Intellectual Capital and business performance. Evidence from Italian banking industry

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This study intends to investigate empirically the relation between the value creation efficiency and firms' market valuation and financial performance, by using data drawn from 21 banks enlisted in the Milan Stock Exchange, Italy. More specifically, by using Pulic's (1998, 2000, 2001, 2002) Value Added Intellectual Coefficient (VAIC) as the efficiency measure of capital employed and intellectual capital, the study examines the relationship between intellectual capital and firms' financial performance, and explores the relation between corporate value creation efficiency and firms'market-to-book value ratios. Multiple regression analysis have been conducted on the collected data. Surprisingly, the results do not show any strong association between the studied variable, except for the relation between a component of VAIC, the CEE, and the different measures of the firm's performance.

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Key words: intellectual capital, VAICTM, firm's performance, banking sector

1. Introduction

In a post-industrial economy, knowledge plays a critical role in the process of creating business value (Drucker, 1993; Sullivan and Sullivan, 2000).

Only knowledge provides the opportunity to improve the wealth of nations, the growth of organisations and the value of individuals (Bounfour and Edvinsson, 2005; O'Donnell et al., 2006).

Knowledge-Based Theory, identifies in knowledge, which is characterised by scarcity and difficult to transfer and replicate, a critical resource for achieving competitive advantage (Nonaka I., 1995; Nonaka I. and Takeuchi H., 1995). The capacity, rapidity, and effectiveness with which organisations generate, elaborate, share and transmit knowledge and information determine the generated value of firms; they are, moreover, at the basis of the firm's competitive advantage sustainable over the long term. (Nonaka and Takeuchi, 1995; Edvinsson and Malone, 1997; Bontis, 2002; Choo and Bontis, 2002).

Generally, intangibles, being based on knowledge, are thus recognised at the theoretical level as critical factors in generating sustainable competitive advantage necessary for the creation of superior business performance (Barney, 1991).

In this context, knowing how an organisation creates value, based on its potential of knowledge, becomes a central question in management research (Bontis, 1999). Moreover, value creation resides at the very heart of strategic management literature and it is the primary rationale of intellectual capital (Edvinsson and Sullivan, 1996; Petrash, 1996; Roos and Roos, 1997; Bontis, 2001).

The transition from an administrative-patrimonial setting to a knowledge-based one thus entails the valorisation of intangible resources, and places knowledge, and technological development at the centre of the firm (Catalfo P. L. and Caruso G. D., 2002).

The result of all this is a modification of the modalities of creation of business value, which are no longer centred on the great mass of fixed material capital, but rather on the creation, acquisition and valorisation of a kind of capital which is called 'intangible' or 'immaterial', also termed 'knowledge capital' or 'intelligence capital' (Black S. and Lynch L. M., 1996).

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Inventory and capital cannot create value if they are not activated and combined and even knowledge is not worth much, if it is not put to productive use along with other resources of the firm. Firms create value, combining different types of resources (tangibles and intangibles) and by supporting the interactions among them, which can provide higher intellectual (Choo and Bontis, 2002) and financial potential (Bontis, 2003).

In knowledge economics, traditional business evaluation criteria are no longer sufficient. The concept of intellectual capital itself explains the difference between a firm's market value and its book value, but most of all it is these intangible factors that 'make the difference' between businesses.

In other words, intangible goods interact with tangible and financial ones to generate business value and economic growth.

This awareness gives rise to the belief that a firm's market value is a function, aside its accounting/financial value, also of its intellectual capital.

An extensive research has been carried out on Intellectual capital, since the financial

accounting does not explain the increasing gap between a firm's market value and its book value (e.g. Lev and Zarowin, 1999; Lev, 2001; Lev and Radhakrishnan, 2003). Simply, a firm's market value exceeding its book value has been defined as intellectual capital (Edvinsson and Malone, 1997). The intellectual capital of a firm plays a significant role in the modern approach of value creation.

Several authors in the field of business economics use the terms intangibles, intangible resources, intangible goods, knowledge assets and intellectual capital as synonyms (Lev B., 2003). The present study shares this usage[16].

Moreover, although the concept of intellectual capital has been subject over the years to diverse interpretations, the proposed patterns of its representation found in the literature are based on classifications that are very similar to one another (Bontis N., 2001).

The intellectual capital is recognized as a major corporate asset capable of generating sustainable competitive advantages and superior financial performance (Barney, 1991), it is still difficult to find an appropriate measure of intellectual capital.

From the empirical perspective, several studies that tried to demonstrate the existence of a relation between intellectual capital and business performance encountered problems linked mainly to the measurement of intellectual capital (IC). In recent years, a series of empirical studies have been carried out using Ante Pulic's VAIC (Value Added Intellectual Coefficient) (1998), which can be calculated starting from the balance sheet data, as a proxy of IC.

Pulic (2000a, b) proposed Value Added Intellectual Coefficient (VAIC) as an indirect measure of efficiency of value added by corporate Intellectual Capital. The VAIC method provides the information about the efficiency of tangible and intangible assets that can be used to generate value to a firm (Pulic, 2000a, b). Financial capital (monetary and physical), human capital, and structural capital have been recognized as major components of VAIC.

The research, based on the banking sector in Italy, examines different misures of firm's performance in relation to VAIC and its components.

The paper aims to describe the literature review in respect to Intellectual Capital, measured by VAIC, and its applications in various countries and industries. The next section highlights methodology of the research, including research framework and data collection tools and hypothesis. The final section will conclude with research results and suggestions of VAIC application.

