with firm leverage.*

* 1. Control variables

In our models we add other variables as controls variables. We add the variable firm size, consistent with Pucci et al. (2015) who argue that that size should be related to IC value, though they do not find it to be a significant determinant of IC value. Further, Youndt et al. (2004) and Goebel (2015) argue that firm size is a positive driver of IC value, due to the advantages of better access to resources enjoyed by larger firms along with their greater market power. Goebel finds a negative relationship between firm size and IC value, proxied by LRVTB, as do as well as Forte et al. (2017) who measure IC value in terms of MtB.Firm growth is included as a control variable as IC is recognized as pivotal driver for generating economic wealth and growth (Guthrie and Petty, 2000; Bontis, 2003). Thus, a positive relationship between IC value and firm growth signals market recognition that greater IC investment drives the firm growth. Firm age, or length of establishment, is included as a control variable, recognizing that companies develop IC value cumulatively over time (Nahapiet and Ghoshal, 1998), or conversely, as argued by Leonard-Barton (1992), core competencies can inhibit firm growth through time due to their tendency to convert them into core rigidities over the time.

**5. Research methodology and sample selection**

The study sample includes all Italian companies listed on the Electronic Market of the Milan Stock Exchange. Our study period commences in 2009 in order to avoid the direct effect of the global financial crisis on firm market values, and extends to the year 2014. All of the accounting and financial market data are collected from the AIDA Database. The study sample ends in 2014 as the most recent return on assets ratio for the year following that in our analysis, and the last year available on the AIDA Database at the time of writing, is for the year 2015. The sample initially includes 221 companies, representing all Italian firms listed as at 2009. From this sample, firms that were delisted due to mergers, acquisitions, or bankruptcy, and firms with missing data are removed, arriving at a final balanced panel of 122 listed firms, thereby giving 732 firm-year observations, as shown in Table I.

**[Insert Table 1 here]**

As discussed in the literature review above, two alternative dependent variables to measure IC value: (i) the market-to-book ratio (consistent with the market capitalization method) and (ii) the VAIC (consistent with the return on assets method). The market-to-book ratio is measured in terms of the mean of the opening and closing value of the market to book ratio. We use the mean value of this ratio and not its closing value in order to smooth some of its volatility in a given year. In a departure from the recent extant literature (Maditinos, 2011; Morariu, 2014; Goebel, 2015), this paper focuses on the MtB ratio for several reasons. It is expected that firm market and book values will not be equal. The book values of publicly traded firms largely reflect the value of their tangible and capital assets (Crăciun and Scriosteanu, 2008). However, according to *IAS 38 (Intangible Assets)*, in contrast to tangible assets, most IA are difficult to identify, and are recognized in the statement of financial position only when they are purchased separately or as part of a business combination, but are not recognized when they are developed within the firm. Moreover, Schiemann *et al*. (2015) argue that the future economic benefits arising from IA are uncertain, thereby violating one of the requirements for asset recognition in the financial statements.

Thus, accounting standards give rise to inadequate IC accounting and to an “asymmetric recognition of intellectual capital in the financial statements” (Schiemann *et al.*, 2015, p.8). Hence, one way to measure the value of IC is to assume that efficient financial markets inherently perform accurate firm valuations and that any excess of market over book value will constitute a correct valuation of the firm’s IA (Lal Bhasin, 2012). Thus, when there is a large difference between a firm’s market and book values, that difference may be attributed to IC (Edvinsson and Malone, 1997; Brennan, 2001; Ordóñez de Pablos, 2003; Kok, 2007; Whiting and Miller, 2008; Lal Bhasin, 2012; Tseng *et al*., 2015). However, a number of shortcomings of the MtB ratio as an estimator of IC value may also be identified. Dumay (2012) and Goebel (2015) criticize the MtB ratio as an indicator of IC value due to: (i) the application of historic cost accounting (which influences book value); and (ii) market value fluctuations being potentially driven by the environment or economic factors other than IC value. The study sample in this paper consists of listed firms which prepare their financial statements following IAS/IFRS, so the problem of historic cost accounting is at least partially avoided as most of the assets and liabilities are assessed at their “fair” values. Furthermore, the MtB ratio is measured in this paper as the mean MTB of the opening and closing value, in order to reduce the effect of market value fluctuations. Finally, ease of calculation and the availability of data are also important considerations which render this measure one of the most widely used tools to evaluate IC among the alternatives (Ghosh and Wu, 2007; Godyn, 2013). The values of firm MtB ratios are provided by the AIDA Database.

