



Statistical analysis of the Impact of Intellectual Capital elements on future Performance: A Case Study of Tehran Stock Exchange

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Abstract

This research aimed to investigate the relationship between intellectual capital elements (human capital, customer capital and structural capital) and future performance of the listed companies on Tehran Stock Exchange. The Pulic Model was used for the intellectual capital and the EVA, P/E, Q, GR and ROA for the performance of the companies. Data required for calculating VAIC were collected from the annual reports of 111 companies listed in Tehran Stock Exchange during the years 2007-2012. The statistical test used for data analysis was liner multiple regressions. Eviews6 software was used for test the hypotheses. The results of this study confirmed that there is a significant relationship between intellectual capital and two of the financial performance indexes, namely P/E and GR. But no relationship was observed between intellectual capital and Tobin Q index of financial performance.

Keyword: Intellectual capital (IC), VAICTM, financial performance, Tehran stock exchange.

Introduction

The determinants of firm performance are two main research streams. First, the traditional economy is based mainly. And on the importance of external factors and market in determining the success of firms underlines. Other research is based on the paradigm of behavioral and sociological and organizational factors and their relevance to the environment are as the main factors determining the success of the company. I hope this research, it is useful to guide the Iranian public and private organizations to managing and measuring intellectual capital, and all users able to by better understanding of the concept of intellectual capital and its importance to various indicators of financial, their the return on investment is higher. Since process intellectual capital in Iran more than theory and less practice test until useful and important is more to the users, (financial managers and investment) for benefit is more apparent, this need is most felt.

The purpose of this paper is investigation the relationship between intellectual capital and future performance of the companies. Therefore, in this paper is to define Intellectual Capital, element of Intellectual Capital and the (VAIC) model. The remainder of this paper contains a brief summary of the relevant literatures and develops the theoretical framework for our research hypotheses. After that, is explain the methodology, discusses and analyzing. And the final section will bring concludes with our research result.

Viewpoint Intellectual Capital: IC was first proposed by Galbraith 1969, as a form of knowledge, intellect, and brainpower activity, which uses knowledge to create value. A company can create differentiated advantages with this capital.

The importance of IC has been widely acknowledged by scholars. Schiuma and Lerro believe that human, relational, structural, and social capital as the four main knowledge-based categories building the knowledge-based capital of a region and find that policy makers for the definition of policies oriented towards the development of regional knowledge asset domains to develop regional innovation capacity. Walsh et al. indicated that the investments of companies in the enhancement of human capital, structural capital, and customer capital would increase their organizational values¹.

Human Capital is the availability of skills, talent and know-how of employees that is required to perform the everyday tasks that are required by the firm's strategy. Structural Capital is the availability of information systems, knowledge applications, databases, processes and other infrastructure required to support the firm in executing its strategy. Relational Capital is the external linkage of the Company with Suppliers and Customers that enables it to procure and sell goods and services in an effortless manner².

Background and Theoretical Basis: Maditinos et al. was attempted to investigate the empirical relation of IC with firms market and financial performance of 96 listed firms in Athens Stock Exchange and argued that only (HCE) has significant and substantive positive relation with financial performance (ROE) of firms³. Dunn and Lucas examined the empirical relation of IC performance and financial performance of hotel industry of Australia over the period of 2004-2007 conducting VAICTM methodology. They concluded that (ICE) Intellectual Capital Efficiency is based on Human Capital Efficiency (HCE) of hotel industry of Australia which positively encourages financial performance (ROA) of hotel industry. Ji-jian et al. was

