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The Influence of the Intellectual Capital on the Firms' Market Value: A Study of Listed Firms in the Tehran Stock Exchange (TSE)

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Abstract**—**Intellectual capital is one of the most valuable and important parts of the intangible assets of enterprises especially in knowledge-based enterprises. With respect to increasing gap between the market value and the book value of the companies, intellectual capital is one of the components that can be placed in this gap. This paper uses the value added efficiency of the three components, capital employed, human capital and structural capital, to measure the intellectual capital efficiency of Iranian industries groups, listed in the Tehran Stock Exchange (TSE), using a 8 years period data set from 2005 to 2012. In order to analyze the effect of intellectual capital on the market-to-book value ratio of the companies, the data set was divided into 10 industries, Banking, Pharmaceutical, Metals & Mineral Nonmetallic, Food, Computer, Building, Investments, Chemical, Cement and Automotive, and the panel data method was applied to estimating pooled OLS. The results exhibited that value added of capital employed has a positive significant relation with increasing market value in the industries, Banking, Metals & Mineral Nonmetallic, Food, Computer, Chemical and Cement, and also, showed that value added efficiency of structural capital has a positive significant relation with increasing market value in the Banking, Pharmaceutical and Computer industries groups. The results of the value added showed a negative relation with the Banking and Pharmaceutical industries groups and a positive relation with computer and Automotive industries groups. Among the studied industries, computer industry has placed the widest gap between the market value and book value in its intellectual capital.

Keywords**—**Capital Employed, Human Capital, Intellectual Capital, Market-to-Book Value, Structural Capital, Value Added Efficiency.

I. Introduction

THE aim of this study is to investigate the relationship between the market value of companies and the intellectual capital defined as knowledge-based equity of companies. The intellectual capital of a company consists of all components of intellectual capital (human capital, structural capital and capital employed) and their ability to create value, which is evaluated at the market value. As such, monitoring the components of intellectual capital is not enough, but also the intellectual capital efficiency. A company can have the best qualification structure of intellectual capital, however, if it creates a little value with regard to its resource, its intellectual ability is low [1].

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The increasing gap observed between market value and book value of many companies has drawn attention towards investigating the value missing from financial statements. According to various scholars, intellectual capital is considered to be the hidden value that escapes financial statements and the one that leads organizations to obtain a competitive advantage [7], [9]. Additionally, research results suggest that the limitations of financial statements in precisely explaining firm value reveal the fact that, nowadays, the source of economic value is the creation of intellectual capital and no longer the production of material goods [7].

The main purpose of the present study is to examine the relationship between intellectual capital and market value. The methodology for the measurement of intellectual capital was based on the studies [23], [7]. The empirical investigation was conducted using data drawn from a panel consisting of 154 Iranian companies listed in the TSE, from ten different industries groups (period 2005 to 2012). Moreover, based on the aforementioned value added intellectual coefficient (VAIC^{TM}) methodology, the study, analytically examines the separate effects of value added efficiency of capital employed, value added efficiency of human capital, and value added efficiency of structural capital on market value.

Section II includes a short literature review concerning the main variables of the study. In the Sections III and IV, the hypothesis and the research methodology are being presented. The results and conclusions are discussed in the Sections V and VI respectively.

II. Literature Review

Various attempts have been made towards developing a widely accepted definition of intellectual capital, until most authors finally agreed on its basic parameters. In broad terms, 'intellectual capital' can be defined as the intellectual or knowledge-based resources of an organization. Furthermore, the creation of a universal definition by defining intellectual capital was contributed as the intellectual material that can be formalized, captured, and leveraged to produce a higher value asset [11]. In the same method, intellectual capital was defined as the knowledge that can be converted into value and intellectual capital can be also defined as the gap observed between a firm's book and market value. [9]. Also, according to [12], a method for determining the intellectual (intangible) assets of a company is to compare market to book value. These arguments are based on the nature of intellectual capital. The intellectual assets of a company are intangible in

nature and are characterized as "hidden assets", since it is difficult to identify their contribution to a firm and quantify them in a financial statement [8].