The second measure used to measure IC value is VAIC (Morariu, 2014). The literature reviewed reveals the use of VAIC as both a dependent and an independent variable. In this study, it will be included as the dependent variable in order to test the extent to which it is related to IC value. The dependent variables (*MtB and VAIC*) are continuous variables measured as follows. The market-to-book ratio (MtB) is the mean of the opening and closing value of the market to book ratio in order to smooth at least some of the volatility in market value. For the VAIC, three coefficients are selected to measure the independent variables under consideration. The first coefficient is the *VAHU* (value added human capital) coefficient which equals value added scaled by human costs. These costs are total expenditures for employees (total salaries and wages). The second coefficient is *SCVA*, the value added structural capital coefficient, which equals structural capital (SC) scaled by value added. Here, SC is equal to the value added of the company less expenditures for employees. The third coefficient is *VACA*, the value added capital employed coefficient. This coefficient is equal to the value added of the firm scaled by the book value of the equity (Morariu, 2014). The VAIC dependent variable that we employ in our models is the sum of the three coefficients, *VAHU*, *SCVA*, and *VACA*. Our two models are shown in Equations 1 and 2 below.

(1)

(2)

Where = the mean MtB ratio over the financial year; = the natural logarithm of the total intangibles assets ratio, measured as total intangible assets to total assets; = the return on assets ratio; = the debt-equity ratio; = the natural logarithm of total assets; = the growth in sales dummy variable; = the natural logarithm of firm age in years; and = the model error term.

Table II provides detailed definitions for the set of independent variables, along with a summary of the coefficient signs expected from theory and the hypotheses to be tested.

**[Insert Table II here]**

**6. Results and discussion**

6.1 Descriptive statistics

Tables III and IV report the descriptive statistics for the continuous and dummy model variables, respectively, for the sample period 2009-2014. Table III shows that the MtB ratio has a mean of 1.47, and so on average the market value exceeds the book value of firms, as expected, and thus firms typically create significant market value over their book value base. This finding suggests that in general substantial differences exist between company market and book values (Brennan and Connell, 2000). Lipunga (2014) highlights that such differences may be explained by the existence of IC assets not recognized in company balance sheets (Brennan and Connell, 2000). Gan and Saleh (2008) argue that while some of these differences are attributable to the current value of physical and financial assets exceeding their historical cost, a large proportion is due to the growth of IA. According to Abeysekera (2007), the IC held by a firm can be thought of as a form of “unaccounted capital” in accordance with the traditional accounting system terminology, and may be described as the knowledge-based equity that supports the knowledge-based assets of a firm. This knowledge generates a potential reserve that contributes to growing future revenues.

**[Insert Tables III]**

The sample firms have an intangible asset (*lnTINT*) ratio of -4.74 (the natural logarithm of the variable *TINT*). The sample firms have a mean *ROA* of 23.37%. Further, the scale of the ROA is greater than might be anticipated due to relatively low sample period equity values. Sample firm size is, on average, € 12.80, in natural logarithm terms. The mean *AGE* of the sample companies (length of establishment) is 3.31 (or 27.38 years), suggesting that firms on average are fairly established. The sample firms have a mean debt/equity ratio of 63%. Finally, the firms have a mean of Value-Added Intellectual Capital Coefficient (*VAIC*) of 2.14, indicating that they create, on average, 2.14 euros of firm value for each euro invested in the firm. Table IV shows that, on average, 58.20% of the sample firms register an increase in revenue from the previous year, suggesting that IC value contributes to increasing firm revenues.