Findings from this study will assist to determine if italian listed bank appear to continue to rely on traditional business practices and perceptions (that is, a reliance on natural resources for

[16] Among others, D'Egidio (2003) revises a distinction between the terms 'intangible resources' and 'intellectual capital', where the former are the result of the dynamics of the intellectual capital, its photographable part. In this sense, the notion of intellectual capital identifies the '*system* of resources and intangible activities of the firm, where one talks of system and not of the whole in order to focus more precisely on the established relations between the intangibles that make up the intellectual capital which is the base for the creation of value

wealth creation) or are shifting towards a greater reliance on intellectual capital factors of production in determining productivity, profitability and market valuation

The present contribution adopts the same position, and has set itself the objective of measuring the relation between IC and business performance through a model of multivariate linear regression, using VAIC as indicator for IC and as sample the universe of banks quoted on the Italian Stock Exchange (Borsa Valori). The banking sector was chosen as it is considered intellectually intensive.

Following many other researchers, including Firer and Williams (2003), this study also uses VAIC as an aggregate measure of firms' intellectual capital.

The added value of the paper consists in the fact that does not appear to be any published empirical study that correlated IC and business performance through the use of VAIC methodology in the Italian context.

2. Description of the variables of the econometric model

Intellectual capital: definition and measurement models

There are numerous definitions for intellectual capital since the beginning of its research in the early 1980s. Itami (1987), the pioneers in this field, defined intellectual capital as intangible assets which includes particular technology, brand name, customer information, reputation and corporate culture that are invaluable to a firm's competitive power. Stewart (1997) explained intellectual capital as knowledge, information, intellectual property and experience that can be put to use to create wealth. Edvinsson (in Bontis, 2000) viewed intellectual capital as applied experience, organizational technology, customer relationships and professional skills that provide a firm with a competitive advantage in the market. For Bontis (2000), intellectual capital means individual workers' and organizational knowledge that contributed to sustainable competitive advantage, while Pulic (2001) includes all employees, their organization and their abilities to create value added that is evaluated on market into intellectual capital.

Thefore, different interpretations of intellectual capital can be found in the literature. Basically these different terminological meanings correspond to one fundamental reality, which consists of the non-physical production of a future income on the part of the intangibles controlled by a firm as the result of preceding events or transactions (self-production or acquisition). In other words, intangible goods interact with tangible and financial ones to generate business value and economic growth.

Scholars, national and international accounting bodies, political bodies at the European level have validated, at least at a general level, the conceptual frame of reference which divides intellectual capital into: human capital, organisational capital, and relational capital (Zambon S., 2003). According to several authors, organizational capital and relational capital constitute the structural capital of a business. This classification, which is currently the most widespread and accepted, represents a development of the one originally elaborated by Edvinsson and Malone[17] (EDVINSSON L. and Malone S., 1997; Edvinsson L., 1997) and applied to the Swedish insurance and financial firm, Skandia (Skandia, 1994, 1995)[18].

[17] The term intellectual capital, equivalent to the concept of business competences, was used by Edvinsson as an alternative to the definition of intangible resources of an accounting nature, in the attachment to the annual financial accounts for the year 2003 for the Swedish company, Skandia, currently in the vanguard in reporting on intellectual capital.

[18] Skandia, a market leader in the insurance and financial services sectors, was the first in the world (1994) to integrate traditional economic-financial balance sheets with specific reports containing data regarding the consistency and likely evolution of its own intellectual capital. The need for this came from the fact that, for some businesses, the firm's stock value appeared to be as much as eight times superior to the evaluation of net capital resulting from the balance sheets. This was considered symptomatic of the recognition on the part of the market of the presence of immaterial values of considerable entity for a company, expressed by the price of shares, which proved difficult to quantify or monitor. This

We share the statement according to which human capital is considered the primary element of intellectual capital and the most important source of sustainable competitive advantage (Nonaka and Takeuchi, 1995; Edvinsson and Malone, 1997; Sveiby, 1997; Seleim, Ashour and Bontis, 2004).

Human Capital consists of the people who make up the organisation and who contribute to its success through their skills and motivation. At the base of each organisation are the people, or better, the system of knowledge, competences, capabilities, creativity and innovation founded on the knowledge of each person operating in the firm but also the entrepreneurial, organisational, and working qualities which come together to constitute the business institution.

Organisational capital depends on the capacity of the firm to retain knowledge and to re-use it in the productive process; the infrastructure allows human capital to express its potential. It is represented by the ensemble of operational knowledge and business routines, by internal processes, and by the degree of management cohesion. Organisational capital includes the components linked to innovation, to the processes and the culture of the firm and is subdivided into innovation capital and process capital. The former includes brands, patents, software and so on, whilst the latter relates to process manuals, database, managerial best practices, IT networks and so on.

Relational capital is the ensemble of intangible values matured in the relations of the firm with its external environment (clients, distributors, suppliers, investors) and which is expressed, for instance, through esteem and reputation amongst the client base, good union relations, deserved credit with the banks, and the trust and consent which the firm enjoys amongst its employees. In practice, it is the trust assets (customer satisfaction, customer loyalty, brand awareness, business image, etc.) 'stored' in the memory of subjects external to the business, which enable the sharing and reciprocal transfer of knowledge and information relating to the respective activities and needs, and allow the business to carry out its economic function in a more rational way, in terms both of effectiveness and efficacy (Bontis N, 2001).

The present shares the tripartition of IC in Human, Structural (Organizational) and Relational.

Every firm possesses these three intangible dimensions of value although, depending on its own business model, each may choose to accentuate some more than others.

This leads us also to underline the evolution over time from the notion of immaterial resources, 'non physical' ones, to that of intangible resources, which is in line with the absence of contours of the resource and the consequent difficulty in individuating and evaluating it autonomously through traditional means (Mancini D., Quagli A., Marchi L., 2003).

Increasing attention to the key role played by intellectual capital in the processes of creation of value has resulted in the 34 methods of measurement of intellectual capital (Sveiby, 2001) as shown in figure 1.

need then led to the development of Business Navigator, a reporting system focused on the components of intangible capital.

