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A study on the effect of intellectual capital on firm performance: Evidence from Tehran Stock Exchange

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A B S T R A C T

The aim of this paper is to analyze the effect of intellectual capital on firm performance. The proposed study uses two regression models to find out whether there is any meaningful relationship between intellectual capital and Tobin's Q as well as earnings per share (EPS). To test the research hypothesis, a sample of 19 companies listed in Tehran Stock Exchange over the period 2010-2012 based on panel method is chosen. The study uses the method originally proposed by Pulic to measure intellectual capital. The results of the implementation of two regressions analysis indicate that there were not any meaningful relationships between these two components. Therefore, the results indicate that the intellectual capital has no effect on firm performance.

1. Introduction

The rise of the "new economy", one principally driven by information and knowledge, has led to an increased interest in intellectual capital (IC) (Bontis et al., 2001). An area that has captured the interest of a number of scholars and practitioners is the IC utilization as an instrument for determining enterprise value. This has been a controversial issue, with some writers suggesting that well established management and reporting systems are increasingly losing their relevance because they are unable to provide executives with necessary information for managing knowledge-based processes and intangible resources (Bornemann, 1999). Chen et al. (2005) performed an empirical investigation of the relationship between intellectual capital and firms' market value and financial performance. Juma and McGEE (2006) investigated the relationship between intellectual capital and new venture performance through an empirical investigation of the moderating role of the environment.

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Traditionally, land, labor and capital used to be considered the most valuable assets in economics. For years, physical assets were considered the main determinants of the performance of any economic activity. However, the fast expansion of science, technology and finally the globalization altered the pattern and structure of the production system. The new production system is mainly driven by technology, knowledge, expertise and relationships with stakeholders, which may collectively be described as Intellectual Capital (IC). In the new economic system known as the knowledge economy, intangible or intellectual assets have eventually recognized as the prominent resources. Companies like software, finance, pharmaceutical; banking, hotel etc. depend entirely on a considerable extent on the IC for earning revenues. Production or manufacturing firms use IC with its physical assets to sharpen their competitive edge. Goh (2005) studied intellectual capital performance of commercial banks in Malaysia. Makki and Lodhi (2009) investigated the impact of intellectual capital on return on investment in Pakistani corporate sector.

The objective of this paper is to empirically examine the effect of an extant measure of IC and traditional measures of corporate performance based on Tobin's Q and earnings per share (EPS). Data for the analysis are collected from a sample of 19 publicly listed companies from the Tehran Stock Exchange over the period of 2010-2012.

1.1 Intellectual capital

The term intellectual capital includes inventions, ideas, general knowledge, design techniques, computer programs and publications. An ex-editor of the business magazine "Fortune", Thomas Stewart describes intellectual capital as "something that cannot be touched, although it slowly makes you rich". Jacob Ben- Simchon, (2005) the term 'intellectual capital' uses to enclose all of the non-tangible or intangible assets and resources of a firm, as well as its practices, patents and the implicit knowledge of its members and their network of partners and contracts. Stewart (1997) defines it as 'packaged useful knowledge', Sullivan (2000) as 'knowledge that can be converted into profit', Reeds et al. (2000) as the 'sum of knowledge' of its members and practical translation of this knowledge into brands, trademarks and processes. Edvinsson and Malone (1997) define it as the possession of knowledge, applied experience, organizational technology, customer relations and professional skills that provide a company with a competitive edge in the market. One of the most popular models for classifying IC was introduced by Saint-Onge (1996) in the early 1990s. It divides IC into three parts including Human capital, Structural capital; and Customer capital.

1.2 Human Capital

Human Capital (Lepak & Snell, 1999; Low & Kalafut, 2002) is the skill and creativity of employees and that can be encouraged by investing more in their training programs. Human capital includes employees' experience and expertise, which increases the efficiency of organizations. More efficient employee means more efficient of organization to boost Value Added (VA) efficiency.

1.3 Structural Capital

Structural Capital is another important IC determinant, which consists of all non-human assets. It recognizes as all systems, procedures, databases, copyrights, patents, structural procedures, rules and policies, which are important for decision making as argued by Bontis et al. (2000).

1.4 Intellectual capital and firm performance

According to Reeds (2000), IC is a strong predictor of a company's performance. Bontis et al. (2000) reviewed three IC elements, namely the human, structural and customer elements, as well as their interrelationships. The main conclusions that could be drawn from the study are that human and customer capital are important factors in the way in which businesses are run and that structural

capital has a positive influence on business performance. Riahi-Belkaoui (2003) investigated the relationship between IC components and the performance of selected multi-national firms in USA. The result suggested that intellectual capital was positively associated with financial performance.
Sofian et al. (2005) examined the impact of the degree and form of IC on management accounting practices, specifically, performance measurement and corporate performance. Results suggested that IC could influence on the corporate performance. do Rosário Cabrita and Vaz (2005) investigated the inter relationships and the interaction effects among IC components and organizational performance, in the Portuguese banking context. The results indicated a significant relationship between IC and organizational performance. Bharathi (2010) performed an empirical investigation and after analyzing the human capital and the physical capital of 98 scheduled commercial banks of India, he studied their effects on the value based performance. The study confirmed that the observed vast differences in performance of different segments of Indian banks were mainly due to the underlying differences in HC. Richeri et al. (2007) reported a positive relationship between both CIV and ICE and the dependent variables ROE, ROA and ROS.

