“Does intellectual capital matter for firms’ performance? Some evidence from accounting data”

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Does intellectual capital matter for firms' performance? Some evidence from accounting data

Abstract

This study aims to analyze the relation between intellectual capital and firms' performance. It shows that balance sheet intangibles and human capital are positively related to accounting performance. However, we also find that R&D has negative influences on earnings from operations, and both advertising and human capital are negatively associated with sales growth rate. A negative relation between human capital and return volatility is demonstrated. Furthermore, the paper examines the influences of firm size, M/B and industry on the effects of intellectual capital.

Keywords: intellectual capital, intangible assets, R&D, advertising, bonus and salary, accounting performance, market performance.
JEL Classification: G11, G14, G32.

Introduction

This study examines the association between intellectual capital and the performance of firms, in particular, focusing on the implications from observing accounting data. Intellectual capital is a more extensive definition of intangible assets; it is composed of three common components, i.e., human resources, organizational resources, and relational resources. In management practice, intellectual capital has received more attention with regard to being treated as having an important role in the creation of firms' value. Blair and Kochan (2000) point out that the importance of intangible assets, including parents, copyrights, brand names, organizational capital, reputational capital, and human capital, has been massively increasing recently. The influence of intellectual capital seems to be especially significant in the knowledge-intense companies that have mushroomed, such as biotechnology, information technology, software, and telecommunication firms. Arvidsson (2003) developed a disclosure checklist that presents intellectual capital in greater detail in annual reports. He suggests that human capital and relational capital, such as marketing ability and R&D, are included in intellectual capital[1]. In this study, we focus primarily on four categories of intellectual capital that can be quantified, i.e., balance sheet intangibles[2], human resources, technology, and brand value.

In recent years, intangible assets have played an increasingly important role in the value creation process of firms, especially high-tech corporations and knowledge-intense companies (see, Holland, 2002; Lev, 2001; Sullivan and Sullivan, 2000; and Sveiby, 1997). Hall (2001) also shows that the valuation effect of intangible assets on firms' market value is more important than that of tangible assets. Most related studies focus on either a specific case (Dumay, 2009) or evidence from some unique data (see, Zéghal and Maaloul, 2010).

This study examines the association between intellectual capital and the performance of firms. In the last decade, there have been some arguments about the evaluation of intangible assets. Holland (2001) points out, that intangible assets are generally unrecognized due to problems of how to disclose the assets' value; therefore, it is difficult to evaluate how much profit those intangible assets will bring to the firms. One influence of intangible assets on the value of companies is related to information asymmetry. Barth, Kasznik and McNichols (2001), and Aboody and Lev (2000) suggest that since there is a lack of specific measurements to assess the intangibles and it is difficult to estimate a fair value for them, firms with more intangible assets would have more information asymmetry between managers and investors, and more uncertainty about their own value than would other firms. Garcia-Ayuso (2003) and Lev (2001) find that this information asymmetry risk also impairs the efficient allocation of capital because of some factors, such as the increase in the cost of capital, the increase in the bid-ask spread, illiquidity of the capital markets, and inappropriate investment decisions. On the other hand, investors often have no interests in taking an active role in the companies' management; once the investors decide to invest in the companies, the principal agency problems occur. Herein lies the risk that management teams (agent) would not always act in the best interest of the investors (principals). Therefore, information asymmetry between managers and investors aggravates agency problems and increases agency costs.

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[1] According to Arvidsson (2003), human resources is information that is related to the board members, the management teams, and the employees; relational resources is information on the companies' relationships with, e.g., suppliers, customers, and partners; organizational resources is information on IT (information technology), processes, organizational routines, etc; R&D is information about the firms' R&D operations, R&D projects, etc; and environ/social is information related to company policy, ethics, environment protection, responsibility to society, etc.

[2] For the most part, intangibles are defined herein as goodwill, licenses, patents, franchises, trademarks, and some other rights. In section 3, we will introduce specific intangible assets.

Previous studies show the relationship between share repurchases and intangible assets as well. Because information asymmetry is often regarded as a reason for share repurchases and firms with more intangible assets would take information asymmetry more seriously, the likelihood of share repurchases is positively correlated with firms' intangible assets and the market's reaction to a share repurchase announcement (Barth and Kasznik, 1999). Barth, Clement, Foster and Kasznik (1998) also find that estimated brand value is positively correlated with firms' market value and returns.

In order to eliminate information asymmetry and agency problems, the investors require information about the firms' intangibles. Wyatt (2005) emphasizes that investors need more information about the intangibles of the firms and the role that they play in the value creation process. There are two sources from which the investors can acquire such information – annual reports and analyst reports. Healy and Palepu (2001) confirm that analyst reports play a very important role in bridging managers and investors; it can mitigate the information asymmetry as well as improve the reliability of the information. Barth, Kasznik and McNichols (2001), and Amir, Lev and Sougiannis (2003) find that the information provided by financial analysts is more important for knowledge-intense companies; because the information about intangibles in annual reports is insufficient for these kinds of companies, financial analysts must play the role of obtaining from the management teams adequate information to evaluate the firms. Arvidsson (2003) suggests that the managers of knowledge-intense companies disclose intangibles focusing on R&D, and their relation to other companies, suppliers, and customers. Bukh and Meineche (2002) also find significant effects of intangibles on R&D in financial analysts' reports for IPO companies in the pharmaceutical and research industries. In this study, we focus primarily on annual reports. If firms disclose more information about intangibles in their annual reports, information asymmetry may be reduced and the true value of the firms may be more easily recognized.