6.2 Correlation analysis

Table IV presents a Pearson correlation matrix for our model variables. For the MtB model, in Equation 1, there is a positive correlation between the dependent variable *MtB* and *lnTINT* (0.121, p=0.000), and *LEV* (0.358, p=0.000), while it is positive and weak in relation to *GROWTH* (0.096, p=0.009). A negative correlation exists between *MtB* and *SIZE* (-0.156, p=0.000), and firm age (*lnAGE*) (-0.263, p= 0.000). The moderate negative correlation between *MtB* and *AGE* may be explained by firms incurring structural and process-related rigidities that are difficult to discard as they age (Loderer and Waelchli, 2010; Leonard-Barton, 1992). Finally, to test for potential multicollinearity issues, a Variance Inflation Factors, though not reported, was computed for all of the variables, however finding that the statistics are well below the threshold of 2 in each case and in equations 1 and 2.

**[Insert Table IV here]**

For the VAIC model in Equation 2 (using the VAIC as the dependent variable) Table V shows a moderate positive correlation between the dependent *VAIC* and the independents *ROA* (0.203, p=0.000) and *SIZE* (0.106, p=0.004). The correlation is insignificant between *VAIC* and the other independent variables. These findings show that while *MtB* is not affected by the firm *SIZE*, *VAIC* is influenced by both firm scale and profitability. Finally, the weak correlation between *MtB* and *VAIC* at the 5% level suggests that a higher level of IC is associated with an increase in company value.

6.3 Regression analysis

Table V presents the results of the two panel linear regression models to examine the relationship between the *MtB* ratio and *VAIC*, proxies for IC value, and potential explanatory variables. Model 1 has within, between and overall R-square statistics of 11.49%, 3.6%, and 3.78%, respectively. The F-test (Prob>F) for the model is significant at the 1% level. Model 2 has within, between and overall R-square statistics of 3.80%, 3.04%, and 3.00%, respectively. The model F-test (Prob>F) is significant at the 1% level. In order to compare the two models, we run the AIC and BIC tests and examine the lower value (the model in which the independent variables better explain the variation in the dependent variable). The AIC value for Models 1 and 2 are 1,757.95 and 3,639.601, respectively. The BIC value for Models 1 and 2 are 1,790.121 and 3,671.771, respectively. Thus, the variables in Model 1 better explain the variation in the dependent variable than is the case for Model 2.

**[Insert Table V here]**

For Model 1 with *MtB* as the dependent, the coefficient of *lnTINT* in model 1 is positive, consistent with expectations, and significant at the 5% level. Consistent with Stewart (1997), Brennan (2001) Ordóñez de Pablos (2003), Villalonga (2004), and Cazavan-Jeny (2004), this positive relationship underlines the argument that the *MtB* ratio represents a fair approximation of IC. It also suggests that investors and financial markets may place significant emphasis on investments in intangible assets. More specifically, the value generated by intangibles may not always be reflected in the financial statements, while forward-looking companies realize that such assets are an integral facilitator of the performance of their business. Thus, increasing investment in (recognized) IA tends to increase the market to book ratio in firms as financial markets “read” the signal of higher future firm value. Thus, hypothesis H1a is supported.

The coefficient of the variable *ROA* is positive, consistent with expectations, and significant at the 5% level. Thus, increasing firm profitability leads to an increase in firm *MtB* ratios. This finding is consistent with Cazavan-Jeny (2004), Nicholson and Kiel (2004), and Forte et al. (2017). Accordingly, hypothesis H2 is supported. The coefficient of the variable *LEV* is positive, consistent with expectations, and significant at the 1% level. The finding is consistent with Goebel (2015), Keenan and Aggestam (2001), and Forte et al., (2017). Thus, lenders encourage more active monitoring of investment in, and the management of, IC value, in firms. Accordingly, hypothesis H3a is supported.