1.5 Measuring intellectual capital

Pulic (2000) developed an idea called "Value Added Intellectual Coefficient" (VAIC) to measure the IC in companies. He was concerned with two other important aspects of valuation and value creation yet unsolved by other methods:

(1) Market-based IC value cannot be calculated for companies, which are not listed on the stock market. Such companies need an alternative way to determine their market-based IC value.

(2) There is no adequate system of monitoring the efficiency of current business activities performed by employees, or whether their potential is directed towards value creation or value destruction.

The VAIC^{TM} method is designed to provide information about the value creation efficiency of tangible and intangible assets within a company. The model starts with a company's ability to create value added (VA). VA is the difference between sales (OUT) and inputs (IN) and is represented by the following equation:

$$VA = OUT - IN$$

Outputs (OUT) represent the revenue and comprise all the products and services sold on the market. Inputs (IN) contain all the expenses incurred in earning the revenue except labor expenses. It is important to note that in this model labor expenses are not included in IN. Due to its active role in the value creating process; intellectual potential represented by labor expenses is not measured as part of cost components. Thus, a key aspect in Pulic's method is to treat labor as a value creating entity. The result is that VA expresses the new created wealth of a period. VA is influenced by the efficiency of Human Capital (HC) and Structural Capital (SC). The second relation of VA, one employing physical capital (CA), is called the 'value added capital coefficient' (VACA). This is an indicator for the VA created by one unit of physical capital:

$$VACA = VA/CA$$

Pulic assumes that if a unit of CA generates bigger returns in one company than another, then the first company is better at utilization of its CA. Thus, better utilization of CA is part of the IC of companies. When compared with a group of firms, VACA becomes an indicator of the intellectual abilities of the company to better harness physical capital. The next relation is VA and HC. The 'human capital coefficient' (VAHU) shows how much VA is created by a dollar spent on employees. The relationship between VA and HC indicates the ability of HC to create value in a company. Thus, the relation between VA and HC indicates the ability of HC to create value in a company:

$$VAHU = VA/HC$$

Similarly, when VAHU is compared over a group of companies, VAHU becomes an indicator of the quality of the human resources of the company and their abilities to generate VA for every dollar

spent on HC. The third relationship is "structural capital coefficient" (STVA), which shows the contribution of structural capital (SC) in value creation. In Pulic's model, SC is VA minus HC. The lesser the contribution of HC in value creation, the greater is the contribution of SC. According to Pulic (2000), this has been verified by empirical research, which shows in traditional industrial sectors. In heavy industry and mining for example, VA is only slightly bigger than HC with an insignificant SC component. On the other hand, in the pharmaceutical industry and software sectors, an entirely different situation is observed. HC creates only 25-40 percent of the entire VA and the major contribution is due to SC. Therefore, the third relationship between VA and employed SC is calculated in a different way because HC and SC are in reverse proportion as far as value creation is concerned. STVA measures the amount of SC needed to generate a dollar of VA and it is an indication of how successful SC is in value creation. Unlike VACA and VAHU, VA is in the denominator for STVA. Thus, the third relation between VA and SC is calculated as:

$$STVA = SC/VA$$

The final ratio is the calculation of the intellectual ability of a company. It is the sum of the previously mentioned coefficients. This results in a new and unique indicator – the $VAIC^{TM}$:

$$VAIC^{TM} = VACA + VAHU + STVA$$

Pulic's method has the attraction of ease of data acquisition and enables further analysis to be conducted on other data sources.

1.6 Research model and Hypothesis

Using pulic's model, this paper addresses two research propositions:

H_1: The intellectual capital influences on firm performance through tobins'q
H_2: The intellectual capital influences on firm performance through Earnings per share.