Empirical studies discuss the relationship between intangible assets and some other factors, such as analyst coverage, share repurchases, etc. They do not consider the relationship with the performance of the firms. However, intellectual capital reveals the firms' future growth opportunities and whether it would lead to better company performance. Therefore, in this study, our contribution is that we present the association between intellectual capital and the performance of firms. Our experimental variables for measuring the intangible assets consist of three accounting-based proxies from Barth, Kasznik, and McNichols (2001): balance sheet intangibles (scaled by total assets), advertising expenses, and research and development (R&D) expenses (both scaled by total sales). Other experimental variables for measuring managers' compensations are bonus and salary. We predict that balance sheet intangibles, advertising expenses, and R&D expenses are positively correlated with the firms' accounting performance and the volatility of the firms' stock returns. The compensation of the management teams may encourage the managers to work toward improving the firms' performance; thus, the bigger are the salary and bonus for the managers, the better is the performance of the firms.

The remainder of the paper is organized as follows. Section 1 introduces the hypotheses. Section 2 describes the empirical models. Data is described in section 3. Section 4 interprets the results and provides discussions. The final section presents the conclusions and a brief summary.

1. Research hypotheses

In this section, we divide intellectual capital into two categories: visible intangibles that can be recognized in financial statements and invisible intangibles that are concerned with technology, brand values, and human resources.

Under GAAP regulations, balance sheet intangible assets should be recognized at cost; however, there exist evaluation problems concerning whether or not these balance sheet intangibles are assessed at a fair value, and whether they promote the performance of the firms? Thus, we examine the relation between balance sheet intangible assets and the performance of companies. For invisible assets, we discuss how the firms' technology skills affect their performance; we also consider the association between brand values and the performance of firms. Finally, we will examine the relation between firms' performance and the compensation of the management teams.

This article considers the performance of the companies based on two aspects. One is accounting performance, which can be observed from financial statements. It can also be measured OPEPS (earnings per share from operations), OANCFPS (net cash flow per share from operating activities), and sales growth. The other one is market performance, which can be measured as stock price returns or the volatility of the returns. In the following discussion, we will interpret each hypothesis with regard to accounting and market performance.

1.1. Balance sheet intangibles vs. performance. An asset, as defined by the Financial Accounting Standards Board, "embodies a probable future benefit that involves a capacity, singly or in combination with other assets, to contribute directly or indirectly to future net cash inflows" (SFAC 6; Paragraph 26).

Thus, no matter what kinds they are, assets would bring future benefits and cash inflow to the firms. However, future economic benefit is uncertain, and the level of uncertainty is generally considered to be greater for internally developed intangibles than for purchased intangibles or tangible assets. Unlike tangible assets, which can always be recognized, it is not easy to evaluate the balance sheet intangibles' value fairly even if they are recognized at cost. Nevertheless, although their true values are uncertain, balance sheet intangibles can still generate future cash flow for the firms in the long term. Therefore, we predict that firms with more intangibles would have better future performance than firms with less intangible assets[1].

Hypothesis 1: The balance sheet intangibles of firms are positively associated with their accounting performance.

Because intellectual capital embodies future growth options for the firms, the implication is that firms with more intangibles would have higher growth opportunities than the would other firms. Therefore, both tangible and intangible assets provide future cash inflow to the companies and should be rationally valued in the stock market[2]. However, since there are no specific valuation methods for intangible assets, the reported balance sheet intangibles are less reliable, and the information asymmetry between managers and investors may be greater. Even though the investors are able to obtain information about intangibles from analyst reports[3], they still feel unsure about the firms' future performance due to the uncertainty of the intangibles' value. Given the lack of public information about firms' intangible assets and the fact that issues regarding intangible assets have become increasingly important in the economy over time, investing in firms with a higher proportion of intangibles involves greater risk. Guo, Lev and Zhou (2004) use the bid-ask spread, the quoted depth of stocks, and the stock return volatility as indicators of information asymmetry. Glosten and Milgrom (1985) find a relation between information asymmetry and bid-ask spread – the larger is the asymmetry, the wider is the spread. French and Roll (1986) also prove that stock return volatility is primarily related to the information made available to investors – the higher is the quality and the quantity of the information given to investors, the lower is the stock return volatility. Thus, we predict that firms with higher intangible assets would have more information asymmetry because the firms' stock returns would be more volatile.

Hypothesis 2: The balance sheet intangibles of firms are positively correlated with the volatility of their stock returns.

1.2. R&D and performance. Technology plays a very important role in the value creation process of firms, especially knowledge-intense companies, and is regarded as a long-term investment in intangible assets. Under the regulations of the Generally Accepted Accounting Principles (GAAP), purchased intangibles, e.g., goodwill can be capitalized at cost; however, internally developed intangibles, e.g., R&D and advertising, must be fully expensed as incurred[4]. They are not recognized under the GAAP because of the measurement difficulties related to the uncertainty of their values. Although they are expensed in financial statements, evidence from previous research suggests that a large portion of the benefits derived from those fully expensed intangible assets is relevant to the firms' future earnings (Sougiannis, 1994; Lev and Sougiannis, 1996; and Aboody and Lev, 1998). This implies that the more the firms invest in R&D, the better their future income, as well as accounting performance, would be. Therefore, we consider research and development expenditure, as a relevant proxy for technology, is positively correlated with firms' accounting performance.

Hypothesis 3: R&D expenses are positively correlated with firms' accounting performance.

In high-tech industries, e.g., pharmaceutical, electronics, biotechnology, and research industries, technology is the foundation of the firms' growth opportunities; the investors in those kinds of companies would have higher expectations with regard to the firms' future performance. However, the inherent uncertainty of R&D generates in the investors a lack of confidence about the firms' future value; hence causing severe volatility in the stock returns.