conducted the study to measure the IC performance and its impact on financial performance of 32 automobiles companies listed in Shanghai Stock Exchange. The empirical findings revealed that all the determinants of VAIC™ have substantive effect on financial performance of 32 automobiles countries³. Hossein Hassani⁴ in a study examined the relationship between intellectual capital and value added and profitability of listed companies in Tehran Stock Exchange. He studied period of 2004-2008. In this study, the intellectual capital was measured with different methods. Finally, regression analysis was used for testing the hypotheses. The results of data analysis revealed that the first hypothesis (the relationship between IC, and earnings and EVA) was not accepted. The second hypothesis (the relationship between VAIC, and earnings and EVA) was rejected, but the third hypothesis (the relationship between the CIV, and earnings and EVA) was accepted. Mojtahedzadeh et al.⁵, in their research titled the relationship between intellectual capital (human, customer, structural) and insurance industry performance (in managers' view), investigated the relationship between intellectual capital and insurance industry performance from managers' point of view. Their study showed that intellectual capital elements (human, customer or interactional and structural) have significant relationships with the performance of the company when studied independently and separately, but when they were studied at the same time, only the elements of human and structural capital had a significant relationship with the performance of the company. Ahangar⁶ attempted to investigate the empirical relation of IC with firm market value and financial performance of 96 listed firms on Athens Stock Exchange. He argued that only HCE has significant positive relationship with financial performance (ROE) of firms. Namazi and Ebrahimi⁷ investigated the impact of intellectual capital on the current and future financial performance of listed companies on the Tehran Stock Exchange. The research period was from years 2002 to 2004, and the selected sample consisted of 120 companies (belonging to the automotive, metals, non-metallic minerals and chemical industries). For testing these hypotheses, partial least squares regression was used. The results suggested that regardless of company size, debt structure and past financial performance, there is a significant positive relationship between intellectual capital and current and future financial performance of the company at the level of all companies as well as industries level, company size. But the relationship between debt structure and current and future financial performance at the level of all companies is positive and significant and in level chemical and pharmaceutical industries the relationship is positive as well. However, at the level of automotive, metal and non-metallic minerals industries, the relationship is not significant clear. Saudah Sofia⁸ argued that IC has positive relationship with financial performance of firms and, the same findings are supported by Riahi-Belkhoui who concluded that IC has a positive and substantive impact on corporate performance of US multinationals. Another study revealed that VAIC™ has positive and significant relationship with financial, stock exchange and economic performance of industries. He, furthermore, concluded that VAIC™ has a significant

relationship only with market performance of high tech industries while Capital Employed Efficiency (CEE) is the key determinant of financial and stock market performance⁹.

Richier conducted a study with IC stock (CIA) and IC efficiency (ICE) and corporate financial performance as measured by ROA, ROE and ROS of 1000 biggest Brazilian companies. The study results suggest the existence of a positive relationship between both CIV and ICE, and the dependent variables ROE, ROA and ROS. B. G. Bharathi Kamath measures the performance of banks in Pakistan on a new dimension of intellectual capital. The study estimates the value added intellectual capital (VAIC) of the banks in Pakistan for a two-year period. The study concludes that the private sector banks were doing much better than all other banks in Pakistan on intellectual capital efficiency levels. The good performance is attributed to proper usage and management of human resources⁶.

Material and Methods

Since the results of this study can be used in financial decision-making process, it has a practical purpose. This type of research emphasizes effective actions and pays less attention to habits. Regarding methodology, the present study is correlational research. We used multiple regression model. For testing the significance of multiple regression model, F Fisher and student t test are used. These two statistical techniques test the significance of general multiple regression and detailed multiple regression Coefficients. If, in the significant level of 95%, observed F value is bigger than critical F value ($F > F_{\alpha(K-1, N-K)}$), H_0 is rejected, but otherwise H_0 is accepted. It is clear that if H_1 is accepted, the regression will be significant (Yaltaji, 1999). Also, if the observed t value exceeds the critical t value, the null hypothesis is rejected, and otherwise it cannot be rejected. Confirmation of H_0 means that the Coefficient is not statistically significant, and its rejection means that the Coefficient is statistically significant¹⁰.

Research Hypotheses

Main hypothesis: The intellectual capital has a significant positive impact on the future financial performance of the Listed Companies on Tehran Stock Exchange.

First Subsidiary hypothesis: Value Added Capital employed Coefficient (VACA) has a significant positive impact on the future financial performance.

Second Subsidiary hypothesis: Value Added Human Capital Coefficient (VAHC) has a significant positive impact on the future financial performance.