The observed gap between market and book value that has been highlighted in the great deal of research on the intellectual capital [2], [21], [22] can be, therefore, attributed to the intellectual capital assets that are not recognized in balance sheets [6]. The role of intellectual capital in filling the gap between book and market value has brought even wider research attention towards the investigation of its nature [7].

Intellectual capital means anything an enterprise can use to increase its competitive advantage in the market place, including knowledge, information, intellectual property rights and experience [16], [17]. In other words, intellectual capital is presented as intangible assets and it produces value to enterprises that can be reflected as final income in financial statements, but it cannot be expressed as an accounting title in financial statements. Therefore, if an enterprise can quantify, evaluate as well as analyze those intangible assets, it will increase its competitiveness in the industry. Therefore, intellectual capital is an intangible asset, but not all intellectual capital is captured within existing accounting definitions of intangible assets (in other words, accounting intangible assets are a sub-set of intellectual capital) [14]. Following an accounting-based definition, some have argued that a corporation's intellectual capital can be defined as the difference between the value of its tangible net assets and its market capitalization. Furthermore, such a broad definition does not help in the recognition or identification of individual elements of intellectual capital. Without such recognition or identification, it is difficult to measuring the intellectual capital of the companies.

References [18]-[20] proposed a measurement scheme termed the Intellectual Assets Monitor, which includes three categories: internal structure, external structure, and employee competence.

Although there are a variety of intellectual capital definitions, mostly due to the fact that both knowledge-based and economic-based approaches exist [5], a considerable number of scholars and practitioners identify three basic components of intellectual capital; human capital, structural capital and customer (relational) capital [8], [22].

References [25], [26] developed a convenient methodology of measuring intellectual capital and also argued that the market value of organizations is created by capital employed and intellectual capital, the latter consisting of human and structural capital. This methodology proposed aims to provide information about the value creation efficiency of both tangible, capital employed, and intangible, human and structural capital, assets of an organization. This method is named VAIC^{TM} and is distinguishable because it indirectly measures intellectual capital via the measurement of value added efficiency of capital employed (VACE), value added efficiency of human capital (VAHC), and value added efficiency of structural capital (VASC). The VAIC^{TM} methodology is being adopted in this research, following the methodological framework of [7], [23]. The key assumption of this model is that human capital is an investment, not a cost. Value-added is thus the difference between output and input. With VAIC^{TM} defined through its components of human capital coefficient, structural capital coefficient, and physical capital employed coefficient, business managers have an indicator with which to study and monitor the company's value creation efficiency due to intellectual capital.

In spite of the inherent limitations of method of measuring intellectual capital, its simplicity, subjectivity, reliability, and comparability make it an ideal measure for the context of the present study. Taking that into account, according to [28], the simplicity of VAIC^{TM} offers good services to researchers and, furthermore, enables cross-sectional comparisons. Moreover, VAIC^{TM} is argued to be an appropriate intellectual capital measurement tool due to the fact that all data applied in its calculation are based on audited information, which is objective and verifiable [23].

On the field of empirical research, a multitude of studies has empirically utilized VAIC^{TM} as a measure of intellectual capital. Reference [23] utilized the VAIC^{TM} methodology to measure the relationship between intellectual capital and traditional measures of corporate performance.

Reference [7] conducted an empirical investigation on the relationship between intellectual capital, market value and financial performance. They used a large sample of Taiwanese listed companies and utilized [25], [26]'s VAIC^{TM}. Their study underlined the importance of intellectual capital in the enhancement of firm profitability and revenue growth. The empirical results proved that: investors valuate higher companies with better intellectual capital efficiency; and companies with better intellectual capital efficiency obtain a higher degree of profitability and revenue growth in the current and following years [7]. The VAIC^{TM} methodology, developed by [25], [26], has been, moreover, adopted in various other studies, mostly in those conducted in emerging and developing countries. On another study, [15] tried to determine whether a significant relationship between VAIC^{TM} and market to book value ratio really exists. The author used data from the financial statements of banks listed in the Istanbul Stock Market over the years 1998 to 2001. The results demonstrated that there was no significant relationship between the dependent variable (MV/BV) and the independent variables (VAIC^{TM} and its three components). Reference [3] investigated the impact of the value creation efficiency on investors' capital gains on shares. He used data collected from listed companies in Thailand's stock market and utilized the VAIC^{TM} methodology. The empirical research found that firms' intellectual capital has a significant positive relationship with its investors' capital gains on shares.