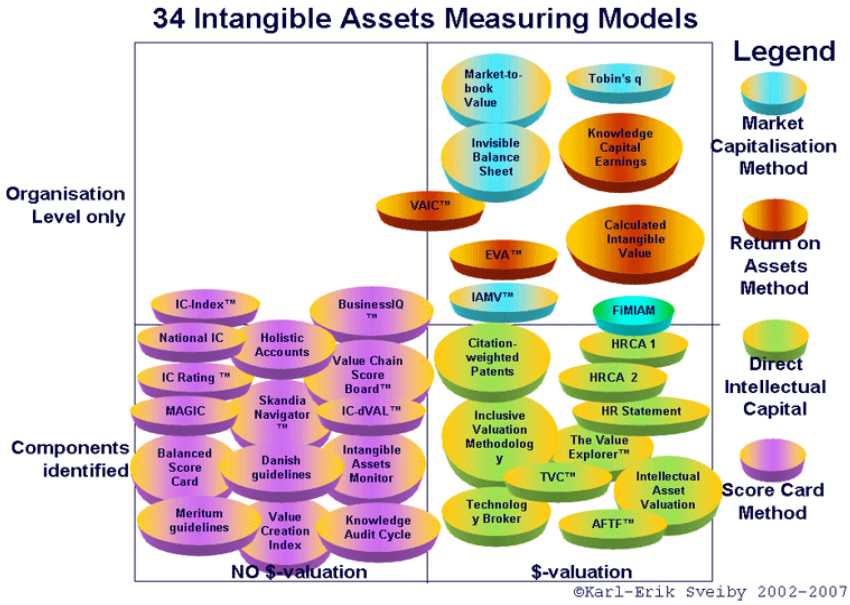

Figure 1. The main methods for IC measurement

A detailed description of the models is beyond the aim of this paper; we will thus limit ourselves to describing VAIC as it was selected as a suitable indicator for measuring IC in empirical research.

Value Added Intellectual Coefficient (VAIC)

VAIC measures how effectively immobilised capital and intellectual capital contribute to the creation of business value for the firm, taking into consideration three main elements: human capital, structural capital, and physical capital.

The methodology for calculating VAIC is the following (Pulic A., 1998, 2000, 2001, 2002)

$$VAIC™ = (ICE + CEE)$$

where:

ICE = Intellectual capital efficiency
CEE = Capital employed efficiency

Intellectual Capital 'ICE' has two components, human capital and structural capital. Human capital pertains to all expenses relating to employees. The new aspect is that salaries and wages are no longer considered as costs but as investments.

$$ICE = HCE + SCE$$

where:

HCE = Human capital efficiency
SCE = Structural capital efficiency

Human capital efficiency (HCE) is calculated by dividing the value added by the human capital:

$$HCE = VA/ HC.$$

and

$$SCE = (VA\text{-}HC) / VA$$

where:

H.C. total investment in salaries and wages for company

VA is acronym of gross global value added created by the company (British Ministry for Commerce and Industry, refers to value added as 'the preferred system for measuring the wealth created by a company's activity).

Then, the human capital (HC) of the company is calculated as the sum of the total salaries for the company, and the structural capital (SCE) of the company is calculated by subtracting the human capital from the value added.

The value added (VA) of a company can also be calculated as outputs less inputs, e.g.:

$$VA = P + C + D + A$$

P describes operating profits, C employee costs (the salaries and the social expenses of staff) and D + A depreciation and amortisation of assets.

Capital employed efficiency (CEE) describes how much of the company's value added is generated with the tangible capital employed. It is calculated by dividing the value added by capital employed (CE):

$$CEE = VA / CE$$

where:

CE = book value of the net assets for company i;

CEE and HCE can be viewed as the value-added by a euro input of physical assets and human capital, respectively. SCE represents the proportion of total VA accounted for by structural capital.

Summarising, VAIC™ can be seen as the composite sum of three separate indicators: (1); Human Capital Efficiency (HCE) – an indicator of VA efficiency of human capital; (2) Structural Capital Efficiency (SCE) – an indicator of VA efficiency of structural capital and (3) Capital Employed Efficiency (CEE) – an indicator of VA efficiency of capital employed

$$VAIC™ = HCE + SCE + CEE$$

Intellectual capital efficiency is a new measure. In the industrial era, efficiency was measured by the number of products. Workers who made more products in a time unit were more effi cient. For the new economy and the knowledge worker this way of measurement is not adequate any more. Knowledge workers produce value. According to that, it is necessary to measure how much value they create and how efficiently they do this. (KOLAKOVIĆ M. - HOLMIK D, 2006).

As the equation indicates, this form of capital does not have an independent dimension like human capital (HC). In fact, it depends on the creation of value added and is inversely proportional to HC.

VAIC is obtained (as in the formula above) from the sum of the efficiency of employed capital and efficiency of intellectual capital. This aggregate indicator provides an understanding of the general efficiency of a company and indicates its intellectual capacity. In other words, VAIC

measures how much new value has been created for each unit of monetary resources invested. An higher coefficient indicates a greater creation of value using business resources.

The benefits of such a methodology are the following:

1) it uses the concept of value added;

2) it creates a standardised and coherent base for measurement, which allows for better and more effective comparative analysis between firms;

3) all data used in calculating VAIC are based on a review of the information acquired and thus calculations can be considered objective and verifiable;

4) the technique is simple to calculate and use.

The recognition of such important positive aspects steered our choice towards this index, which is used in an increasing number of studies. In order to take into account all the business investments in human capital we have considered it appropriate to use two VAIC formulations: one in which VAIC is divided into its HCE, SCE, CEE components (known as decomposed VAIC); and a further formulation which considered as well as the costs of labour also the costs relating to training of the job force (defined as modified VAIC).