Third Subsidiary hypothesis: Value added structural capital coefficient (STVA) has a significant positive impact on the future financial performance

Collecting Research data: The final sample of the present study consists of 111 firms of the listed companies on Tehran stock exchange. The selected data cover a period of six years, from 2007 to 2011. All this six periods are the basic knowledge and have a significant importance in the economy of Iran. The method of sample selection was according to Systematic delete method. The selected companies should have the following characteristics: During the study period, they should not have any changes in the fiscal year. During the research course, they should not make a loss. The information needed to define the variables should be available.

Independent variables: The VAIC methodology developed by Ante Pulic¹¹⁻¹² forms the underlying measurement basis for the independent variable in the present study. In his words, VAIC is an analytical procedure designed to enable management, shareholders and other relevant stakeholders to effectively monitor and evaluate the efficiency of VA by a firm's total resources and each major resource component. There are four independent variables in this research:

Value Added Capital employed Coefficient (VACA): It shows show much value a monetary unit invested in capital employed has created.

Value Added Human Capital Coefficient (VAHC): It shows how much value a monetary unit invested in capital human has created.

Value added structural capital coefficient (STVA): It shows how much value a monetary unit invested in capital structure has created.

Value Added Intellectual Coefficient (VAICTM): VAICTM of a firm is calculated through the following five steps:

Value added can be calculated by the following formula:

$$VA = OP + EC + D + A$$

Where, OP is operating profits, EC employee costs (the salaries and the social expenses of staff) and D and A, depreciation and amortization of assets, respectively.

The calculation of Value Added Capital employed Coefficient (VACA_{it})

$$VACA_{it} = VA_{it}/CA_{it}$$

Where, CA_{it} = Capital Employed = Physical Assets + Financial Assets = Total Assets - Intangible Assets at end of 't' period. VACA_{it} = the value created by one unit of capital employed during the 't' period.

Calculation of Value Added Human Capital Coefficient (VAHC_{it})

Human Capital (HC): Overall employee expenses (salaries, education, and training), in this analysis, are considered as an investment, not as cost, and thus not as substantial part of INPUT any more. Therefore:

$$VAHC_{it} = VA_{it}/HC_{it}$$

Where, HC_{it} = investment in Human Capital during the 't' period or total salary and wage including all incentives. VAHC_{it} = Value added by one unit of Human Capital invested during period of 't'.

Calculation of the value added structural capital coefficient (STVA_{it}).

Structural Capital (SC): Result of Human Capital's past performance (organization, licenses, patents, image, standards, and relationship with customers). Therefore:

$$STVA_{it} = SC_{it}/VA_{it}$$

Where, SC_{it} = Structural capital (VA_{it} - HC_{it}). STVA_{it} = the proportion of total VA accounted by structural capital.

Calculation of Value Added Intellectual Coefficient (VAIC_{it})

$$VAIC_{it} = VAHC_{it} + VACA_{it} + STVA_{it}$$

Where, VAIC_{it} = Indicate corporate value creation efficiency on firm resources.

Dependent variables: The dependent variable in this research is the financial performance of firms. Also for calculating the dependent variable, (i.e., financial performance), economic value added (EVA), the price per share to earnings per share ratio (P/E), Tobin Q (Q), revenue growth (GR) and Rate of return on assets (ROA) are used. How to calculate dependent variables is presented below:

Economic Value Added (EVATM): The EVATM method of value measurement has its basis in traditional accounting. As defined by Stern Stewart, EVATM is the difference between a company's net operating income after taxes and its cost of capital of both equity and debt. In corporate finance, Economic Value Added or EVA is an estimate of a firm's economic profit – being the value created in excess of the required return of the company's investors¹³.

$$EVA = NOPAT_t - (WACC * CAPITAL_{t-1})$$

(WACC) is the weighted average cost of capital; CAPITAL_{t-1} is the net book value of the company last year; NOPAT is the net operating profit after tax.

$$NOPAT = \text{Operating Income} \times (1 - \text{Tax Rate})$$

The WACC formula is:

$$wacc = \frac{E}{V} * Re + \frac{D}{V} * Rd * (1 - TC)$$

Where: Re = cost of equity, Rd = cost of debt, E = market value of the firm's equity, D = market value of the firm's debt, V = E + D, E/V = percentage of financing that is equity, D/V = percentage of financing that is debt, Tc = corporate tax rate.