With regard to the control variables in model 1, the coefficient of the variable *SIZE* is negative, contrary to expectations, and significant at the 1% level. Thus, it would appear that the *MtB* ratio falls as firm size increases, suggesting that due to their lower flexibility and greater complexity, larger firms encounter more difficulties in the development of their IC (Goebel, 2015). From an empirical perspective, this result is consistent with Goebel (2015) and Forte et al. (2017), though inconsistent with Fama and French (2001). The finding may be also explained by larger firms not generating higher IC value than smaller companies as greater size does not mean a higher proportion of intangible assets. The coefficient of the variable *AGE* is positive and significant at the 10% level. The finding is not consistent with the results of Loderer *et al*. (2016) and Forte et al., (2017) who find that younger firms invest more in R&D and in radical innovation, while older firms concentrate their efforts more on incremental innovation and the better management of assets in place. The finding also suggests that *MtB* tends to increase over time due to the recognition in the balance sheet of those assets which are initially only ideas in production and to growth in firm reputation over the years, consistent with Nahapiet and Ghoshal (1998). Finally, the coefficient of the control dummy *GROWTH* is positive and significant at the 5% level. The result is consistent with the prior literature (Guthrie and Petty, 2000; Bontis, 2003), and suggests that financial markets “price” IC investments with an increase in market value, thereby driving the firm growth.

For Model 2 with *VAIC* as the dependent, the coefficient of the variable *lnTINT* is negative though significant. As expected, investments in intangible assets do not impact on *VAIC*. In fact, *VAIC* measures how much new value (value added) is created per monetary unit of resources invested. Thus, the H1b is not supported. The coefficient of the variable *ROA* is positive, as expected, and significant at the 1% level. The finding is consistent with El-Bannany (2008) who finds for the UK banking sector a positive relationship between *VAIC*, or some of its components, and firm profitability. Moreover, our finding differs from previous studies as it finds a positive relationship with profitability when *VAIC* is specified as dependent rather than as an independent variable. This suggests that making profits enables firm directors to undertake other useful activities such as encouraging staff to innovate which may in turn lead to increased firm profitability (El-Bannany, 2008). Accordingly, hypothesis H2 is also supported in Model 2. The variable *LEV* has a negative sign, as expected, which is significant at the 5% level, suggesting that the higher is firm leverage, the higher the firm’s dependence on debt and financial risk, thereby negatively affecting *VAIC*. Thus, our hypothesis H3b is supported by our findings. Another possible explanation lies in the cost of capital. As the cost of debt is typically lower than the cost of equity, increased leverage implies a reduction in the average cost of capital and, consequently, a weaker pressure on managers to generate returns for investors, hence reducing structural capital, an important component of the growth of *VAIC*. The coefficient of the control variables *SIZE*, *lnAGE* and *GROWTH* are insignificant in Model 2.

**7. Conclusion**

Liebowitz and Suen (2000) who review the metrics that have been proposed or are used for measuring intellectual capital, observe that many of these on IC are readily available to stakeholders. They also note that most of the metrics proposed to measure IC value are poor at determining the size and growth of an organization’s knowledge. Moreover, most of the metrics are rather too simple, and do not address the types of knowledge that produce the most value-added benefits for an organization. Thus, most of the measurement methods proposed in the extant IC literature remain vague. Osinski et al. (2017) present 44 methods for evaluating intangible assets which are grouped according to their corporate, economic or strategic management taxonomies. Grounded in the extant literature, and starting from the argument that the literature should promote a readily obtainable method to measure IC value, the objective of this paper is to compare two of the most commonly employed methods to measure IC value and to determine which is a better predictor of this value for investors. The two methods are the market to book ratio (Market Capitalization Approach) and the VAIC (Return on Assets Method). To our best knowledge, an innovation of our paper is that it is the first to compare the two competing methods for proxying IC value in an Italian context. Moreover, our study innovates as it employs the VAIC as a dependent rather than as an independent variable.

Analyzing a sample of 122 Italian non-listed firms for the period 2009-2014, we estimate two panel linear regression models. Our findings suggest that MtB is a better IC value predictor than VAIC as the statistics power is higher for this specification than for VAIC. Moreover, our findings suggest that while the investment in intangible assets, which are associated with IC value, as disclosed in the statement of financial position drives IC value in terms of the market to book ratio, these investments are not associated with VAIC, as expected. This is the case even though one of the components of VAIC is capital employed efficiency including net equity.