Hypothesis 4: R&D expenses are positively correlated with the volatility of firms' stock returns.

1.3. Brand values and firms' performance. The notion of brand is that of a special name that consumers have a high level of recognition and are willing to pay higher than otherwise average prices or make more frequent purchases. Keller (1997) suggests several benefits of a brand name, such as greater

[1] For the most part, intangibles are defined herein as goodwill, licenses, patents, franchises, trademarks, and some other rights.

[2] Hall (2001b) shows that the valuation effect of intangible assets on firms' market value is more important than that of tangible assets.

[3] Barth, Kasznik and McNichols (2001) conclude that firms with more intangibles will have higher analyst coverage.

[4] The International Accounting Standards Committee (IASC) also produced a rule for intangible assets; it requires intangibles, whether internally developed or externally acquired, to be recognized at cost in the balance sheet unless they meet the following three criteria: (1) the definition of an intangible asset – an identifiable asset without visible substance that is controlled and clearly distinguished from the firms' goodwill; (2) the future economic benefits that are generated from the assets will probably flow to the firms; (3) the costs of the assets can be assessed reliably. If the intangible assets do not meet the above criteria, they will be considered as expenses when they are incurred.

loyalty from customers, larger profits, less vulnerability in a competitive market, more price inelastic that consumers response to price increases, more price elastic that consumers response to price decreases, more trade alliances and supports, increased market communication and effectiveness, and higher licensing and brand extension opportunities. Those benefits generated from branded products potentially provide firms with a higher operating margin than those from unbranded products. However, there are three arguments proposed by the U.S. GAAP. First, the recognition of brand values is different across firms[1]. Second, although brand values change over time, these changes generally do not mean that brands can be recognized as assets. Under the U.S. GAAP regulations, the impairment of brand values should be write-downs; the recognition of increases in the brand values is not permitted. Third, expenditures that would increase brand values, e.g., advertising, should be expensed instead of capitalized.

The above discussion indicates that although internally developed brand values cannot be recognized in the balance sheet, advertising expenses can be regarded as a proxy for brand values. Abdel-khalik (1975), and Hirschey and Weygandt (1985) test whether advertising expense is a value-relevant proxy for brand value; the result confirms the conjecture that advertising expenses really benefit the development of valuable brand names. Barth, Clement, Foster and Kasznik (1998) also find that the estimated brand value is positively associated with advertising expense, brand operating margin, and brand market share. Thus, we hypothesize that firms with higher advertising expenses would have more valuable brands, which in turn provide them with higher operating earnings.

Hypothesis 5: Advertising expenses are positively correlated with firms' accounting performance.

Additional research reveals that estimated brand value is significantly positively correlated with stock prices after controlling for advertising expenses, operating margin, market share, analysts' earnings forecasts, and recognized brand assets (Barth, Clement, Foster and Kasznik, 1998). Aaker and Jacobson (1994) also examine the relationship between brand quality and stock returns using the EquiTrend measure of brand quality; the results suggest a positive correlation between two. Nevertheless, although advertising expense is an alternative measurement of brand values, not all expenditures incurred in promoting brands result in increases in brand values. Thus, the uncertainty of the future cash flow that advertising would bring to the firms would make the investors feel uncertain about the firms' future values.

Hypothesis 6: Advertising expenses are positively correlated with the volatility of firms' stock returns.

1.4. Human resources. Human resources include information that concerns the members of the board, the management teams, and the employees, such as education level, salary, and bonus. Because education level is not quantifiable, salary and bonus can be regarded as proxies for human resources. The higher the salary and bonus are, the higher are the human resources value and, therefore, the higher is the intellectual capital.

Bonus and salary also represent the compensation given to the firms' managers, with those managers having the capability to increase the firms' value being compensated with a higher salary and bonus. On the other hand, firms use compensation as a monitor toward reducing agency problems. Thus, they would pay a higher bonus and salary to the management teams to encourage them to work toward maximizing the firms' value. Therefore, we predict that firms that give more compensation to their managers would have better performance than those that offer less.

Hypothesis 7: The bonus and salary of firms are positively correlated with their accounting performance.

As previously known, more compensation for managers mitigates agency problems. It also reduces the risk that the management teams (agent) would not always act in the best interest of the investors (principals). Moreover, the managers would be willing to disclose more information to convince the investors that they are exerting their best efforts to increase the firms' value. Hence, the investors would increase their holding periods, thus reducing the volatility of the stock returns.

Hypothesis 8: The bonus and salary of managers are negatively correlated with the volatility of firms' stock returns.

2. Empirical model

To test the hypotheses mentioned in section 1, we conduct our examination based on the following regression equations:

$$\begin{aligned} &Accounting\ Performance = a_0 + \\ &+ a_1 INTANGIBLE_{it} + a_2 ADVERTISING_{it} + \\ &+ a_3 R\&D_{it} + a_4 (BONUS + SALARY)_{it} + \varepsilon_{1it}, \end{aligned} \quad (1)$$

$$\begin{aligned} &Market\ Performance = b_0 + \\ &+ b_1 INTANGIBLE_{it} + b_2 ADVERTISING_{it} + \\ &+ b_3 R\&D_{it} + b_4 (BONUS + SALARY)_{it} + \varepsilon_{2it}, \end{aligned} \quad (2)$$

[1] Internally developed brands should be expensed rather than recognized as assets unless they are purchased. Purchased brands are typically recognized and amortized according to their estimated useful life, which is no more than forty years.

