Research Paper

Impact of Intellectual Capital on Cost of Capital and Market Value

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Abstract

Today, the role of intellectual capitals is more effective than financial capitals in valuation of science-based industries in business units. Accounting system plays a key role for finding appropriate strategies towards achieving efficient methods for evaluation of intellectual capitals. One of the most salient failures in traditional accounting systems is not to reflect the value of intellectual capitals in the fiscal reports of the business units. This research is conducted to investigate the relationship between intellectual capital and cost of financing and the market value of listed companies in Tehran Stock Exchange for an eight year period from 2005 to 2012 and to evaluate the data of 84 firms. To measure intellectual capital, the value added intellectual capital coefficient, value added intellectual capital, and value added capital applied were used. Applying these criteria is the most commonly used method for intellectual capital measurement. To analyze the collected data, Pearson correlation method, univariate and multivariate regression models, and Z test of Wang were utilized. The results of this work showed that the value added capital applied, value added intellectual capital, and value added intellectual coefficient have an inverse effect on weighted average cost of capital but do not affect market value.

Keywords: Value added intellectual capital; value added intellectual capital coefficient; valued added capital applied; weighted average cost of capital; market value; cost of financing.

Introduction

Intellectual capital is an issue theoretically addressed over the past few years in a global scale among the firm resources with highest return in entrepreneurship. Hence, today, the necessity of development and management of intellectual capital is an inevitable requirement at national scale within the business field, as it has led to initiation of knowledge-based economy.

Measuring the intellectual capital is important in terms of two aspects: inter organizational aspect which seeks to have a better allocation of resources towards optimum performance and minimizing the costs of organization; and extra organizational which aims to present the information about existing and potential investments of the organization for prediction of future growth and long-term plans.

One of the most important problems in traditional accounting systems is their failure in measuring the intellectual capitals of the firms. Therefore, there is a growing tendency in the firms for accounting the real values of intangible and intellectual capitals in their fiscal bills.

Since the investors are willing to exchange the stocks of other firms, it is needed to determine the market value of these stocks and then the financial value of the firm. In return, the firms should try two maximize the wealth of its shareholders, so then the stocks attract attention of the investors for dealing the stocks of the given firm. This type of demand would result in an increase in the price of stocks in the market. One approach for raising the wealth of shareholders is to enhance the value of common stock of the firm. Thus, the managers are obliged to focus on variables or factors attracting the shareholders within the process of raising the stock value.

Cost of capital is considered as the cost of finance for firms. To maximize wealth of their shareholders and have a sustainable development and steady activity, firms need financial resources. Effect of cost of finance is obvious in the financial structure as these resources involve costs. This cost of capital is calculated by measuring the costs of different financing sources and their weights in the capital's structure. Furthermore, cost of each component of capital structure is determined through assessing the related resources.

Considering the importance of mentioned variables in decisions made by the users and importance of intellectual capital, it is aimed to evaluate the relationship between these factors. Then, the main objective of this research is to figure out that whether there is a significant relationship between intellectual capital and cost of capital and market value. If the answer is positive, then we should respond that how significant is this relationship.

Literature review and hypotheses
Definitions of intellectual capital

The literature of intellectual capitals indicates the value and intangible nature of this capital. Following lines shows some definitions form different aspects for the intellectual capital:

- It is a mix of four components including market, human assets, spiritual properties, and infrastructural assets (Brooking, 1996).
- Intellectual capital is a combination of an intellectual part such as human capital and a non-intellectual part such as structural capital (Roos et al, 1997).
- Each intellectual (knowledge, information, spiritual property, and experience) which can create wealth (Stewart, 1997).
- A concept used for classification of all intangible organizational resources and diagnosis of their interrelationships (Bontis et al, 1999).

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- Intangible property includes human capitals such as skills, talent, and knowledge, information capital such as database, information systems, and technological infrastructures, organizational capital such as culture, leadership style, and knowledge share (Kaplan and Norton, 1996).