The choice to use the decomposed VAIC is justified by the better results of this model in relation to the aggregate VAIC (Chen et al. 2005). The choice to modify VAIC is justified by the consideration of taking into account the global cost of labour (HC) also the cost of training.

3. Business performance: definition and models

The literature presents different measurements for business performance. In theory, such measurements can be summarised as (Cariola et al., 2006):

- Accounting measurements (utilising accounting and financial data);
- Market measurements (utilising data deriving from the market);
- Mixed measurements (utilising both typologies).

At the present time, there is no practical or theoretical justification for preferring one measurement over the others, so in order to carry out the analysis we have chosen to use both accounting measurements, which point out the firm's profitability, and mixed measurements which correlate an accounting measurement and a market measurement (Firer and Williams, 2003).

Indicators ROI and ROA were selected as proxies for profitability measurements, and the Market-to-Book Ratio (MBV) as a proxy for market performance.

Table 1

Performance indicators used in the empirical analysis

ROI Return on investment	ROA Return on asset	Market-to-Book ratio
Ratio operating income and the invested capital.	Ratio the net income before interest and the invested capital	Ratio between market value and book value

4. Previous studies on IC measurement in the banking sector

The banking sector in general is an ideal area for IC research because:

- there are reliable data available in the form of published accounts (balance sheets, P/L);
- the business nature of the banking sector is "intellectually" intensive; and the whole staff is (intellectually) more homogeneous than in other economy sectors.

Several empirical studies have tried to test the relation between IC (measured through VAIC) and business performance in the banking sector. Amongst these, I quote the study on the Japanese banking sector (Mavridis, 2004); on the Turkish one (Yalama and Coskun, 2007); on the Austrian banks (Pulic, 1999); on the Croatian banks (Pulic, 2001); on the Portuguese banks (Cabita and

Bontis, 2006); on the Malaysian banks (Goh, 2005); on the Bangladesh banks (Naibullah et al., 2006); on the Greek banks (Kyrmizoglou, 2003). For Italy, there does not appear to be any published study empirically analysing the correlation between IC measured through VAIC and business performance, either in the banking sector or other productive sectors.

5. Hypothesis at the base of the model

Although IC is universally recognised as the main driving force for the creation of business value, not all empirical studies have succeeded in demonstrating the importance of the relation between IC and business performance (Firer and Williams, 2003). Considering that studies carried out in different economic contexts have led to different results (Firer and Williams, 2003; Chen et al., 2005), the present research has a descriptive aim: to verify the correlation between VAIC and business performance in the Italian banking sector, using two methodologies:

H1. The first measures the correlation between VAIC broken down into three components and performance measurements (market and accounts)

H2. The second measures the correlation between modified VAIC and performance measurements (market and accounts).

6. Methodological aspects

The verification of the correlation between VAIC and firm performance was carried out through the following steps.

The first phase was the choice of the sample to be analysed. Since it is well known that the banking sector is made up of intellectually intensive companies, our attention focused on the analysis of the 21 banks currently quoted in the Italian Stock Exchange (Borsa Valori) as reported in Table 2:

Table 2

List of the banks used as sample in the study

-Banca Carige
-Banca Finnat
-Banca Generali
-Banca Ifis
-Banca Intermobiliare
-Banca Italease
-Banca Monte Dei Paschi Di Siena
-Banca Popolare Etruria E Lazio
Banca Popolare Milano
-Banca Popolare Spoleto
-Banca Profilo
-Banca Desio E Brianza
-Banco di Sardegna
-Credito Artigiano
-Credito Bergamasco
-Credito Emiliano
-Credito Valtellinese
-Intesa San Paolo
-Medio Banca
-Unicredit
-Ubi

After having constructed the sample we proceeded to analyse the financial picture for the three-year period 2005/2007 through the index technique. Thus personnel and training costs were analysed; further we extrapolated from service costs those relating to occasional project-based or fixed-term performance, including them with the personnel costs.

We requested some data necessary for the calculation of the Market to Book Ratio, such as the value of shares and the official prices of said shares, directly from the Italian Borsa Valori[19].

After having analysed the Income Statement (table 2) and having extrapolated the necessary data , we proceeded to its reclassification according to the analytical prospect for the determination of the added value reported in table 4:

The choise of the formulation of value added developed by ABI (the Italian Banking Association) for banks is because this takes into account the special characteristics of the banking business.

Table 3

Income statement

Net interest
Dividends and other income from equity investments
Net interest income
Net fees and commissions
Net trading, hedging and fair value income
Net other expenses/income
Net non-interest income
OPERATING INCOME
Payroll costs
Other administrative expenses
Recovery of expenses
Amortisation, depreciation and impairment losses
on intangible and tangible
Operating costs
OPERATING PROFIT
Goodwill impairment - - - - -
Provisions for risks and charges
Integration costs
Net write-downs of loans and provisions
for guarantees and commitments
Net income from investments
PROFIT BEFORE TAX
Income tax for the period
NET PROFIT ATTRIBUTABLE TO THE GROUP

[19] A propos of which, we thank Dr Ricciardi and Dr Cavaliera, from the Research and Development sector in the Italian Borsa Valori, for providing us with the necessary data.