Price-Earnings Ratio - P/E Ratio: A valuation ratio of a company's current share price compared to its per-share earnings¹⁴.

Calculated as:

$$\frac{P}{E} = \frac{\text{Market Value per Share}}{\text{Earnings per Share (EPS)}}$$

Q Ratio (Tobin's Q Ratio): A ratio devised by James Tobin of Yale University, Nobel laureate in economics, who hypothesized that the combined market value of all the companies on the stock market should be about equal to their replacement costs. The Q ratio is calculated as the market value of a company divided by the replacement value of the firm's assets¹⁴

$$Q = \frac{\text{Value of Stock Market} + \text{Liabilities Book Value}}{BV_{TA}}$$

Where: BV_{TA} = Total net Asset Book Value = Net book value of equity

Revenue Growth (GR): Revenue growth illustrates sales increases/decreases over time. It is used to measure how fast a business is expanding. More valuable than a snapshot of revenue, revenue growth helps investors identify trends in order to gauge revenue growth over time. Or Revenue Growth is the percent increase (or decrease) in a company's revenue between two or more equivalent fiscal periods¹⁴.

$$GR = \left[\left(\frac{\text{current years revenues}}{\text{last years revenues}} \right) - 1 \right] * \%100$$

Rate of return on assets (ROA): Return on assets is the ratio of annual net income to average total assets of a business during a financial year¹⁴.

$$ROA = \frac{\text{Net Income}}{\text{Total Assets}}$$

Statistical method: For analyzing the research hypothesis, and for investigating the relationship between intellectual capital and future performance, the research independent variables were inserted in to regression equation as delayed variables with a delay period.

$$Y_{it} = a_0 + a_1VAIC_{it}(-1) + e_{it} \quad (1) Y_{it} = a_0 + a_1VACA_{it}(-1) + a_2VAHU_{it}(-1) + a_3STVA_{it}(-1) + e_{it} \quad (2)$$

$Y_{it} = EVA_{it}, P/E_{it}, Q_{it}, GR_{it}, ROA_{it}$

Results and Discussion

To choose between pool data and panel data we can use F limer test. Since the P-value of F limer in table 1 for all indexes is less than 5% (p-value ≤ 0.05), the Null hypothesis is rejected, and method of panel data is accepted. Panel data method is divided into two minor parts: fixed effects method and random effects method. To decide about which method to choose, we used Hausman test. Since the p-values of Hausman test for EVA, P/E and ROA are bigger than 5%, (P-value ≥ 0.05), the Null hypothesis is accepted. Therefore, the random effects method is accepted. And because p-values of Hausman test for Q, GR are less than 5% (p-value ≤ 0.05), the related null hypotheses are rejected and the fixed effects method is accepted. Results of this test are presented in table-1.

Significance of general Multiple regression: With the consideration of observed F value and critical F value for all indexes in table 2 and the total regression p-value, which is lower than 5% (p-value < 0.05), null Hypothesis is rejected and it means that all of coefficients are not zero simultaneously. Therefore, there is a significant relationship between the dependent and independent variables simultaneously.