Components of intellectual capital
The literature review of intellectual capital reveals that the majority of patterns consist of three basic components: human capital, structural capital, and customer capital (Fotros, 2009).

Human capital
Human capital involves all individual capabilities, talents, and knowledge, and experience of the staffs and managers of the organizations; e.g., compatibilities, capabilities, communications, and staffs value (Ja'fari, 2006). Human capital is developed and applied that the staffs spend the main part of their time and talents on activities leading to innovation. Human capital can grow in two forms: organization uses more than its staffs know; and staffs know more than it is useful for the organization (Stewart, 1997).

Structural capital
Structural capital is the knowledge existing in the organization. This capital belongs to the entire organization and can be reproduced or exchanged. Structural capital includes technologies, inventions, innovations, publications, and business processes (Stewart, 1997).

Creation of knowledge banks allows reapplication of the knowledge. Structural capital of a given organization must offer a map or guideline for assets of intellectual capital. For instance, it must define where we should seek for knowledge and who has the highest skill. The only organizational knowledge which should be used as the guideline, is the knowledge directly related to the key strategies of the organization. This knowledge must result in better functional results (Brawn, 2002).

Customer capital (relational capital)
This capital represents the value of present and constant relationships of the firms with people or organizations purchasing their services. Capital indexes are: market share, maintaining the customers, and obtained profit from each customer. Among the intangible capitals, customer capital is probably managed in the worst way. Many businesses are entirely unaware of their customers (Stewart, 1997).

Generally, as customer capital acts as a bridge in the intellectual capital process and conversion of intellectual capital to market value, here, business performance of the organization plays an outstanding role (Glich Li, 2005).

Case History
In the following parts, studies conducted on intellectual capital are briefly discussed:

- Chen et al (2004) conducted a work on intellectual capital and fiscal function of and market value of corporate. Their research provides a comprehensive understanding about the role of intellectual capital in wealth creation and basics of sustainable profits.

- Sharabati et al (2010) studied the relationship between intellectual capital and commercial performance in pharmaceutical sector in Jordan and concluded that measuring the intellectual capital is a primary interest for senior managers of the pharmaceutical firms.

- Kamukama et al (2010) studied the mutual impact of the elements of intellectual capital on each other and tested their combination way and concluded that there is no mutual relationship among them. Furthermore, they found that the effect of human capital on performance is controlled by any of structural and relational capitals.

- In another work, "disclose of intellectual capital and costs of finances in corporate", Orens et al (2009) studied the effect of intellectual capital on disclosure of economic return four countries including Belgium, French, German, and Netherland. Their results indicated that the intellectual capital disclose economic profit in a better way.

- Joshi et al (2010) evaluated performance of intellectual capital and investigated the relationship between its components in Australian banking sector and detected that there is a significant relationship between costs of human forces and value added of human forces with value added intellectual capital and human capital has a higher output as compared to the structural capital. Moreover, they reported that bank size in terms of its assets, number of staffs, and payments of the shareholders slightly or does not affect performance of intellectual capital.

- Maditions et al (2011) studied effect of intellectual capital on market value and financial performance of the Greek firms using the value added coefficient of intellectual capital and found that there is a significant positive relation between intellectual capital and fiscal output of intellectual capital and future fiscal return.

- In another work, "organizational characteristics and intellectual capital in Canada and Middle East", Nazari et al (2009) studied the relationship between organizational (cultural, environmental, etc.) characteristics with intellectual capital management in Canada, Iran, and Lebanon. Their results show the differences in these three centuries in terms of the relations between intellectual capital and the organizational characteristics.

- Ting and Leon (2009) studied performance of intellectual capital and its relation with fiscal performance of the financial institutes and concluded that there is a positive relationship (R = 71.6%) between value added intellectual capital and payment return to the shareholders in financial sectors of Malaysia.