Table 4

Analytical statement to determine total gross Added Value

REVENUE
Interest income and similar revenues
Fee and commission income
Dividend income and similar revenue
Gains and losses on financial assets and liabilities held for trading
Fair value adjustments in hedge accounting 17 22
Gains (losses) on disposals of:
a) loans
b) available-for-sale financial assets
c) held-to-maturity investments
d) financial liabilities
Gains and losses on financial assets/liabilities at fair value through profit and loss
250. Gains and losses on tangible and intangible assets measured at fair value
220. Other net operating income
240. Profit (loss) of associates
310. Total profit or loss after tax from discontinued operations - -
1. TOTAL NET REVENUES
CONSUMPTION
20. Interest expense and similar charges
50. Fee and commission expense
180.b Other administrative expense
130. Impairment losses on:
a) loans
b) available-for-sale financial assets
c) held-to-maturity investments
d) other financial assets/liabilities
190. Provisions for risks and charges
200. Impairment/write-backs on property, plant and equipment
210. Impairment/Write-backs on intangible assets
260. Impairment of goodwill
2. TOTAL CONSUMPTION
150. Premiums earned (net)
160. Other income (net) from insurance activities
NET RESULT OF INSURANCE MANAGEMENT
3. TYPICAL GROSS ADDED VALUE
270. Gains and losses on disposal of investments
4. TOTAL GROSS ADDED VALUE
180.a Cost of labour (staff expenses)
180.b Other administrative expense: indirect taxes and duties
180.b Other administrative expense: donations
5. PROFIT BEFORE TAX
290. Tax expense (income) related to profit or loss from continuing operations
330. Minorities
6. NET PROFIT FOR THE YEAR

After having calculated the gross global added value and VAIC components, we proceeded to the calculation of ROI, ROA and of the Market to Book Ratio . The variables value for the period 2005 (t), 2006 (t+1), 2007 (t+2), both dependent that independent, are shown in table 5.

Once the computing phase of the study had been completed, we moved on to the evaluation of the model of multivariate regression to demonstrate how VAIC (decomposed and modified) impact on company performance.

Table 5

BANCHE	Roi	Roa	MBV	Dip.	HCE	SCE	CEE	HCEMOD.	SCEMOD.	CEEMOD.
Banca Carige t	0,014934	0,01656	2,8	3749	1,7014519	0,4122667	0,0383738	1,7014519	0,4122667	0,0383738
Banca Carige t+1	0,026634	0,024527	2,7	3714	1,9180718	0,4786431	0,0556443	1,9180718	0,4786431	0,0556443
Banca Carige t+2	0,2065288	0,1814162	1,6	3777	8,0442918	0,8756882	0,2358474	8,0442918	0,8756882	0,2358474
Banca Finnat t	0,011622	0,013246	2,66	106,5	7,8476088	0,8725726	0,0206363	7,810124	0,8719611	0,0206363
Banca Finnat t+1	0,017432	0,014389	1,18	274	7,5222542	0,8670611	0,0216703	7,4867473	0,8664306	0,0216703
Banca Finnat t+2	0,0141685	0,0115696	1,09	280,5	6,3573357	0,8427014	0,0176228	6,323283	0,8418543	0,0176228
Banca Generali t	0,010761	0,007595	1,54	581	1,6562444	0,3962244	0,0250709	1,6562444	0,3962244	0,0250709
Banca Generali t+1	0,011963	0,007888	2,03	555	1,8541661	0,460674	0,0238298	1,8541661	0,460674	0,0238298
Banca Generali t+2	0,0168571	0,0095805	1,81	550	2,1202516	0,5283579	0,0267471	2,1202516	0,5283579	0,0267471
Banca Ifis t	0,01109	0	4,48	106,5	1,0644117	0,0605139	0,0128012	1,0584083	0,055185	0,0128012
Banca Ifis t+1	0,011478	0,000472	4,67	135,5	1,1324517	0,1169602	0,0129175	1,1167939	0,1045796	0,0129175
Banca Ifis t+2	0,0088285	0,0047997	5	183,5	1,7905649	0,441517	0,0165615	1,7758584	0,436892	0,0165615
Banca Inrermobiliare t	0,023889	0,017378	2,5	374	3,0187381	0,6687358	0,033473	2,9789654	0,664313	0,033473
Banca Inrermobiliare t+1	0,02139	0,01348	3,5	398	2,9714335	0,6634621	0,0300253	2,9471477	0,6606889	0,0300253
Banca Inrermobiliare t+2	0,0224522	0,0150124	2,5	424	2,8075378	0,643816	0,0330532	2,7945933	0,6421662	0,0330532
Banca Italease t	0,025631	0,019271	2,4	450	2,8395979	0,6478375	0,0398126	2,7731344	0,6393972	0,0398126
Banca Italease t+1	0,017554	0,012691	2,68	547	2,5942509	0,6145323	0,0289475	2,5408015	0,6064234	0,0289475
Banca Italease t+2	0,0467413	0,0309105	2,22	699	3,8185424	0,73812	0,0519054	3,7668724	0,7345278	0,0519054
Banca Monte dei Paschi di siena t	0,00843	0,005983	1,9	13295	3,7917341	0,7362684	0,0103138	3,7917341	0,7362684	0,0103138
Banca Monte dei Paschi di siena t+1	0,008719	0,006192	2,7	12934	5,0533009	0,8021095	0,0108701	5,0533009	0,8021095	0,0108701
Banca Monte dei Paschi di siena t+2	0,0286247	0,0211495	1,2	12632	-9,3580248	1,1068602	-0,0259573	-9,3580248	1,1068602	-0,0259573
Banca Popolare Etruria e Lazio t	0,006445	0,003818	1,76	1611	1,206413	0,1710965	0,021162	1,206413	0,1710965	0,021162
Banca Popolare Etruria e Lazio t+1	0,009659	0,006616	1,69	1643	1,4249662	0,298229	0,024349	1,4249662	0,298229	0,024349
Banca Popolare Etruria e Lazio t+2	0,0112373	0,0061741	1,6	1643	1,6678254	0,4004169	0,0242692	1,6678254	0,4004169	0,0242692
Banca Popolare Milano t	0,008757	0,006001	1,2	6521	1,9732045	0,4932102	0,0172979	1,9732045	0,4932102	0,0172979
Banca Popolare Milano t+1	0,097545	0,068808	1,5	6368	2,2001826	0,5454923	0,1893413	2,2001826	0,5454923	0,1893413
Banca Popolare Milano t+2	0,0121007	0,0080263	0,9	6507	2,5346357	0,605466	0,01961	2,5346357	0,605466	0,01961
Banca Popolare Spoleto t	0,008349	0,004805	0,99	571	1,9112296	0,4767766	0,016798	1,9112296	0,4767766	0,016798
Banca Popolare Spoleto t+1	0,088178	0,051252	1,18	616	1,9873975	0,4968294	0,1706361	1,9873975	0,4968294	0,1706361
Banca Popolare Spoleto t+2	0,0104417	0,00586	1,1	661	1,8557685	0,4611397	0,0158931	1,8557685	0,4611397	0,0158931
Banca Profilo t	0,010566	0,007527	1,3	171	2,0480762	0,5117369	0,0204446	2,0074317	0,501851	0,0204446
Banca Profilo t+1	0,013426	0,010364	1,5	160	2,2047562	0,5464351	0,0245707	2,1573037	0,5364584	0,0245707
Banca Profilo t+2	0,0044571	0,014716	1,5	151	2,7067505	0,6305533	0,0248289	2,6489752	0,6224955	0,0248289
Banco Desio e Brianza t	0,01392	0,014584	1,8	1140	2,6526272	0,6230152	0,0204235	2,6356855	0,6205921	0,0204235
Banco Desio e Brianza t+1	0,015681	0,017524	1,1	1265	2,7515238	0,636565	0,0226155	2,7210327	0,6324925	0,0226155
Banco Desio e Brianza t+2	0,011004	0,0159244	0,6	1316	2,7693565	0,6389053	0,0161718	2,7524817	0,6366915	0,0161718