Table-1
Test Results F Lymr and Hausman of hypothesis

| Index | Test F Lymr | | | Hausman test | | |
|-------|-------------|----------|------------|--------------|----------|----------------|
| | Statistic | p-value | Results | Statistic | p-value | Results |
| EVA | 1.6778 | (0.0001) | panel data | 6.1939 | (0.1851) | Random effects |
| P/E | 1.2819 | (0.0393) | panel data | 0.5784 | (0.9654) | Random effects |
| Q | 1.7685 | 0.0000 | panel data | 40.3517 | 0.0000 | fixed effects |
| GR | 2.5512 | 0.0000 | panel data | 31.5712 | 0.0000 | fixed effects |
| ROA | 14.8863 | 0.0000 | panel data | 5.4006 | (0.2486) | Random effects |

Table-2
Results of data analysis to test the hypothesis using panel data

| Index | | EVA | P/E | Q | GR | ROA | |
|--|--------------------|--------|----------|---------|----------|----------|----------|
| Regression PLS | p-value | 0.0004 | 0.0479 | 0.000 | 0.000 | 0.000 | |
| | Test F of Fisher | 5.0755 | 2.2951 | 2.3486 | 2.9337 | 9.0664 | |
| | Test Durbin-Watson | 1.7201 | 1.6959 | 1.6562 | 2.1385 | 1.8406 | |
| | R2 | 0.23 | 0.13 | 0.18 | 0.24 | 0.46 | |
| coefficients elements of Intellectual Capital | Coefficient | VACA | 1.897561 | 0.04494 | -0.55663 | 0.189853 | 1.780336 |
| | | VAHC | 2.877851 | 0.03458 | -0.00904 | 0.000488 | 0.015391 |
| | | STVA | 7.898491 | -16.192 | 5.831140 | -1.10406 | 12.18233 |
| | | VAIC | -3.95813 | -0.0140 | -0.02785 | 0.000804 | 0.025291 |
| | | C | -4.14329 | 20.6982 | -0.72282 | 1.326401 | -0.76507 |
| | Statistics t | VACA | 0.719669 | 0.02350 | -1.33737 | -2.46989 | 1.979055 |
| | | VAHC | -2.32141 | 0.37150 | -0.22308 | 0.54230 | 0.372250 |
| | | STVA | 0.919524 | -2.6779 | 9.975514 | -10.9793 | 4.044553 |
| | | VAIC | -0.36557 | -0.1759 | -0.68682 | -1.03205 | 0.691521 |
| | | C | -0.60384 | 4.37332 | -1.49802 | 16.4059 | -0.2367 |
| | p-value | VACA | 0.4720 | 0.9813 | 0.1817 | 0.0138 | 0.0482 |
| | | VAHC | 0.0206 | 0.7104 | 0.8236 | 0.5178 | 0.7098 |
| | | STVA | 0.03582 | 0.0076 | 0.0000 | 0.0000 | 0.0001 |
| | | VAIC | 0.7148 | 0.8604 | 0.4925 | 0.3025 | 0.04895 |
| | | C | 0.5462 | 0.0000 | 0.1347 | 0.0000 | 0.8130 |

The results of data analysis related to the five indexes presented in table-2 are interpreted as follows:

Economic Value Add (EVA): Comparing observed t with critical t, and considering p value related to all the coefficients, we can conclude that the null hypotheses related to STVA - VAHU are rejected at 0.05 level of significance. However, the null hypotheses related to VACA - VAIC are accepted at the same level of significance. Therefore, among those four independent variables, only structure capital, human capital have a positive significant relationship with future EVA. The observed statistic of Durbin- Watson revealed that the model does not have self-correlation. Moreover, the obtained R² shows the independent variables of the model (value added structure capital and value added human capital) are able to account for 23% of the variance related to the dependent variable.

The regression equation is as follows:

$$EVA_{it} = -4.14 - 3.95VAIC_{it} + e_{it} \quad (3) \quad EVA_{it} = -4.143 + 1.89VACA_{it} + 2.87VAHC_{it} + 7.89STVA_{it} + e_{it} \quad (4)$$

Earnings per share price index (P/E): Defining the (P/E) index as the dependent variable and Comparing observed t with critical t, and considering p value related to all the coefficients, we can conclude that the null hypotheses related to STVA is rejected at 0.05 level of significance. However, the null hypotheses related to VAHU, VACA and VAIC are accepted at the same level of significance. So from those four independent variables there is a negative significant relationship only between STVA and P/E. The observed statistic of Durbin-Watson revealed that the model does not have self-correlation. Moreover, the obtained R² shows the independent variable of

the model (value added structure capital) is able to account for 13% of the variance related to the dependent variable. The regression equation is as follows:

$$P/E_{it} = 20.69 - 0.014VAIC_{it} + e_{it} \quad (5) \quad P/E_{it} = 20.69 + 0.04VACA_{it} + 0.03VAHC_{it} - 16.19STVA_{it} + e_{it} \quad (6)$$