- In another work, Bontis (1998) studied the relationship between intellectual capital and business performance of Malaysian servicing and manufacturing industries and conclude that intellectual capital have a 20 to 30 % effect on business performance of the studied corporates.

- Jui (2008) studied the relationship between intellectual capital and market value of a corporate in an American electronic industry and found presence of a positive correlation between intellectual capital and market value.

- Hemmati et al (2010) conducted a study on non-fiscal firms, and investigated the relationships among the intellectual capital, market value, and financial performance of the non-fiscal listed companies in Tehran Stock Exchange. Their results showed significant relations among these factors.
- Hemmati and Zamani (2011) investigated the relation of intellectual capital and value added and abnormal cumulative return and concluded that by increasing intellectual capital of the firms, their value added and abnormal cumulative return indicate a raise and drop, respectively.
- Mojtahed Zadeh (2010) studied the relationship between intellectual capital and performance of insurance companies and concluded that human, customer, and structural capitals, when independently tested, indicate positive relationship with company performance. However, the concurrent study of these factors indicated that only human capital and structural capital affect performance.
- Anvari Rostami and Seraji (2005) measured intellectual capital and investigated the relation between intellectual capital and market value of the stock and found that measuring the intellectual capital through the market value difference and book value of the companies indicates a stronger relationship with stock exchange value of the companies at industrial level.
- Sayadian (2009) studied intellectual capital and proposed a method for its reporting for one of Iranian banks. The results of this work indicated that the structural capital (with a score of 39%) is considered more by the managers as compared to other components of intellectual capital. In this regard, human capital (32%) and relational capital (29%) are in next places.
- Mozaffari (2010) studied "relationship between intellectual capital and market value and financial performance of the non-fiscal listed companies in Tehran Stock Exchange" and detected presence of significant relationship between them.

Hypotheses

The present work involves 2 main hypotheses and 6 minor hypotheses:

Major hypothesis 1: intellectual capital has an impact on firm capital.

Minor hypothesis 1.1: The value added capital applied (VACA) has an impact on weighted average cost of capital (WACC).

Minor hypothesis 1.2: Value added intellectual capital coefficient (VAIN) has an impact on WACC.

Minor hypothesis 1.3: Value added intellectual coefficient (VAIC) has an impact on WACC.

Major Hypothesis 2: intellectual capital has an impact on market value.

Minor hypothesis 2.1: VACA has an impact on market value.

Minor assumption 2.2: VAIN affect market value.

Minor hypothesis 2.3: VAIC affect intellectual capital of the firm.

Materials and Methods

Methodology

The present research is practical and descriptive, in terms of its purpose and its methodology categories, respectively. Since the historical information is used for testing the assumptions, it falls in the semi-empirical category, in terms of its research environment. In other words, it has a post-event methodology. The main purpose of post-event works is to study the existing relations between the variables, through which the data are collected for analysis from a natural environment or the past events with no direct intervention of the researcher. To analyze research assumptions, the Pearson correlation and univariate and multivariate regression analyses, and Z-Wang tests were carried out in the present research. To analyze significance of regressions, F and coefficients of regression models, F-tests and T-test were applied, respectively. Besides, variance inflation factor (VIF) is applied to study linearity among the variables. Experience shows that when each VIF exceeds 10, the model gives a warning about lack of linearity among the variables. To ensure lack of self-dependency among the data, the Durbin-Watson statistics was utilized. The research assumptions are tests at 95% confidence level. To gather information related to the research, a desk study was developed. Furthermore, to collect the needed fiscal data for testing the assumptions, the fiscal records of the sample companies for time range of 2005 to 2012 and databases of "Tadbir Pardaz" and "Rahavard e Novin" were used. For the cases which the mentioned software does not provide the required data, the information was directly extracted by the researchers from fiscal records the studied companies. For data analysis, excel spreadsheets and SPSS software were applied.