where *Accounting Performance* is the accounting items, including the OPEPS, OANCFPS, and SALECHG. *OPEPS* is the basic earnings per share from operations for firm *i* in year *t*. *OANCFPS* is the net cash flow (per share) from operating activities for firm *i* in year *t*. *SALECHG* is the 1-year percentage change in net sales: $\frac{SALE_t - SALE_{t-1}}{SALE_{t-1}} \times 100$, for firm *i* in year *t*. We use *VOLATILITY*, measured as the annualized standard deviation of daily stock returns for firm *i* in year *t*, as a proxy for market performance. IT_{it} is the balance sheet intangibles divided by total assets for firm *i* in year *t.* This item includes copyrights, distribution rights and agreements, franchises and franchise fees, goodwill, licenses, operating rights, patents, trademarks and trade names, computer software patents, etc. XAD_{it} is the annual advertising expenses divided by total sales for firm *i* in year *t.* This item represents the cost of advertising media, e.g., radio, television, periodicals, and promotional expenses. $R\&D_{it}$ is the annual R&D expenses divided by total sales for firm *i* in year *t.* This item represents all costs related to the development of new products and services, including software expenses, amortization of software costs, and R&D processes reported by companies. $BONUS_{it}$ is the average dollar value earned per executive officer of the firm, including cash and non-cash, during the fiscal year for firm *i* in year *t. SALARY*$_{it}$ is the average dollar value of the base salary earned per executive officer of the firm, including cash and non-cash, during the fiscal year for firm *i* in year *t.* As explained in section 1, we predict a_1, a_2, a_3, and a_4 to be positive; we also predict b_1, b_2, and b_3 to be positive, and b_4 to be negative[1].

3. Data descriptions

Our sample period is from 1994 to 2007. The initial sample includes all the firms in COMPUSTAT (Standard & Poor's Research Insight). We eliminate financial institutions and utilities because the accounting variables we use to test the hypotheses, i.e., research and development expenditures, and advertising expenses, are not so relevant for firms in these two industries. All data on balance sheet items, i.e., advertising expenses, R&D expenses, market value, earnings per share, cash flow from operations, and sales growth rate, are from COMPUSTAT; those on stock returns are from the CRSP (Center for Research in Security), while data on compensation items, i.e., bonus and salary, are from ExecuComp (Executive Compensation Data). Combing these data and deleting outliers (less than 1%) we collect 8,236 samples.

Table 1 presents the summary statistics of variables for the total sample. The first three variables, i.e., *OPEPS*, *OANCFPS*, and *SALECHG*, are proxies for accounting performance. The difference between the third quartile and the first quartile values for *OANCFPS* is greater than that for the other two variables, which makes the standard deviation for *OANCFPS* even greater. The standard deviation of stock returns is a proxy for market performance (*VOLATILITY*); we use daily returns to compute for the standard deviation and then annualize the value. The correlations between *ADVERTISING* and *R&D* (0.352), and between *ADVERTISNG* and (*BONUS* + *SALARY*) (0.568) are larger than that between other variables[2]. However, there is no other significant correlation among the variables as a whole. We observe that balance sheet intangibles is positively correlated with accounting performance, except for *OPEPS*; *ADVERTISING* expenses and R&D expenses are negatively correlated with accounting performance, except for *SALECHG*; and *BONUS* and *SALARY* are positively correlated with accounting performance, except for *SALECHG*. Some significant results are consistent with our predictions.

Table 1. Descriptive statistics

Descriptive statistics for the variables are presented in a firm year. The values for *SALECHG*, *INTANGIBLE*, *ADVERTISING*, and *R&D* are shown as percentages. The variables are defined as follows: *OPEPS* is the basic earnings per share from operations; *OANCFPS* is the net cash flow per share from operating activities; *SALECHG* is the 1-year percentage change in sales; [($SALE_t$ – $SALE_{t-1}$)/ $SALE_{t-1}$]×100; *VOLATILITY* is the return volatility, measured as the annualized standard deviation of daily stock returns for firm *i* in year *t*; *INTANGIBLE* is the balance sheet intangibles divided by total assets; *ADVERTISING* is the annual advertising expenses divided by total sales; *R&D* is the annual research and development expenses divided by total sales; *BONUS* is the average dollar value earned per executive officer of the firm, including cash and non-cash, during the fiscal year; and *SALARY* is the average thousand dollars value of the base salary earned per executive officer of the firm, including cash and non-cash, during the fiscal year.

	Mean	Median	Std. dev.	First quartile	Third quartile	Observations
OPEPS	1.16	1.04	1.47	0.43	1.76	8217
OANCFPS	2.25	1.67	2.84	0.64	3.20	7780

[1] Because the effect of independent variables on dependent variables may not occur at the same time, we can also consider a lagged effect. It uses the method that is similar to Fama and MacBeth (1973) by separating total sample period into 5 periods. For each period, we use data on the average independent variables in the previous period to match the average dependent variables in the current period. After finishing the formation, we pool these 5 periods' data and make the regression. Through this approach, we can examine the long-term effect of intellectual capital on the firms' performance. We find that the relations between the firms' intangibles and performance would be more significant under this method.

[2] Other correlation coefficients between two independent variables are less than 0.15.