More specifically, the IC measurement approach employed in Model 1 of this paper highlights how the excess of market capitalization over book value, generated by information sets far wider than the accounting system, measures the ‘covered’ portion of IC not currently represented in reported assets or expenses, at least to the extent that can be incorporated in market expectations. Thus, the study adds a critical approach to the extant research on the effect of IFRS adoption on the disclosure of intellectual capital. There exist limitations in the accounting perspective and in financial information when measuring IC value, especially with regard to the distorting effect of historical costs on the difference between the market and book value, though Italian listed companies have prepared both consolidated and separate financial statements according to IFRS since 2005. As a consequence, assets and liabilities are typically assessed at “fair” value, and thus do not closely adhere to the historical cost convention. Thus, the residual positive difference between market and book value should reflect well the value of intangible resources that are as yet unrecognized in the financial statements but that financial markets which use other information sources manage to appraise when assessing a company’s intellectual capital. In summary, the findings of this paper suggest that the MtB ratio is a good predictor of IC, despite the limitations of this ratio highlighted in the literature. Moreover, use of the MtB ratio is pervasive given its ease of calculation for investors. Many significant drivers of MtB have been found. For example, when firms increase their use of intangibles for a number of years sufficient to establish a “good” reputation, there are consequent results in term of profitability and growth. The empirical evidence shows that MtB is an efficient measure of the *structural* attitude of the firm *to creating value using IC*, even with increasing leverage. On the other hand, the same results clearly show that growth *alone* does not imply a better market valuation as market value will most likely fall, even in the presence of greater firm scale, if the firm does not continue to invest in intangible resources.

The VAIC used in Model 2 is a complex indicator of *efficiency* that aims to compare the *actual firm performances.* It is not suprising that the only significant drivers of VAIC are found to be ROA and leverage. The negative relationship with leverage derives from the structure of the indicator that compares value added with the resources employed to “create” it, and thus the more debt employed, the lower the average cost of capital, and the lower the share of VA which has to be created and distributed to financial investors to satisfy their compensation expectations. In other words, our results show that there is no significant relationship between VAIC and specified firm policies such as intangible resources development, or with other *structural* firm characteristics such as firm age or size.

Moreover, VAIC is not completely focused on measuring the impact on the overall efficiency of human and structural capital, but instead, it also takes account of the contribution of physical capital. One may even doubt whether the *real* purpose of the method is to measure IC; it seems more appropriate to include VAIC in the very limited group of useful analytical tools employed for the reclassification and interpretation of past reported firm financial performance. In contrast to MtB, VAIC is not readily obtained by stakeholders as it requires the estimation of its components.

These results evidence the relevance of the MtB (the holistic effects) compared to the VAIC (return assets method) created by interaction between IC components which typically generate an overall value greater than the aggregate value of the individual estimates (Van der Meer-Kooistra and Zijlstra, 2001).

This study is subject to a number of limitations. First, the sample is restricted to a sample of 122 Italian listed companies due to difficulties in obtaining a larger dataset. Second, the MtB ratio measure employed as the dependent variable may suffer limitations as a result of historical cost accounting and equity market value fluctuations. Third, investment in intangible assets may not affect VAIC as the latter constitutes an indirect way of measuring IC value.

This study has implications for academic researchers, practitioners, and firm managers. The approach employed allows academic researchers to investigate the best method of measuring IC value to the benefit of investors. Comparing two of the most common methods applied in the literature to measure IC should enable practitioners and investors to make more informed judgements. According to Omotayo (2015), it is essential for the management of a company to look for the means to gain, maintain, and manage knowledge in order to achieve higher levels of success. The Market Capitalization Approach (which includes MtB methods) explains that investment in intangible assets is essential for the generation of higher future profits. The findings of this paper suggest that managers should manage the risk that firm growth may lead to a decrease in IC value in the absence of a consistent IC-oriented investment strategy. In other words, managers should avoid smoothing their IC investment as the company grows, in order to maintain a stable MtB ratio. Further, practitioners such as financial analysts should be conscious of the existence of different ways of measuring firm performance, as our results show a high correlation between indicator such as VAIC and ROA. It is worth exploring from a non-shareholder perspective the many facets of corporate performance, in order to take account of all stakeholders.

Finally, this study draws attention to avenues for future research. First, where data is available, other dependent variables might be adopted, such as Tobin’s q. Tobin’s q measures the ratio of market value over the replacement value of tangible assets, and in so doing may partially reduce the distortions associated with MtB, though it may not provide a precise measure of IC value. Second, further sources of information available to financial investors regarding company intangible investment policies, including narrative disclosures, might be explored, thus adopting a broader mixed methods perspective. Third, the methodological approach adopted in this paper may be replicated in an international comparative context for listed firms.