Statistical population and sample size

The statistical research populations of this work are all listed companies in Tehran Stock Exchange in a time period of 2005 to 2012 that meet the following requirements:

1. They are not among the financial resellers, banks, and insurance and investment companies.
2. Their fiscal year starts ends on March 20 each year and they have not changed this date within the study years.
3. Complete and detailed information is available on annual financial statements of these companies in bulletin of Tehran Stock Exchange within the study period (2005 to 2012).
4. The studied companies should have at least two years of membership before the research period (2005).
5. The studied companies should be a member to Tehran Stock Exchange at least by the end of 03/20/2013.

By applying some limits, the size of statistical society of this work, i.e., the registered companies in Tehran Stock Exchange, was reduced to 292. Since studying these 292 companies and extracting their information for an eight year period (2005 to 2012) is a time consuming and expensive process, a sampling process was conducted in this work. Among the entire 292 companies, 84 ones were selected as the research community of the present work considering the sampling requirements (sampling error of 0.09 and statistical confidence level of 95%) and using the estimation formula of the "minimum" sample size for a given society.

$$n \geq \frac{\dfrac{z^2\delta^2}{d^2}}{1+\dfrac{1}{N}\left(\dfrac{z^2\delta^2}{d^2}\right)} \rightarrow n \geq \frac{\dfrac{1.96^2 \times .05^2}{0.09^2}}{1+\dfrac{1}{292}\left(\dfrac{1.96^2 \times .05^2}{0.09^2}\right)} \geq 84$$

N: sample size; Z: confidence level (95%); d: sampling error; N: size of the research community; and δ: estimation of the studied characteristics of the society (considered as 5% in this work).

Research variables
 - **Independent variables** used in this work are: VAIN, VACA, and VAIN.
 - **Dependent variables** are: WACC and market value.
 - **Control variables** are fiscal size and leverage.

Measuring the research variables
 - Value added is calculated as follows:
  VA = OP + W
 Where, W is staffs' wage, OP is operational profit, and VA is value added.
 - VACA is calculated as follows:
  VACA = VA/CA
 Where, CA = the entire properties – tangible properties
 - To compute VAIN, we have:
  VAIN = STVA + VAHU
  VAHU = VA/HC
  HC = W – R & D
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  STVA = SC/VA
  SC = VA – HC
 Where, VAHU is value added human capital unit, R&D is cost of research and development, and STVA is structural capital value added.
 - To measure VAIC, the following equation was applied:
  VAIC = VAIN + VACA
 - Estimation of WACC: In this research, WACC is the weighted average cost of Stocks used for financial supplying for investments in the company and is measured using the following equation:
  WACC = P1K1 + P2K2 + … PnKn
 Where, P is ratio of financing method and K is interest rate of financing.
 - Market value (MV): In this research, the value of stock exchange was considered as MV.
 - Company size: The logarithm of total sum of company's properties was considered as company size.
 - Company leverage (LEV): To measure company leverage, the total stock share of stockholders was divided into the overall asset of the company.

Table 1: Research variables

variables	Type of variable	Symbol
Value added capital applied	Independent	VACA
Value added intellectual capital	Independent	VAIN
Value added intellectual capital coefficient	Independent	VAIC
Weighted average cost of capital	Dependent	WACC
Market Value	Dependent	MV
Size	Dependent	SIZE
Leverage	Controller	LEV

Variables including VACA, VAIN, and VAIC are the dependent variables of this work, while variables including cost of debt (KD), cost of equity of the stockholders (KE), and WACC are the dependent variables. Besides, purchase and LEV variables are the supplementary variables. As VAIC is a linear combination of VACA and VAIN, and its effect is studied separately.