Banco di Sardegna t	0,0123	0,000678	1,9	2743	-1,4366005	1,6960878	-0,0253143	-1,4366005	1,6960878	-0,0253143
Banco di Sardegna t+1	0,010306	0,005427	1,7	2710	1,5654156	0,361192	0,0274911	1,5654156	0,361192	0,0274911
Banco di Sardegna t+2	0,0089009	0,0004167	1,5	2694	1,4615923	0,3158147	0,027021	1,4615923	0,3158147	0,027021
Credito Artigiano t	0,007692	0,004059	1,19	862	1,30128	0,2315259	0,0181021	1,2885825	0,2239534	0,0181021
Credito Artigiano t+1	0,010706	0,006733	1,2	886	1,7062385	0,4139154	0,0258663	1,6869611	0,4072181	0,0258663
Credito Artigiano t+2	0,0139721	0,007439	0,96	936	1,951822	0,4876582	0,0285648	1,9286515	0,481503	0,0285648
Credito Bergamasco t	0,013959	0,011028	2,4	2038	1,7951577	0,4429459	0,0314548	1,7783472	0,4376801	0,0314548
Credito Bergamasco t+1	0,015916	0,010727	2,2	2084	2,0504597	0,5123045	0,0310079	2,0260319	0,5064244	0,0310079
Credito Bergamasco t+2	0,0157837	0,0124159	2	2093	2,0866371	0,52076	0,0302406	2,0600611	0,5145775	0,0302406
Credito Emiliano t	0,010785	0,011615	2,25	4245	7,1243322	0,859636	0,0125455	7,1243322	0,859636	0,0125455
Credito Emiliano t+1	0,016854	0,017296	2,22	4358	11,587168	0,9136976	0,0184461	11,407175	0,9123359	0,0184461
Credito Emiliano t+2	0,0057176	0,0064453	2,02	4507	5,2571715	0,8097836	0,0070566	5,1387647	0,8054007	0,0070566
Credito Valtellinese t	0,014502	0,15348	2,15	748	0,8513238	-0,1746411	0,0351423	0,8513238	-0,1746411	0,0351423
Credito Valtellinese t+1	0,013734	0,009086	2,41	783	1,0418279	0,0401486	0,0264073	1,0418279	0,0401486	0,0264073
Credito Valtellinese t+2	0,0076694	0,0048732	2,02	820	1,5852609	0,369189	0,0193923	1,5852609	0,369189	0,0193923
Intesa Sanpaolo t	0,002827	0,002133	2,4	31065	2,3513076	0,0027153	0,0047246	2,3513076	0,5747047	0,0047246
Intesa Sanpaolo t+1	0,168698	0,009808	2,2	28243	0,1915126	-0,1498439	0,0354947	0,1914142	-4,224272	0,0354947
Intesa Sanpaolo t+2	0,0401482	0,0324424	2	48295	3,118557	0,0402258	0,0592131	3,1058761	0,6780297	0,0592131
Medio Banca t	0,004666	0,003673	1,3	435	1,5097141	-0,3376229	0,0138207	1,5097141	0,3376229	0,0138207
Medio Banca t+1	0,009999	0,008188	1,7	480	2,0809675	-0,5194543	0,0192493	2,0809675	0,5194543	0,0192493
Medio Banca t+2	0,0063423	0,0052518	1,5	548	1,8028473	-0,4453219	0,0142413	1,8028473	0,4453219	0,0142413
Unicredit t	0,008246	0,004317	1,4	1512	1,3916545	0,2814308	0,026408	1,3902044	0,2806813	0,026408
Unicredit t+1	0,012677	0,008299	1,2	1566	1,6960616	0,4103988	0,0289066	1,6944525	0,4098389	0,0289066
Unicredit t+2	0,0145281	0,0100033	1,1	2160	12,24399	0,9183273	0,0299489	12,171457	0,9178406	0,0299489
Ubi Banca t	0,016897	0,010534	1,6	2250	2,3510434	0,5746569	0,0292935	2,3510434	0,5746569	0,0292935
Ubi Banca t+1	0,024664	0,017774	1,6	2290	3,1823089	0,6857628	0,0358641	3,1823089	0,6857628	0,0358641
Ubi Banca t+2	0,0211718	0,0144637	1,36	1192	2,900816	0,6552694	0,0322135	2,900816	0,6552694	0,0322135

7. Application of the econometric model

As previously seen the analysis of the correlation between intellectual capital and firm performance in the banks quoted in the Italian Borsa Valori in the years 2005- 2006- 2007 was carried out by applying the method of multivariate linear regression between VAIC (decomposed and modified) and the selected indicators of performance (ROE, ROA, MBV)[20].