Table 1 (cont.). Descriptive statistics

	Mean	Median	Std. dev.	First quartile	Third quartile	Observations
SALECHG	17.22	10.00	39.99	1.67	22.53	8212
VOLATILITY	0.19	0.16	0.09	0.14	0.21	8236
INTANGIBLE	22.86	10.64	36.64	0.00	34.85	7140
ADVERTISING	40.75	4.46	97.19	1.18	30.66	2654
R&D	45.63	10.64	109.09	0.00	35.02	4813
BONUS	1361.85	700.00	2509.20	984.33	2300.81	8213
SALARY	1713.27	1560.90	1025.19	398.23	3070.43	8213

4. Empirical results

4.1. Total sample results. Table 2 presents the summary of our regression. Consistent with our hypotheses, *INTANGIBLE* and *BONUS* + *SALARY* have significantly positive relations with *OPEPS* and *OANCFPS*, while *R&D* has a significantly negative relation with *OPEPS*. This is possibly due to the expenditure of *R&D* activities. On the other hand, *ADVERTISING* and *BONUS* + *SALARY* have a significantly negative relation with *SALECHG*, which may be explained that both variables do not have a short-term effect on the sales growth. In panel A, the regressions do not include year dummy variables and the market size, which result in lower adjusted R-square values. The results are robust when the year dummy variables and the market size variable are included as Panel B, and then we may have significant increased adjusted R-square values.

Table 2. The relationship between performance and intellectual capital

This table presents the regression results for accounting performance and market performance on intellectual capital. White's heteroskedasticity consistent covariance estimates are used. T-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% levels, respectively).

Variable	Panel A: Regression without controlling year dummy variables and firm size			
	Dependent variables			
	OPEPS(*10^3)	*OANCFPS*(*10^3)	*SALECHG*(*10^2)	*VOLATILITY*(*10^4)
INTANGIBLE	3.46*** (2.88)	4.87*** (3.55)	2.97 (1.31)	-0.55 (-0.7)
ADVERTISING	0.29 (0.80)	1.27 (1.63)	-2.67*** (-4.02)	-0.45 (-1.14)
R&D	-1.17* (-1.93)	-1.02 (-1.60)	0.25 (0.24)	0.07 (0.20)
BONUS + SALARY	0.07*** (4.05)	0.13*** (4.61)	-0.07** (-2.27)	-0.33*** (-15.67)
Constant	934.22*** (18.63)	1719.88*** (23.61)	1549.90*** (14.62)	3511.80*** (83.72)
Adj. R-square	0.0144	0.0247	0.007	0.3758
Observations	1991	1991	1991	1991
Variable	Panel B: Regression with controlling year dummy variables and firm size			
	Dependent variables			
	OPEPS(*10^3)	*OANCFPS*(*10^3)	*SALECHG*(*10^2)	*VOLATILITY*(*10^4)
INTANGIBLE	1.93* (1.76)	2.94** (2.24)	2.80 (1.19)	-1.04 (-1.29)
ADVERTISING	-0.33 (-0.91)	0.51 (0.66)	-2.75*** (-4.12)	-0.74* (-1.88)
R&D	-2.26*** (-3.64)	-2.18*** (-3.21)	0.28 (0.25)	-0.31 (-0.81)
BONUS + SALARY	0.04** (2.36)	0.10*** (3.38)	-0.08*** (-2.70)	-0.33*** (-15.67)
Constant	-2361.63*** (-15.78)	-2017.70*** (-9.41)	859.72** (2.23)	2521.60*** (22.26)
Year dummy and size	YES	YES	YES	YES
Adj. R-square	0.280	0.189	0.007	0.439
Observations	1985	1985	1985	1985

In terms of market performance, (*BONUS* + *SALARY*) has a significantly negative relation with *VOLATILITY*, which is consistent with our prediction. However, *INTANGIBLE*, *R&D* and (*BONUS* + *SALARY*) do not have significant effects on *VOLATILITY*. Prior research suggests that high-tech or knowledge-intense

companies invest heavily in intangible assets; hence, those companies would be affected more seriously by economic development, which in turn would cause uncertainty in their operating performance and make their stock returns more volatile. However, we do not find this relation in our research because the pro forma reports prepared by high-tech firms supply more information to the investors; thus, the market reflects the true value of intangibles more accurately.

4.2. Size effect. After examining the total sample and separate-year sample, we examine whether the results would be different among different-sized companies. We expect intangible assets to have a more significant effect on performance among larger firms with more intangibles.

In order to distinguish the firms' sizes, we first separate the period data into three equal categories, i.e., small, middle, and large, according to the independent variables on all available data. Then we merge the data on firms of the same size and make the regressions[1]. We use the difference between the means of the two populations to test for a significant difference between small firms and large firms. The results are presented in Table 3. Panel A, Panel B, and Panel C show the summary statistics for accounting performance; Panel D shows the results for market performance; and Panel E shows the results for compensation.

For accounting performance, as predicted, Panel A, Panel B, and Panel C show that *INTANGIBLE*, *ADVERTISING* and (*BONUS* + *SALARY*) have a more significant impact on accounting performance in small size and middle size firms than in large size firms. However, *R&D* does not seem to have a significant size effect on accounting performance, except for *OPEPS*. This may because *R&D* is more relevant in relation to industry effect.

For market performance, Panel D reveals that *ADVERTISING* and (*BONUS* + *SALARY*) have a significantly negative impact on *VOLATILITY*, which indicates that in large firms with more advertising expenses, advertising expenses, and human capital, these variables would have a more significant influence on the volatility of stock returns than they would in small firms.

Table 3. The influence of size effects

This table presents the influence of size effects on the relationship between accounting performance and market performance and intellectual capital. The t-statistics of the difference between the small size group and the large size ratio group are reported in each panel. White's heteroskedasticity consistent covariance estimates are used. T-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% levels, respectively).