Results and Discussion
Hypothesis 1: VACA has an impact on WACC. The results of regression fitting for this hypothesis are presented in Table 2:

Table2: The results of regression fitting for hypothesis 1

WACC = &0 + &1VACA + &2SIZE + &3LEV						
Variable source	Residual sum of squares	Modified coefficient of determination	Coefficient of determination	F	Significance level	Durbin-Watson
Regression	1676.444	.176	.186	19.100	.000	1.907
Remainder	7343.661					
Total	9020.105					

Model Coefficients			
Model	T statistics	β coefficients	Significance level
VACA	-7.154	-.324	.000
SIZE	7.557	.431	.000
LEV	7.012	0.321	.026

As shown in Table 2, the significance level corresponding to F-test is 0.000 which is obviously less than 5%. Therefore, presence of a linear relation between them is affirmed and the general regression model is statistically significant. Moreover, Durbin-Watson test also shows the relative dependency of the data or, in other words, lack of linearity among the model errors. About the presence or absence of a relationship between VACA and WACC, T-test and the obtained significance level should be evaluated. As the significance level of t-test is 0.00, it can be stated that there is a relationship between VACA and WACC. It must be noted that the negative sign before t implies presence of inverse correlation among the variables; i.e., the increase in VACA results in WACC decrease.

Hypothesis 2: VAIN has an impact on WACC.
The results of regression model fitting are presented in Table 3.

Table3: The results of regression fitting for hypothesis 2

Variable source	Residual sum of squares	Modified coefficient of determination	Coefficient of determination	F	Significance level	Durbin-Watson
WACC = &0 + &1VAIN + &2SIZE + &3LEV						
Regression	1683.104	.160	.169	18.416	.000	1.9
Remainder	8286.436					
Total	9969.540					
Model Coefficients						
Model	T statistics		β coefficients	Significance level		
VAIN	-6.987		-.261	.024		
SIZE	7.427		.416	.000		
LEV	7.058		.365	.03		

As shown in Table3, the significance level of F-test is 0.00 which is less than 5%. Therefore, presence of a linear relationship among the variables is confirmed and the obtained general regression is statistically significant. Moreover, Durbin-Watson statistics confirms the relative independence of data or lack of linearity among the model errors. About the presence or absence of a relationship between VAIN and WACC, T-test and the obtained significance level should be evaluated. As the significance level of t-test is - 0.024, it can be stated that there is a relationship between VAIN and WACC. Again, the negative sign before t implies presence of inverse correlation between these variables; i.e., the increase in VAIN results in WACC decrease.

Hypothesis 3: VAIC has no effect on WACC.
The results of regression fitting model are presented in Table 4.

Table4: The results of regression fitting for hypothesis 3

Variable source	Residual sum of squares	Modified coefficient of determination	Coefficient of determination	F	Significance level	Durbin-Watson
WACC = &0 + &1VAIC + &2SIZE + &3LEV						
Regression	1676.464	.176	.186	19.100	.000	1.907
Remainder	7343.641					
Total	9020.105					
Model Coefficients						
Model	T statistics		β coefficients	Significance level		
VAIC	-6.987		-.126	.000		
SIZE	7.557		.431	.000		
LEV	7.698		.531	.024		

As shown in the table above, the significance level of F-test is 0.00 which is less than 5%. Therefore, presence of a linear relationship between these variables is confirmed and the obtained general regression is statistically significant. Furthermore, Durbin-Watson statistics confirms the relative independence of data or lack of linearity among the model errors. About the presence or absence of a relationship between VAIC and WACC, T-test and the obtained significance level should be evaluated. As the significance level of t-test is 0.000, there is a relationship between VAIC and WACC.

Hypothesis 4: VACA has no impact on MV.
Table 5 presents the results of regression fitting model for this assumption.

Table5: The results of regression fitting for hypothesis 4

		MV = &0 + &1VACA + &2SIZE				
Variable source	Residual sum of squares	Modified coefficient of determination	Coefficient of determination	F	Significance level	Durbin-Watson
Regression Remainder Total	1.604e+25 8.294e+27 8.310e+27	-.005	.002	.290	.748	1.801
Model Coefficients						
Model	T statistics		β coefficients		Significance level	
VACA SIZE	-0.322 -0.698		-0.019 -0.04		.748 .485	

As shown in the table above, the significance level of F-test is 0.748 which is greater than 5%. Therefore, there is no linear relationship between these variables and the obtained general regression is not statistically significant. Furthermore, Durbin-Watson statistics confirms the relative independence of data or lack of linearity among the model errors. About the presence or absence of a relationship between VACA and MV, T-test and the obtained significance level should be evaluated. As the significance level of t-test is 0.748, presence of a relationship between VACA and MV is rejected.