A description of all variables used in the empirical investigation is found in Table 3, while Table 4 reports the descriptive statistics for the VAIC (decomposed and modified) and independent variables selected in this study.

[20] An econometric model assumes the form:
$yt = f(xt) + \varepsilon t$, $t = 1,2,\ldots, T$.
where yt is a vector (n x 1) of variables that the model intends to explain (endogenous variables) which refer to the t-nth observation of the sample under examination, f is a function which makes yt depend on a vector (K x 1) of exogenous variables xt (or explicative variables), and εt represents a vector (n x 1) in casual disturbance term.
The simple linear regression model is an econometric model in which the independent variable yt is hypothesised to depend in a linear way on the explicative term x2t and is influenced by the casual variable εt, and it assumes the form below:
$yt = \beta 1 + \beta 2x2t + \varepsilon t$, t

Table 6

Definition of variables

ROI	Return on investment	Ratio return the operatine income and the invested capital.
ROA	Return on asset	Ratio return the net income before interest and the invested capital
MBV	Market to book value	Ratio betwen market value and book value
HCE	Human capital efficiency	VA/ HC
SCE	Structural capital efficiency	(V.A.-H.C.) / V.A.
CEE	Capital employed efficiency	VA / CE
HCE mod.	Human capital efficiency mod.	VA/ HC mod.
SCE mod.	Structural capital efficiency mod.	(V.A.-H.C.) / V.A. mod.
CEE mod.	Capital employed efficiency mod.	VA / CE mod.

Table 7

Summery statistics

	N	Minimo	Massimo	Media	S.D.
ROI	63	,00282700	,20652800	,0221769524	,03429189931
ROA	63	,00000000	,18141600	,0169001270	,02972837651
MBV	63	,60000000	5,00000000	1,9104761905	,85502014421
HCE	63	-9,35802000	12,24399000	2,6538216190	2,85132413670
SCE	63	-,51945400	1,69608770	,4829738365	,36512986299
CEE	63	-,02595000	,23584700	,0316089206	,04047442720
HCEMOD	63	-9,35802000	12,17145000	2,6361722540	2,83435306846
SCEMOD	63	-4,22427100	1,69608770	,4767012429	,66139518580
CEEMOD	63	-,02500000	,23580000	,0315857143	,04044488028
Validi (listwise)	63				

8. Research methods

The regression model used in this study is shown as follows:

$$ROI_{it} = \alpha_0 + \alpha_1 HCE + \alpha_2 SCE + \alpha_3 CEE + u_{it} \quad (1)$$

$$ROA_{it} = \alpha_0 + \alpha_1 HCE + \alpha_2 SCE + \alpha_3 CEE + u_{it} \quad (2)$$

$$MBV_{it} = \alpha_0 + \alpha_1 HCE + \alpha_2 SCE + \alpha_3 CEE + u_{it} \quad (3)$$

$$ROI_{it} = \alpha_0 + \alpha_1 HCE\ mod. + \alpha_2 SCE\ mod. + \alpha_3 CEE\ mod. + u_{it} \quad (4)$$

$$ROA_{it} = \alpha_0 + \alpha_1 HCE\ mod. + \alpha_2 SCE\ mod. + \alpha_3 CEE\ mod. + u_{it} \quad (5)$$

$$MBV_{it} = \alpha_0 + \alpha_1 HCE\ mod. + \alpha_2 SCE\ mod. + \alpha_3 CEE\ mod. + u_{it} \quad (6)$$

where:

ROI_{it}, ROA_{it}, MBV_{it} the dependent variable for bank i in year t; measured as explained in section 3.

α_0 = constant. $\alpha_1, \alpha_2, \alpha_3$. = coefficients of the independent variables, details of the definitions of the independent variables are given in Table 6 u_{it} = disturbance term – that is the usual error term.

In order to achieve this we used two linear regression models, tested on three performance variables, for a total of 6 applied linear regressions.

Eq. (1), (2), (3), (4), (5), (6), has been estimated by using OLS, a random effect or a fixed effect Panel regression whit time dummies. This approach permits to estimate the relevant parameters of the empirical model by utilising both the cross- sectional and the temporal data. Moreover, bank fixed effects allow us to control for unobserved heterogeneity, and this is important since the regression are otherwise to suffer from omitted variable problems. Whether the individual effects are fixed or random is tested by applying he Hausmann test. (Trivieri F. 2005).

The Hausmann statistics to test the null hypothesis that explanatory variables and individuals effects are uncorrelated, namely to evaluate if individual effect are fixed or random.

According to the Lagrange Multiplier test and to the Haussman linear regressione (OSL) appears to be the appropriate econometric methodology for the estimation by using ROI and ROA and panel regression appears to be the appropriate econometric methodology for the estimation by using MBV.

The following tables present the results of the regressions.