Variable	Panel A: Dependent variable *OPEPS* (*10^3)			
	Small size	Middle size	Large size	t-statistic
INTANGIBLE	5.52*** (2.67)	3.54*** (2.94)	1.88 (1.08)	3.63 (1.35)
ADVERTISING	0.99 (1.38)	0.31 (0.85)	-0.39 (-0.80)	1.38 (1.61)
R&D	-3.06*** (-3.20)	-1.29** (-1.98)	-1.07 (-1.25)	-2.00 (-1.57)
BONUS + SALARY	0.12*** (3.54)	0.07*** (4.07)	0.09*** (3.03)	0.03 (0.76)
Constant	87.45 (0.79)	931.10*** (18.58)	1309.25*** (17.4)	-1221.80*** (-9.14)
Adj. R-square	0.040741	0.014986	0.00875	
Observations	429	1985	835	
Variable	Panel B: Dependent variable *OANCFPS*(*10^3)			
	Small size	Middle size	Large size	t-statistic
INTANGIBLE	7.66*** (3.49)	4.93*** (3.59)	5.52** (2.44)	2.14 (0.68)
ADVERTISING	4.29** (2.16)	1.26 (1.62)	-0.38 (-0.53)	4.67** (2.22)
R&D	-1.57 (-0.95)	-1.00 (-1.44)	-0.92 (-0.78)	-0.65 (-0.32)
BONUS + SALARY	0.16*** (2.7)	0.13*** (4.57)	0.10** (2.17)	0.07 (0.93)
Constant	1058.38*** (6.30)	1722.83*** (23.62)	2072.37*** (19.29)	-1013.99*** (-5.09)
Adj. R-square	0.066622	0.024652	0.01134	
Observations	429	1985	835	

[1] We use total market value as an indicator to distinguish firms' size.

Table 3 (cont.). The influence of size effects

Variable	Panel C: Dependent variable *SALECHG* (*10^2)			
	Small size	Middle size	Large size	t-statistic
INTANGIBLE	8.42 (1.7)	3.06 (1.34)	-4.01 (-0.98)	12.43* (1.94)
ADVERTISING	-0.80 (-0.91)	-2.66*** (-3.98)	-2.33* (-1.94)	1.53 (1.04)
R&D	2.80 (0.57)	0.31 (0.27)	-0.89 (-0.47)	3.69 (0.71)
BONUS + SALARY	-0.07 (-0.88)	-0.07** (-2.31)	-0.11* (-1.81)	0.04 (0.46)
Constant	689.63*** (3.68)	1550.59*** (14.61)	2472.56*** (11.87)	-1782.92*** (-6.37)
Adj. R-square	0.010246	0.007107	0.009219	
Observations	429	1983	834	
Variable	Panel D: Dependent variable *VOLATILITY*(*10^4)			
	Small size	Middle size	Large size	t-statistic
INTANGIBLE	1.46 (1.24)	-0.39 (-0.49)	0.06 (0.06)	1.40 (0.89)
ADVERTISING	0.77 (0.99)	-0.46 (-1.16)	-0.76** (-2.47)	1.53* (1.85)
R&D	1.30 (1.21)	0.049 (0.12)	-0.02 (-0.03)	1.32 (1.12)
BONUS + SALARY	-0.24*** (-6.12)	-0.33*** (-15.70)	-0.39*** (-16.35)	0.15*** (4.11)
Constant	3152.077*** (35.87)	3512.58*** (83.75)	3678.28*** (82.68)	-526.21*** (-5.34)
Adj. R-square	0.194677	0.378524	0.502427	
Observations	429	1985	835	

4.3. Market-to-book ratio. This study adopts two indicators to measure firms' growth opportunities: market-to-book ratio and sales growth rate. The higher the MB ratio and sales growth rate are, the more growth opportunities the firms have. In this section, we will discuss whether the results would be different because of firms' growth opportunities according to these two indicators.

The method we use to distinguish the growth opportunities of the firms is the same as that used to determine the firms' size. The only difference is that we use the market-to-book ratio and sales growth rate to separate the period data into three categories based on all the available data. We expect intangible assets to have a more significant effect on performance among firms with higher growth opportunities.

Table 4. The influence of M/B effects

This table presents the influence of size effects on the relationship between accounting performance and market performance and intellectual capital. The t-statistics of the difference between the low MB ratio group and the high M/B ratio group are reported in each panel. White's heteroskedasticity consistent covariance estimates are used. T-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% levels, respectively).

Variable	Panel A: Dependent variable *OPEPS*(*10^3)			
	Low M/B	Normal M/B	High M/B	t-statistic
INTANGIBLE	-0.19 (-0.08)	3.54*** (2.94)	3.42*** (2.63)	-3.61 (-1.31)
ADVERTISING	-10.69 (-1.48)	0.31 (0.85)	-0.51 (-1.19)	-10.15 (-1.41)
R&D	-8.11** (-2.42)	-1.29** (-1.98)	-1.59** (-2.05)	-6.52* (-1.90)
BONUS + SALARY	0.23*** (3.63)	0.07*** (4.07)	0.03 (1.23)	0.20*** (3.11)
Constant	-61.92 (-0.64)	931.19*** (18.58)	1830.76*** (23.24)	-1892.69*** (-15.20)
Adj. R-square	0.049391	0.014986	0.01247	
Observations	547	1985	776	