The statistical validation test for H_1 has determined that the intellectual capital has no effect on firm performance using Tobin's Q. The results of H_2 also determined that the intellectual capital has no effect on firm performance through EPS. The Pulic model determines that measures for the IC of a company will be VACA, VAHU and STVA. The rate of growth of IC (ROGIC) is taken to be the year-on-year growth rate of VACA, VAHU and STVA of the company.
Thus, for the purpose of this research, two financial ratios are selected as proxy measures for a company's performance. These cover Tobin's Q and shares' performance on the stock market:

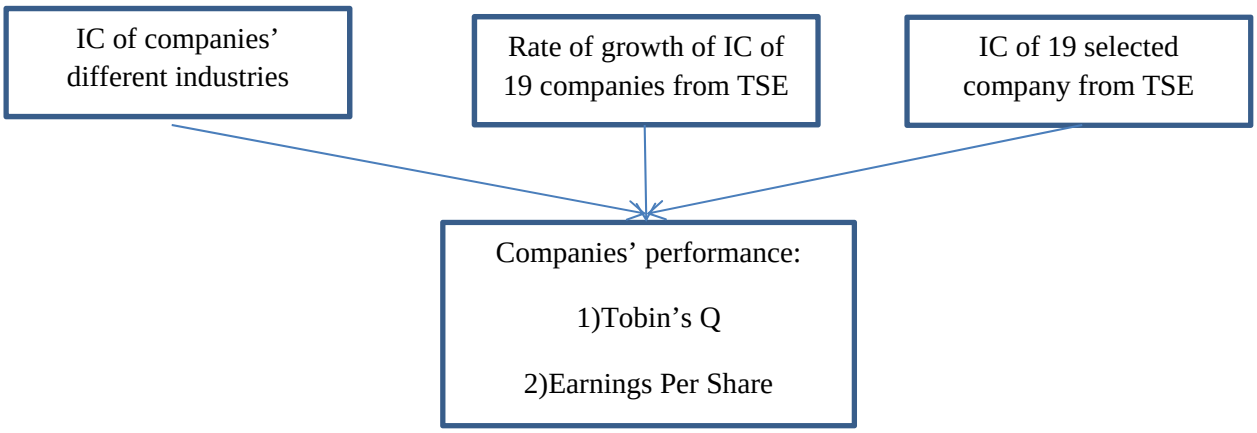
1) Tobin's Q ratio is used to check the value of the company. Tobin Q is the ratio of firm value in the stock market to book value of assets:
   Tobin's Q = (total debt + stock price × shares last count) / (book value of assets)
2) Earnings per share (EPS) is a commonly used measure by analysts in the evaluation of companies in the financial market. It is also a requirement for companies listed on the Tehran Stock Exchange (TSE) to state EPS in companies' annual reports. EPS is a compulsory disclosure item in the quarterly and annual reports for all companies listed on the TSE (Tehran Stock Exchange). It is a commonly cited item in most analysts' reports and recommendations in Tehran. The formula to obtain the EPS is:

$$EPS = \frac{Profit\ to\ shareholders}{Weighted\ average\ number\ of\ shares}$$

This paper is broken into four substantive parts. Following this introductory section, the next section defined Method. This is followed by results. The final section is by way of discussion and conclusion.

2. Method

The data gather from 19 companies publicly listed on Tehran Stock Exchange. Not all companies are useable for this study, for a variety of reasons. The performance of a company depends on internal factors, but is also affected by external factors that may be beyond the company's control.



In addition, over the three-year period from 2010 to 2012, several companies were delisted, merged or acquired. Some companies which incurred huge losses and whose balance sheets degenerated into negative net worth were eliminated. A few companies were also suspended from trading while others did not submit their annual reports for at least one of the three years to the TSE. Given these limitations and constraints, all other remaining companies were selected which yielded a sample of 19 companies for this study. The model is used in this study:

$$Y_i = \beta_0 + \beta_1 VACA + \beta_2 VAHU + \beta_3 STVA + \mu,$$

where Y_i is the dependent variable (the dependent variables Tobins'q and EPS were tested sequentially using the regression model), and the independent variables are VACA, VAHU and STVA were derived from information available in the companies' annual report for the years 2010 and 2012. In this study, we used panel modeling. After tests of the model F-Limer test, the panel model is used. The results determined that the intellectual capital has no effect on firm performance using both Tobin's Q and EPS.

3. Results

As it is mentioned, the sample is composed of 19 companies listed in Tehran Stock Exchange. The methodology for analyzing data is based on panel modeling. The data being in both time series and cross sectional. We have thus made regression using a panel data. Table 1, hereafter describes some descriptive statistics of the variables on the whole period (2010-2012) including mean, median, maximum, minimum, standard deviation, skewness and kurtosis.

Table 1
Descriptive Statistics

Variables	TOBINSQ	EPS	VACA	VAHU	STVA
Mean	2.182702	153693.3	0.162105	87.76719	0.695965
Median	1.770000	3162.000	0.120000	4.010000	0.750000
Maximum	8.110000	1854000.	1.100000	1238.810	1.000000
Minimum	0.895000	6.000000	0.010000	1.140000	0.120000
Std. Dev.	1.457343	389263.0	0.181765	264.7607	0.232455
Skewness	2.471525	3.322893	3.039822	3.428867	-0.682226
Kurtosis	9.772850	13.33833	14.56936	13.72454	2.653966
Observations	57	57	57	57	57
Cross sections	19	19	19	19	19

In this study, we have two hypotheses. For each hypothesis, we analyze data.