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Figure I. IC Value measurement models



Source: Sydler et al. (2014), Sveiby (2001)

**Table I. Sample selection criteria**

|  |  |
| --- | --- |
| **Sample reduction action** | **Number of firms** |
| Population of Italian firms listed on the Italian Stock Exchange in 2009 | 221 |
| Firms delisted after 2009 or subject to a M&A deals | (14) |
| Firms with missing financial and/or governance data in one or more years | (73) |
| Firms with anomalies in the market to book ratio | (12) |
| Final firm sample (balanced) | 122 |
| Total firm-year observations (balanced sample) | 732 |

**Table II. Variable measurement**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable label** | **Variable description** | **Expected sign** | **Hypothesis** |
| *Dependent variable* | |  |  |
| *MTBi.t* | Market to book ratio continuous dependent variable, computed as the mean of opening and closing value. |  |  |
| *VAICi.t* | Value Added Intellectual Capital computed according to Morariu (2014). |  |  |
| *Independent variables* | |  |  |
| *lnTINTi.t* | Intangible assets ratio, measured as the natural logarithm of intangible assets (El-Bannany, 2008), scaled by total assets at year t. | +  +/- | H1a  H1b |
| *ROAi.t* | Firm profitability of the following year, measured as the return on assets. | + | H2 |
| *LEVi.t* | Firm leverage, measured in terms of the debt-equity ratio. The variable is winsorized at the 1% level in order to remove outliers. | +  +/- | H3a  H3b |
| *Control variables* | |  |  |
| *SIZEi.t* | Firm size, measured as the natural logarithm of total assets at year t. | + |  |
| *GROWi.t* | Growth in revenues dummy variable. The variable takes the value of 1 if the revenues of year t+1 are higher than revenues in year t, scaled by the revenues in year t. The variable takes the value 0 otherwise. | + |  |
| *lnAGEi.t* | The natural logarithm of the firm’s length of establishment in years since its foundation date. | - |  |

**Table III. Descriptive statistics for the continuous and dichotomous model variables**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Full sample (Obs: 732 = 122 companies) | | | | | | | | | |  |
| Variables | Mean | St. error | Median | St. dev. | Variance | Min | Max | 25% | 50% | 75% |
| *Panel A): Continuous variables* | | | | |  |  |  |  |  |  |
| *MTB* | 1.47 | 0.06 | 0.98 | 1.54 | 2.37 | -0.53 | 12.75 | 0.57 | 0.98 | 1.83 |
| *VAIC* | 2.14 | 0.15 | 1.74 | 3.96 | 15.68 | -12.80 | 22.49 | 0.88 | 1.74 | 2.79 |
| *lnTINT* | -4.74 | 0.10 | -4.32 | 2.68 | 7.18 | -14.54 | -0.54 | -6.27 | -4.32 | -2.59 |
| *ROA* | 0.00 | 0.00 | 0.00 | 0.09 | 0.01 | -0.99 | 0.25 | -0.02 | 0.00 | 0.04 |
| *LEV* | 0.63 | 0.03 | 0.40 | 0.87 | 0.75 | 0.00 | 5.36 | 0.10 | 0.40 | 0.77 |
| *SIZE* | 12.80 | 0.06 | 12.60 | 1.72 | 2.94 | 9.28 | 18.30 | 11.63 | 12.60 | 13.56 |
| *lnAGE* | 3.31 | 0.03 | 3.26 | 0.75 | 0.56 | 1.39 | 4.95 | 2.77 | 3.26 | 3.78 |
| *Panel B): Dichotomous variables* | | | |  |  |  |  |  |  |  |
|  | | | |  | 0 | | 1 | |  |  |
|  | | | |  | N. | % | N. | % |  |  |
| *GROWTH* |  |  |  |  | 306 | 41.80 | 426 | 58.20 |  |  |
| *Note:* This table reports the descriptive statistics for the dependent and independent variables. 5%. Please see Table II for variable definitions. | | | | | | | | | | |