Table 4 (cont.). The influence of M/B effects

Variable	Panel B: Dependent variable: *OANCFPS*(*10^3)			
	Low M/B	Normal M/B	High M/B	t-statistic
INTANGIBLE	-1.14 (-0.46)	4.93*** (3.59)	4.50** (2.43)	-5.64* (-1.83)
ADVERTISING	1.99 (0.39)	1.26 (1.62)	-0.37 (-0.42)	2.36 (0.46)
R&D	-10.70*** (-2.82)	-1.00 (-1.44)	-1.47* (-1.78)	-9.24** (-2.39)
BONUS + SALARY	0.23*** (3.60)	0.13*** (4.57)	0.11 *** (2.71)	0.12* (1.85)
Constant	564.17*** (4.74)	1722.83*** (23.62)	2792.25*** (22.49)	-2228.08*** (-12.95)
Adj. R-square	0.045179	0.024652	0.01055	
Observations	547	1985	776	
Variable	Panel C: Dependent variable *SALECHG*(*10^2)			
	Low M/B	Normal M/B	High M/B	t-statistic
INTANGIBLE	15.00* (1.67)	3.06 (1.34)	0.82 (-0.42)	15.82 (1.54)
ADVERTISING	6.23 (0.40)	-2.66*** (-3.98)	-2.26*** (-3.51)	8.49 (0.54)
R&D	33.95* (1.69)	0.31 (0.27)	-0.22 (-0.37)	34.17* (1.70)
BONUS + SALARY	-0.11 (-0.56)	-0.07** (-2.31)	-0.06* (-1.83)	-0.05 (-0.26)
Constant	746.02*** (2.76)	1550.59*** (14.61)	1606.17*** (11.82)	-860.16*** (-2.84)
Adj. R-square	0.027051	0.007107	0.022254	
Observations	546	1983	775	
Variable	Panel D: Dependent variable *VOLATILITY*(*10^4)			
	Low M/B	Normal M/B	High M/B	t-statistic
INTANGIBLE	-0.89 (-0.40)	-0.39 (-0.49)	-0.95 (-0.88)	0.07 (0.03)
ADVERTISING	-1.66 (-0.80)	-0.46 (-1.16)	-1.45*** (-3.32)	-0.20 (-0.10)
R&D	5.78** (2.06)	0.05 (0.12)	-0.92** (-2.52)	6.70** (2.36)
BONUS + SALARY	-0.5*** (-6.59)	-0.33*** (-15.70)	-0.25*** (-8.73)	-0.25*** (-3.45)
Constant	3315.39*** (28.72)	3512.55*** (83.75)	3691.67*** (63.27)	-376.28*** (-2.91)
Adj. R-square	0.251585	0.378524	0.610931	
Observations	547	1985	776	

Table 4 presents the regression results. For accounting performance, Panel A, Panel B, and Panel C indicate that *INTANGIBLE* and *ADVERTISING* have a more significant impact on accounting performance in middle and high MB ratio firms than in low MB ratio firms.

Regarding market performance, Panel D reveals that *ADVERTISING*, *R&D* and (*BONUS* + *SALARY*) have a more significant impact on *VOLATILITY* in high MB ratio firms than in low MB ratio firms. This indicates that in the companies with greater growth options, intellectual capital may have more significant influence on firms' performance.

4.4. Industry effect. As previously mentioned, intangible assets play an increasingly important role in the value creation process of firms, especially high-tech corporations or knowledge-intense companies. Therefore, we examine whether the results would be more significant in high-tech or knowledge-intense industries. We use four-digit SIC codes from COMPUSTAT to classify the industries and adopt the definition used in Loughran and Ritter (2004) to find tech stocks. Tech stocks are defined as those in SIC codes 3571, 3572, 3575, 3577, 3578 (computer hardware), 3661, 3663, 3669 (communications equipment), 3671, 3672, 3674, 3675, 3677, 3678, 3679 (electronics), 3812 (navigation equipment), 3823, 3825, 3826, 3827, 3829 (measuring and controlling devices), 3841, 3845 (medical instruments), 4812, 4813 (telephone equipment), 4899 (communications services), and 7371, 7372, 7373, 7374, 7375, 7378, and 7379 (software).

Table 5 shows the regression results. Tech industries suggest that *ADVERTISING* and (*BONUS* + *SALARY*) have significantly positive effects on *OPEPS* and *OANCFPS*, which suggests that the intellectual capital is more likely to play a positive role in tech industries. However, non-tech industries are similar with our overall results in Table 2. Besides, according to prior research, in order to convey real profitability, high-tech or knowledge-intense companies with a high proportion of intangible assets are more likely to report pro forma earnings compared to other companies (Lougee and Carol, 2004). However, since the earnings and cash flows we use to test our hypotheses are under the U.S. GAAP regulations, the true performance of the high-tech or knowledge-intense companies may be distorted because these firms invest heavily in intangibles, e.g., research and development (Francis and Schipper, 1999; Lev and Zarowin, 1999; Collins et al., 1997). This may be the reason why the influence on accounting performance has no significant difference among industries.

Regarding market performance, Panel D indicates negative relations between *ADVERTISING* and *VOLATILITY* in tech industries, and between (*BONUS* + *SALARY*) in non-tech industries. This suggests that the effect of intangible assets on volatility is not significantly different for high-tech (or knowledge-intense) and for non-high-tech (or non-knowledge-intense) firms.

Table 5. The influence of industry effects

This table presents the influence of size effects on the relationship between accounting performance and market performance and intellectual capital. Tech industries are defined from Loughran and Ritter (2004). The t-statistics of the difference between the tech industry group and non-tech industry group are reported in each panel. White's heteroskedasticity consistent covariance estimates are used. T-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% levels, respectively).