Finally, in an exploratory study, [13] used VAIC^{TM} to measure the intellectual capital performance of 17 commercial banks in Bangladesh for the period 2002 to 2004. According to their findings, all 17 banks of the sample had relatively higher human capital efficiency than other capital efficiencies.

III. Hypotheses

The results of previous studies have shown that there is a

growing distance between the market value and the book value of companies. In other words, the market estimates the value of companies with high intangible assets (intellectual capital) to be significant higher that the calculated book value [7], [23], [27]. Therefore, it is hypothesized that the greater the intellectual capital, the higher the ratio of market-to-book value, hence the main hypothesis is as:

- "There is a positive significant relationship between the value added efficiency of intellectual capital and the market to book value."

For testing the paper hypothesis, we used VAIC™ as an aggregate measure for company intellectual ability (intellectual capital). As stated earlier in the paper, VAIC™ includes three component measures: value added efficiency of capital employed (VACE), value added efficiency of human capital (VAHC) and value added efficiency of structural capital (VASC). Since different significance may be put on each of the three components of VAIC™, it would be interesting to examine the separate effect of each on market-to-book value ratio. Such an investigation would increase the explanatory power of the conceptual framework and give raise to interesting observations. Thus, the main hypothesis is broken down to three hypotheses:

H 1: There is a positive significant relationship between the value added efficiency of capital employed and the market to book value.

H 2: There is a positive significant relationship between the value added efficiency of human capital and the market to book value.

H 3: There is a positive significant relationship between the value added efficiency of structural capital and the market to book value.

IV. Research Methodology

A. Sample and Data Selection

For the sake of gathering the needed data related to financial statements of sample companies, we use the electronic archival data provided by TSE. In some cases that our required data is incomplete, we use the manual archive existed in the TSE's library. We also, acquire a part of data from TADBIRPARDAZ and SAHRA (2 Iranian Software).

The final sample of the present study consists of 154 Iranian companies listed in the TSE. These companies were classified in 10 groups (according to official sector classification): Banking, Metals & Mineral Nonmetallic, Food, computer, Building, Investments, Pharmaceutical & Chemical, Cement, and Automotive industries. The selected data cover a period of eight years, from 2005 to 2012. Not all ten sectors are knowledge-based, however, have a significant importance to the Iranian economy.

B.Panel Data Methodology

References [4] and [10] indicate panel data methodology controls for individual heterogeneity, reduce problems associated with multicollinearity and estimation bias, and specify the time-varying relation between dependent and independent variables. This study uses a panel data methodology and an F-test is used to determine whether the fixed-effects model outperforms the pooled OLS. The appropriateness of the random-effects model relative to the pooled OLS model is examined with the Breusche and Pagan Lagrange multiplier (LM) test. Hausman's test is used to compare the fixed-effects model with the random-effects model.

C. Variable Definition

1.Independent Variables

The present study includes four independent variables [24], [25]:

1) VACE, indicator of value added efficiency of capital employed.
2) VAHC, indicator of value added efficiency of human capital.
3) VASC, indicator of value added efficiency of structural capital.
4) VAIC™, the composite sum of the three separate indicators.

The first step towards the calculation of the independent variables is to calculate value added (VA). According to [27] VA is calculated as:

$$\mathrm{VA} = \mathrm{OUTPUT} - \mathrm{INPUT}$$

where OUTPUT equals total income from all products and services sold during the particular financial year; and INPUT is the total costs and expenses that incurred by the firm during the same financial year (excluding labor expenses, which are employees' compensation and all expenses that are related to their training and improvement).