3.1 Panel analysis H_1

For data analysis of the panel analysis (Panel) without fixed effects, with fixed effects and with random effects is used. To determine the effectiveness of model with fixed or random effects Limer (Chow) test and Hausman tests are used. As the Table 2 shows, the results of Chow test indicate that the model with fixed effects is better than pooled model.

Table 2
Redundant Fixed Effects Tests of Hypothesis 1

Effects Test	Statistic	d.f.	Prob.
Cross- section F	7.719917	(18,35)	0.000

In addition, the results of Hausman test indicate that the model with random effects is appropriate. The significance level for the test of Hausman is 0.2701 and it indicates the model with random effects is appropriate. Table 3 shows the results.

Table 3
Correlated Random Effects- Hausman Test of Hypothesis 1

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f	Prob.
Cross- section random	3.921279	3	0.2701

The proposed model to test the hypotheses is as follow:

$$\text{Tobin's Q} = \beta_0 + \beta_1 \text{VACA} + \beta_2 \text{VAHU} + \beta_3 \text{STVA} + \mu$$

The results of random effect show that probability of significant of *F* is equal to 1.534986. This result means that there is no significant coefficient. The coefficient of determination is equal to 0.479435. The t-statistics for VACA is equal to 0.293920, for VAHU is equal to 1.364659, for STVA is equal to -1.372929. The results are summarized in Table 4:

Table 4
The results of Cross- section random effects for Hypothesis 1

Variables	Coefficient	t-Statistics
C	3.798588	2.805220
VACA	0.473377	0.293920
VAHU	0.001838	1.364659
STVA	-2.663874	-1.372929
	Weighted Statistics	
R-Squared	0.479435	
Prob(F- statistics)	0.127973	
Durbin- Watson stat	3.099752	

The results of hypothesis 1 indicate that the intellectual capital has no impact on firm performance using Tobin's Q.

3.2 Panel analysis H_2

To determine the effectiveness of model with fixed or random effects Limer (Chav) test and Hausman test are used. As the Table 5 shows, the results of Chav test indicate that the model with fixed effects is better than pooled model.

Table 5
Redundant Fixed Effects Tests of Hypothesis 2

Effects Test	Statistic	d.f.	Prob.
Cross- section F	41.053239	(18,35)	0.000

The results of Table 6 indicate that the model with random effects is appropriate. The significance level for the test of Hausman is 0.7573, which indicates that the model with random effects is appropriate. Table 6 shows the results:

Table 6
Correlated Random Effects- Hausman Test of Hypothesis 2

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f	Prob.
Cross- section random	1.182302	3	0.7573

The proposed model to test the hypotheses is as follow:

$$\mathrm{EPS} = \beta_0 + \beta_1 \mathrm{VACA} + \beta_2 \mathrm{VAHU} + \beta_3 \mathrm{STVA} + \mu$$

The results of random effect show that the probability of significant of *F* is equal 0.156264, which is not significant. The coefficient of determination is equal to 0.008. The t-statistics for VACA is equal to 0.754536, for VAHU is equal to 0.402277, for STVA is equal to -0.349443. The results are shown in Table 7 as follows,

Table 7
Cross- section random effects of Hypothesis 2

Variables	Coefficient	t-Statistics
C	193564.6	1.269689
VACA	35992.05	0.754536
VAHU	13.62999	0.402277
STVA	-67391.39	-0.349443
Weighted Statistics		
R-Squared	0.008768	
Prob(F- statistics)	0.925194	
Durbin- Watson stat	1.994272	

The results of hypothesis 2 indicate that the intellectual capital has no effect on firm performance using EPS.

4. Discussion and Conclusion

Drawing upon a sample of 19 publicly listed companies on the Tehran Stock Exchange, this paper has examined the effect of intellectual capital on firm performance. In this paper, we have used Tobin's Q and EPS to test the firms' performance. The results have indicated that the intellectual capital had no effect on firm performance in both hypotheses. This research is not without its limitations. The selected companies were chosen from Tehran Stock Exchange. Different countries have various accounting practices and stock exchanges around the world have different disclosure and other listing requirements. As the Pulic model uses data from the published financial statements, any differences in national accounting rules may influence results in other countries. It is also limited to publicly listed companies as financial information for privately held companies is not readily available. The shares of private companies are not traded freely and are not subjected to market forces. Hence, their market values are not easily or reliably determined. In addition, the selected companies were analyzed over a three-year period between 2010 and 2012. Data from earlier years cannot be used because there was no requirement to disclose labor costs prior to the year 2010.

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