Hypothesis 5: VAIN has no impact on MV.
Table 6 presents the results of regression fitting model for this assumption.

Table6: The results of regression fitting for hypothesis 5

		MV = &0 + &1VAIN + &2SIZE				
Variable source	Residual sum of squares	Modified coefficient of determination	Coefficient of determination	F	Significance level	Durbin-Watson
Regression Remainder Total	3.103e+25 8.803e+27 8.334e+27	-.002	.004	0.604	.547	1.803
Model Coefficients						
Model	T statistics		β coefficients		Significance level	
VAIN SIZE	-0.807 -.573		-.046 -.032		.42 .567	

As shown in Table 6, the significance level of F-test is 0.547 which is greater than 5%. Thus, there is no linear relationship between these variables and the obtained general regression is not statistically significant. In addition, Durbin-Watson statistics confirms the relative independence of data or lack of linearity among the model errors. About the presence or absence of a relationship between VAIN and MV, t-test shows a significance level of 0.42, so that presence of a relationship between VAIN and MV is rejected.

Hypothesis 6: VAIC has no impact on MV.
Table 7 presents the results of regression fitting model for this assumption.

Table7: The results of regression fitting for hypothesis 6

		MV = &0 + &1VAIC + &2SIZE				
Variable source	Residual sum of squares	Modified coefficient of determination	Coefficient of determination	F	Significance level	Durbin-Watson
Regression Remainder Total	1.607e+25 8.294e+27 8.310e+27	-.005	.002	0.291	.748	1.802
Model Coefficients						
Model	T statistics		β coefficients		Significance level	
VAIC SIZE	-.698 -.323		-.04 -.019		.485 .747	

As shown in Table 7, the significance level of F-test is 0.747 which is above 5%. Thus, there is no linear relationship between these variables and the obtained general regression is not statistically significant. Durbin-Watson statistics also confirms the relative independence of data or lack of linearity among the model errors. About the presence or absence of a relationship between VAIC and MV, t-test shows a significance level of 0.485, so that presence of a relationship between VAIC and MV is rejected.

Conclusion
The results derived from hypotheses of this research are presented in Table 8

Table8: Summary results of regression fitting of all research hypotheses

Hypothesis	Studied variable	Impact on WACC	Outcome
1.1	VACA	Inverse	Confirmed
1.2	VAIN	Inverse	Confirmed
1.3	VAIC	Inverse	Confirmed
Hypothesis	Studied variable	Impact on MV	Outcome
2.1	VACA	Without impact	Rejected
2.2	VAIN	Without impact	Rejected
2.3	VAIC	Without impact	Rejected

As shown in Table 8, there are inverse significant relations among VACA, VAIN, and VAIC and WACC, while the relationship between purchase and LEV and WACC is direct. In general, it can be stated that intellectual capital has an impact on MV; which is also confirmed by Bontis, Brenman, Miller, Palik, Riahi, Fearer, Ismail, Hang, Makki, Nik Mohammad, Mozafari, and Zamani. However, the results of the work conducted by Choi are not consistent with those of us. Considering the inverse relationship between intellectual capital and cost of capital in companies, to reduce these costs the managers are recommended to focus their efforts on intellectual capital and its components. In this way, the real goal of the company for cost reduction and maximizing the wealth of its stockholders is realized. Considering the inverse relationship between structural capital and company performance, the managers are advised to have a particular focus on optimum use of financial leverage and structural capital for improving their performance. Moreover, the stockholders and other decision makers are also suggested to pay attention to this criterion during evaluating performance of their companies.

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