Second, capital employed (CE), human capital (HC) and structural capital (SC) is being calculated as:

$$\mathrm{CE} = \text{Total assets} - \text{intangible assets}$$

$$\mathrm{HC} = \text{Total investment on employees(salary, wages, etc)}$$

$$\mathrm{SC} = \mathrm{VA} - \mathrm{HC}$$

$$\mathrm{VACE} = \mathrm{VA}/\mathrm{CE}$$

$$\mathrm{VAHC} = \mathrm{VA}/\mathrm{HC}$$

$$\mathrm{VASC} = \mathrm{SC}/\mathrm{VA}$$

Finally, VAIC™ and its three components are being calculated as:

$$\mathrm{VAIC}^{TM}=\mathrm{VACE}+\mathrm{VAHC}+\mathrm{VASC}$$

2.Dependent Variables

The present study includes one dependent variable and that is Market-to-book value ratios.

The market-to-book value ratio is simply calculated by dividing the market value (MV) with the book value (BV) of common stocks

D. Empirical Models

In order to examine the hypotheses of this study, we test empirically the relations between VAIC™ and market-to-book value ratio using model (1); and we examine the effects on VACE, VAHC and VASC on market-to-book value ratio by using the following models (1-1), (1-2), and (1-3).

$$M/B = a_0 + a_1 VAIC™ + \varepsilon \quad (1)$$

$$M/B = a_0 + a_1 VACE + \varepsilon \quad (1\text{-}1)$$

$$M/B = a_0 + a_1 VAHC + \varepsilon \quad (1\text{-}2)$$

$$M/B = a_0 + a_1 VASC + \varepsilon \quad (1\text{-}3)$$

V. Results

The F-test and the Lagrange multiplier test indicate that the fixed-effects and the random-effects models outperform the pooled OLS. In addition, the Hausman test generally indicates that the random-effects model is superior to the fixed-effects model.

Because the data are pooled, heteroskedasticity and autocorrelation may influence the OLS results. For the panel data analysis, a likelihood ratio test and the Wooldridge test identified heteroskedasticity and autocorrelation, respectively.

A. Statistical Results

In this section, the empirical analysis of the relationship between intellectual capital and market to book value is presented and discussed in various industries. Table I shows the statistical index of industries. After the estimation of the Hausman test, the regression model conducted and according to the Tables II-IV, the results of the estimating regression models and statistical test in the various industries between the intellectual capital and the market to book value are as follow:

TABLE I
The Statistical Index of Industries

statistical index / Industry Groups	Adj.R^2	Prob (F-statistic)	S.E. of regression	Sum squared reside	Log likelihood	SD dependent var.
Banking	0.958	-	0.186	0.034	5.312	0.918
Pharmaceutical	0.884	0.00	1.088	11.84	-26.14	3.201
Metals & Mineral Nonmetallic	0.532	0.02	5.034	304.1	-60.1	7.361
Food	0.343	0.00	1.567	93.4	-93.78	1.934
Computer	0.884	-	2.034	49.64	-31.76	5.982
Building	0.491	0.00	1.752	95.15	-76.77	2.458
Investments	0.551	0.00	0.316	1.997	-1.926	0.472
Chemical	0.622	0.00	1.639	69.86	-63.01	2.667
Cement	0.649	0.02	6.413	781.5	-99.04	8.342
Automotive	0.57	0.00	2.399	650.6	-324.5	3.203

TABLE II
Model (1-1): The Effect of VACE on M/B

Industry Groups	Coefficient	t-static	Prob.
Banking	2.00	9.93	0.06
Pharmaceutical	0.31	0.95	0.36
Metals & Mineral Nonmetallic	5.11	2.27	0.04
Food	0.44	1.89	0.06
Computer	2.00	6.24	0.00
Building	0.00	0.07	0.51
Investments	0.00	0.16	0.87
Chemical	0.94	2.12	0.04
Cement	9.33	1.92	0.06
Automotive	0.18	-1.62	0.10