**Table IV. Correlation matrix**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | *MTB* | *VAIC* | *lnTINT* | *ROA* | *SIZE* | *LEV* | *lnAGE* | *GROWTH* |
| *MTB* | 1 | 0.087\* | 0.121\*\* | -0.06 | -,156\*\* | ,358\*\* | -,263\*\* | ,096\*\* |
|  |  | *0.02* | *0.00* | *0.12* | *0.00* | *0.00* | *0.00* | *0.01* |
| *VAIC* | 0.087\* | 1 | -0.04 | 0.203\*\* | 0.106\*\* | 0.02 | -0.02 | 0.02 |
|  | *0.02* |  | *0.33* | *0.00* | *0.00* | *0.53* | *0.59* | *0.57* |
| *lnTINT* | 0.121\*\* | -0.04 | 1 | 0.108\*\* | -0.07 | 0.05 | -0.165\*\* | -0.01 |
|  | *0.00* | *0.33* |  | *0.00* | *0.07* | *0.22* | *0,00* | *0.83* |
| *ROA* | -0.06 | 0.203\*\* | 0.108\*\* | 1 | 0.171\*\* | -0.04 | 0.00 | 0.03 |
|  | *0.12* | *0.00* | *0.00* |  | *0,00* | *0.32* | *0.97* | *0.37* |
| *SIZE* | -0.156\*\* | 0.106\*\* | -0.07 | 0.171\*\* | 1 | -0.080\* | 0.107\*\* | -0.01 |
|  | *0.00* | *0.00* | *0.07* | *0.00* |  | *0.03* | *0,00* | *0.84* |
| *LEV* | 0.358\*\* | 0.02 | 0.05 | -0.04 | -0.080\* | 1 | -0.04 | 0.00 |
|  | *0.00* | *0.53* | *0.22* | *0.32* | *0.03* |  | *0.28* | *0.89* |
| *lnAGE* | -0.263\*\* | -0.02 | -0.165\*\* | 0.00 | 0.107\*\* | -0.04 | 1 | -0.06 |
|  | *0.00* | *0.59* | *0.00* | *0.97* | *0.00* | *0.28* |  | *0.10* |
| *GROWTH* | 0.096\*\* | 0.02 | -0.001 | 0.03 | -0.01 | 0.00 | -0.06 | 1 |
|  | *0.01* | *0.57* | *0.83* | *0.37* | *0.84* | *0.89* | *0.10* |  |
| Note: This table reports the Pearson (Spearman) correlation coefficient for the model variables below (above) the diagonal. The asterisks indicate statistical significance at the following levels: \*\* = 1%; \* = 5%. | | | | | | | | |

**Table VI. Linear panel regression models**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | Model 1: MTB  Listed Firms= 122  Obs: 732 | | | Model 2: VAIC  Listed Firms= 122  Obs: 732 | | | |
| Variables | Exp. sign | Coeff. | p-value |  | Exp. sign | Coeff. | p-value |  |
| Constant |  | 7.704 | 0.000 | \*\*\* |  | 2.063 | 0.794 |  |
| *lnTINT* | + | 0.098 | 0.021 | \*\* | +/- | -0.182 | 0.235 |  |
| *ROA* | + | 2.613 | 0.001 | \*\*\* | + | 10.748 | 0.000 | \*\*\* |
| *LEV* | + | 0.615 | 0.000 | \*\*\* | +/- | -0.592 | 0.046 | \*\* |
| *SIZE* |  | -0.660 | 0.000 | \*\*\* |  | 0.024 | 0.970 |  |
| *lnAGE* |  | 0.664 | 0.058 | \* |  | -0.206 | 0.870 |  |
| *GROWTH* |  | 0.163 | 0.039 | \*\* |  | -0.125 | 0.661 |  |
|  |  | *Model specification:*  R-square:  Within= 11.49%; Between= 3.6%; Overall= 3.78%  F(6, 604) = 13.06; Prob> F= 0.000  VIF < 2% for all variables | | |  | *Model specification:*  R-square:  Within= 3.80%; Between= 3.04%; Overall= 3.00%  F(6, 604) = 3.97; Prob> F= 0.000  VIF < 2% for all variables | | |