Index Q Tobin: Regarding Index Q Tobin, Comparing observed t with critical t, and considering p value related to all the coefficients, we can conclude that the H₁ hypothesis for STVA is confirmed at 0.05 level of significance. Thus, between the value added structure capital and Q, a positive significant relationship can be found. The observed statistic of Durbin-Watson revealed that the model does not have self-correlation. In addition, the obtained R² shows that the independent variable of the model (value added structure capital) is able to account for 18% of the variance related to the dependent variable.

The regression equation is as follows:

$$Q_{it} = -0.72 - 0.02VAIC_{it} + e_{it} \quad (7) \quad Q_{it} = -0.72 - 0.55VACA_{it} - 0.009VAHC_{it} + 5.83STVA_{it} + e_{it} \quad (8)$$

Revenue growth rate (GR): Comparing observed t with critical t, and considering p value related to all the coefficients, we can conclude that the null hypotheses related to STVA, VACA and VAIC, are rejected at 0.05 level of significance. However, the null hypothesis related to VAHU is accepted at the same level of significance. So there are positive significant relationships between structure capitals and physical capital and intellectual capital with GR. The observed statistic of Durbin- Watson revealed that the model does not have self-correlation.

Moreover, the obtained R^2 indicates that the independent variables of the model (value added structure capital, Value Added Capital employed and value added intellectual capital) can account for 24% of the variance related to the dependent variable.

The suited regression equation is as follows:

$$GR_{it} = -1.32 + 0.0008 VAIC_{it} + e_{it} \quad (9) \quad GR_{it} = -1.32 + 0.18 VACA_{it} + 0.0004 VAHC_{it} - 1.1 STVA_{it} + e_{it} \quad (10)$$

Rate of return on assets (ROA): Concerning the dependent variable ROA, with the comparison observed t with critical t , and consideration p value related to all the coefficients, it can be concluded that the null hypotheses related to STVA, VACA and VAIC are rejected at 0.05 level of significance. However, the null hypothesis related to VAHU is accepted at 0.05 level of significance. Therefore, STVA, VACA and VAIC have positive significant relationships with ROA. The observed statistic of Durbin- Watson revealed that the model does not have self-correlation. Moreover, the obtained R^2 shows that the independent variables of the model (value added structure capital, Value Added Capital employed and value added intellectual capital) account for 46% of the variance related to the dependent variable.

$$ROA_{it} = -0.76 + 0.02 VAIC_{it} + e_{it} \quad (11) \quad ROA_{it} = -0.76 + 1.78 VACA_{it} + 0.01 VAHC_{it} - 12.18 STVA_{it} + e_{it} \quad (12)$$

Conclusion

In this study, the impact of the intellectual capital components on and their relationships with the future financial performance of companies in Tehran Stock Exchange were studied. Despite the fact that the IC is recognized as an increasingly important strategic asset for sustainable competitive advantage, the results of this study are not able to support this claim. Intellectual Capital was found to have a significant positive relationship only with GR and ROA, as indexes of future financial performance. The findings related to the impact of intellectual capital components on EVA, P/E, Tobin Q, GR, and ROA indexes are shown below.

The results of this research showed that human capital and structure capital have a positive significant relationship with EVA index. The obtained results demonstrated that there was a significant relationship between VAHC and P/E. Therefore, there is a direct (positive) significant relationship between VACA and Q. According to the results, VACA and STVA have a positive significant effect on GR and ROA indexes.

The reason for the above findings may be that companies in Tehran Stock Exchange are not sensitive to intellectual property. These companies focus mainly on physical assets and, in their assessments, they consider physical assets and materials as their criterion.

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