TABLE III
Model (1-2): The Effect of VAHC on M/B

Industry Groups	Coefficient	t-static	Prob.
Banking	-1.75	-9.47	0.06
Pharmaceutical	-1.02	-4.48	0.00
Metals & Mineral Nonmetallic	-0.48	-1.17	0.26
Food	0.08	0.75	0.45
Computer	0.24	8.60	0.00
Building	0.05	1.13	0.26
Investments	0.00	0.12	0.90
Chemical	0.03	0.42	0.67
Cement	-0.42	-1.25	0.22
Automotive	0.12	2.53	0.06

The results of data analysis using panel data methodology indicate that most studied statistical indicators confirmed the correctness of all tests in ten industrial groups. More careful study of statistical analysis and tests' results showed that first hypothesis (H_1) is confirmed with a 90 percent confidence interval for some industrial groups including banking, metals and mineral nonmetallic, foods, chemicals, cement, and computers. Furthermore, the coefficient of VACE for different industries shows different degree of relationships between VACE and the ratio of market value to book. This relationship is stronger than other variables in the cement industry. However, the most significant relationship belongs to the computer.

TABLE IV
Model (1-3): The Effect of VASC on M/B

Industry Groups	Coefficient	t-static	Prob.
Banking	9.76	9.34	0.06
Pharmaceutical	22.07	3.92	0.00
Metals & Mineral Nonmetallic	0.04	-0.40	0.69
Food	0.05	0.43	0.66
Computer	-3.83	2.67	0.02
Building	1.56	1.17	0.25
Investments	0.43	1.06	0.30
Chemical	0.06	0.20	0.84
Cement	2.98	0.20	0.85
Automotive	0.07	0.18	0.83

According to statistical results, second hypothesis (H_2) for some industrial groups including banking, pharmaceutical, and computer is confirmed with a 90 percent confidence interval;

however, there is a negative coefficient for banking and pharmaceutical industries which indicates that there is an adverse relationship between the amount of value added of human capital and the ratio of market to book value. On the other hand, there is a significant direct relationship between the amount of value added of human capital and the ratio of market to book value in the computer industry. Also, there is not any significant relationship between the value added of human capital and the ratio of market to book value in other industries.

Due to statistical results, the third hypothesis (H_3) is confirmed for some industry groups including banking, pharmaceutical, investment and computer with a 90 percent confidence interval. The results also indicate that there is a positive relationship between the value added of structural capital and ratio of market to book value in the banking, pharmaceutical and investment industries. This relationship is stronger for the pharmaceutical industry, while there is a negative relationship in the computer industry.

VI. Conclusion

This paper examines the influence of intellectual capital on the market value of listed companies in Tehran Stock Exchange (TSE) that belong to ten major active industries in Iran. The results show that intellectual capital variables have the most effect on the ratio of market to book value in the banking, pharmaceuticals and computer industries, and have least effect in the food industry. Among the studied industries, computer industry has the widest gap between the market value and book value in its intellectual capital.

Overall, the empirical findings suggest that the Iranian market is placing greater faith and value in physical capital assets than intellectual ones. In order to encourage greater acceptance and understanding of the concept of intellectual capital and the development of its related assets, policy makers should be more attention in economic decision and intensify their initiatives. Moreover, on a microeconomic level, companies should improve their intellectual assets and understand that only with those will be able to remain competitive, fight against the severe domestic and foreign competition, and create sustainable competitive advantages.

Finally, it must be, underlined that the empirical results indicate the existence of a significant relationship between the ratio of market to book value and only one of three components of intellectual capital (value added efficiency of human capital or VAHC). Thus, it is concluded that in the Iranian business context, the development of human resources seems to be one of the most significant factors of economic success. Hence, improving human capital characteristics seems to be of vital importance for Iranian companies.

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