Xi : reg roi hce sce cee

Number of obs = 63
F (5, 57) = 6.71
Prob > F = 0.0001
R – squared = 0.6129

Table 8

Coefficients

roi	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
Hce	-.0012819	.0009956	-1.29	0.203	-.0032755	.0007117
Sce	.0047287	.0113094	0.42	0.677	-.0179179	.0273753
Cee	.6644081	.1323095	5.02	.000	.3994629	.9293534
_Itime_2006	. 0046835	.0078807	0.59	0.5	-.0110973	.0204643
_Itime_2007	.004698	.0031078	1.51	0.136	-.0015252	.0109212
_cons.	-.0008334	.0068704	-0.12	0.904	-.0145911	.0129242

Xi : reg roa hce sce cee

Number of obs = 63
F (5, 57) = 3.39
Prob > F = 0.0095
R – squared = 0.5354

Table 9

Coefficients

roa	Coef.	Robust Std. Err.	t	P> | t |	[95% Conf. Interval]	
Hce	-.0001984	.0010548	-0.19	0.852	-.0023105	.0019138
Sce	.0007368	.0116002	0.06	0.950	-.0224921	.0239658
Cee	.5505887	.1341349	4.10	.000	.2819883	.8191892
_Itime_2006	-.0110231	.0079942	-1.38	0.173	-.0270313	.0049851
_Itime_2007	-.0025621	.0066239	-0.39	0.700	-.0158262	.010702
_cons.	.0041955	.0119753	0.35	0.727	-.0197845	.0281756

Xi : xtreg mbv hce sce cee

Number of obs = 63
Number of group = 21
Wald chi2 = 150.57
Prob > chi2 = 0.0000

Table 10

Coefficients

mbv	Coef.	Robust Std. Err.	t	P> | t |	[95% Conf. Interval]	
Hce	.0287602	.0197108	1.46	0.145	-.0098723	.0673926
Sce	-.031113	.138383	-.22	0.822	-.3023387	.2401126
Cee	-1.859424	1.130888	-1.64	.100	-4.075925	.3570759
_Itime_2006	. 0697977	.1661079	0.66	0.511	-.13817	.2777654
_Itime_2007	- .02885738	.1024689	-2.82	0.005	-.4894091	-.0877384
_cons.	1.980879	.1796912	11.02	0.000	1.628691	2.333067

Xi : reg roi hce mod_ sce mod_ cee mod_

Number of obs = 63
F (5, 57) = 8.97
Prob > F = 0.0000
R – squared = 0.7781

Table 11

Coefficients

roi	Coef.	Robust Std. Err.	t	P> | t |	[95% Conf. Interval]	
Hcemod_	8.11e-06	.0016344	0.00	0.996	-.0032648	.0003281
Sce mod_	-0.222489	.0088965	-2.50	0.015	-.0400639	-.0044339
Cee mod_	.6439348	.1330039	4.84	0.000	.377599	.9102705
_Itime_2006	-.0006122	.0043998	-0.14	0.890	-.0094226	.0081982
_Itime_2007	.007118	.0052893	1.35	0.184	-.00034735	.0177096
_cons.	-.0102389	.0066335	1.54	0.128	-.0030443	.0235222

Xi : reg roa hce mod_ sce mod_ cee mod_

Number of obs = 63
F (5, 57) = 3.37
Prob > F = 0.0097
R – squared = 0.5355

Table 12

Coefficients

roi	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
Hcemod_	.0002015	.0010665	-0.19	0.851	-.002337	.0019341
Sce mod_	0.004278	.0037935	0.11	0.911	-.0071686	.0080242
Cee mod_	.5507432	.1345033	4.09	0.000	.2814051	.8200814
_Itime_2006	-..10946	.00846	-1.29	0.201	-.0279009	.0060089
_Itime_2007	-.0025419	.0071649	-0.35	0.724	-.0168893	.0118055
_cons.	.0043148	.0093643	0.46	0.647	-.0144369	.0230665

Xi : xtreg mbv hce mod_ sce mod_ cee mod_

Number of obs = 63
Number of group = 21
Wald chi2 = 146.60
Prob > chi2 = 0.0000

Table 13

mbv	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
Hcemod_	.0278926	.0207397	1.34	0.179	-.0127565	.0685416
Sce mod_	0.191803	..0272796	0.70	0.482	-.0342868	0.726474
Cee mod_	-1.857157	1.134652	-1.64	0.102	-4.081033	.3667188
_Itime_2006	-.0754121	.1098009	0.69	0.492	-.1397937	.2906179
_Itime_2007	-.2928023	.1044491	-2.80	0.005	-.4975187	-.088086
_cons.	1.95897	.1864036	10.51	0.000	1.593626	2.324314

9. Main results of the research

Analysing the different assessed multivariate linear regressions, we can clearly see that, for Italian banks quoted in the three year period 2005-2007, the value of intellectual capital did not weigh upon business performance, as the variation of the dependent variables ROI and ROA was not significant relative to the variations of the explicative variable, represented by the value of hce and sce.

In fact, the values of the independent variables contained in the evaluations reported above present values proximate to 0, signalling an irrelevant incidence on the dependent variables. Just the cee, shows a significant positive relationship with roi and roa (table 8, 9), and negative relationship with mbv(Table 10).

The results of the modified VAIC with the addition of training costs do not modify the result of the evaluation and the assessments on the correlation between IC and performance.

10. Concluding remarks

A possible interpretation of the results of this empirical study is reported in the following observations.

The correlation between IC value and business performance measured by profitability indicators is low for reasons linked to the intrinsic limitations of the profitability indicators themselves.

The measurement of such indicators is influenced by estimations, approximations and conjectures that can alter the capacity of such estimators to synthesise the value of the business.

The negative correlation between IC value (like VAIC's components) and MBV is, in the opinion of the author, to be attributed to the imperfect functioning of the capital market in Italy. Elsewhere, where financial markets are wide and highly efficient, the creation of business value can be captured by the market value of the business. In Europe in general, and in particular in Italy, this does not occur, hence the need to initiate a process of diffusion of value by management through other means and more appropriate channels (Guatri L. and Bini M., 2005).

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