Variable	Panel A: Dependent variable *OPEPS*(*10^3)		
	Tech industries	Non-tech industries	t-statistic
INTANGIBLE	1.21 (0.63)	3.95*** (2.85)	-2.73 (-1.15)
ADVERTISING	2.56** (2.50)	-0.29 (-0.72)	2.86*** (2.61)
R&D	-1.45 (-0.92)	-1.11* (-1.93)	-0.35 (-0.21)
BONUS + SALARY	0.14*** (3.27)	0.091*** (4.20)	0.05 (1.12)
Constant	332.60** (2.36)	935.08*** (17.38)	-602.48*** (-3.99)
Adj. R-square	0.214858	0.011913	
Observations	143	1848	
Variable	Panel B: Dependent variable *OANCFPS*(*10^3)		
	Tech industries	Non-tech industries	t-statistic
INTANGIBLE	4.02 (1.51)	5.13*** (3.33)	-1.12 (-0.37)
ADVERTISING	2.99* (1.83)	0.78 (0.87)	2.22 (1.19)
R&D	0.78 (0.74)	-1.53** (-2.14)	2.31* (1.83)
BONUS + SALARY	0.20*** (2.71)	0.15*** (4.70)	0.05 (0.70)
Constant	897.06*** (3.00)	1728.53*** (22.66)	-831.47*** (-2.69)
Adj. R-square	0.162076	0.020807	
Observations	143	1848	
Variable	Panel C: Dependent variable *SALECHG*(*10^2)		
	Tech industries	Non-tech industries	t-statistic
INTANGIBLE	-2.60 (-0.80)	4.47 (1.64)	-7.08* (-1.67)
ADVERTISING	-1.52** (-2.02)	-3.01*** (-3.72)	1.49 (1.35)
R&D	0.24 (0.46)	0.15 (0.12)	0.09 (0.06)
BONUS + SALARY	-0.08 (0.92)	-0.05 (-1.25)	-0.04 (-0.38)
Constant	1458.31*** (2.67)	1512.27*** (13.36)	-53.97 (-0.10)
Adj. R-square	-0.00197	0.005887	
Observations	144	1847	

Table 5 (cont.). The influence of industry effects

Variable	Panel D: Dependent variable *VOLATILITY*(*10^4)		
	Tech industries	Non-tech industries	t-statistic
INTANGIBLE	-0.60 (-1.09)	-0.82 (-0.87)	0.23 (0.21)
ADVERTISING	-0.79*** (-4.33)	-0.33 (-0.68)	-0.46 (-0.90)
R&D	-0.01 (-0.03)	0.32 (0.72)	-0.33 (-0.65)
BONUS + SALARY	-0.01 (-0.98)	-0.35*** (-13.53)	0.33*** (14.83)
Constant	1759.68*** (24.30)	3580.11*** (72.23)	-1820.43*** (-21.10)
Adj. R-square	0.095807	0.365823	
Observations	144	1849	

Conclusion

Prior researches merely discuss the relationship between intangible assets and some other factors, such as analyst coverage, share repurchases, etc. The influence of intangible assets on firms' performance is not fully analyzed. Thus, the primary purpose of this article is to investigate the relation between intangible assets and firms' performance. We examine whether firms with more intangible assets, i.e., balance sheet intangibles (including goodwill, licenses, franchises, trademarks, etc.), technology, brand value, and human capital, would have better performance (including accounting and market performance). The proxies that represent these four categories of intangibles are balance sheet intangibles (*INTANGIBLE*), R&D expenses (*R&D*), advertising expenses (*ADVERTISING*), and human capital (*BONUS* + *SALARY* for executive officers). We also use basic earnings per share from operations (*OPEPS*), net cash flow per share from operating activities (*OANCFPS*), and sales change (*SALECHG*) as proxies for accounting performance, and the annualized standard deviation (*VOLATILITY*) of daily returns as a proxy for market performance. We also consider the effect of intangible assets on compensation (*BONUS*) to the managers. Tests are based on accounting items from COMPUSTAT, compensation data from ExecuComp, and stock returns from the CRSP from 1994 to 2007.

In the first set of tests, we use the total sample to examine the association between intangible assets and firms' performance. We predict that firms with more intangible assets would have better accounting performance and provide more compensation to executive officers. We also predict that firms with more balance sheet intangibles, advertising expenses, and R&D expenses would have higher volatility of stock returns, whereas those that give higher salary and bonus to managers would have lower volatility of stock returns. Consistent with our predictions, we find that firms with more balance sheet intangibles, and higher bonus and salary would have better accounting performance (except for (*BONUS* + *SALARY*) to *SALECHG*). Also, as predicted, firms with more bonuses for managers would have better market performance, and those with more balance sheet intangibles, higher salary, and greater earnings per share from operations would provide more bonuses to executive officers. Contrary to our predictions, we do find a significantly negative relation between advertising expenses and earnings per share from operations, between R&D expenses and sales growth rate, and between balance sheet intangibles and the volatility of firms' stock returns.

The subgroup tests in relation to size effect, growth opportunities, and industry effect are also presented. In terms of size, as predicted, we find that the impact of balance sheet intangibles, advertising expenses, and bonus and salary for managers on accounting performance is more significant for small and middle size firms. Also, consistent with our predictions, higher advertising expenses, R&D expenses, and bonus and salary for managers would have a more significant influence on the volatility of stock returns in large firms than in small firms. Regarding firms' growth opportunities, we use market-to-book ratio (MB ratio) for growth opportunities. Inconsistent with our predictions, we find that balance sheet intangibles and advertising expenses have a more significant impact on accounting performance in high MB ratio firms than in low MB ratio firms. We also find that advertising expenses, and bonus and salary for managers have a more significant impact on accounting performance in low sales growth rate firms than in high sales growth rate firms. With regard to market performance, we find that higher advertising expenses, R&D expenses, and bonus and salary for managers would have a more significant influence on the volatility of stock returns in high MB ratio firms than in low MB ratio firms. The findings also indicate that advertising expenses, R&D expenses, and bonus and salary for managers have a more significant impact on the volatility of stock returns in low sales growth rate firms than in high sales

growth rate firms. As for compensation, inconsistent with our predictions, we find that more balance sheet intangibles, advertising expenses, R&D expenses, and bonus and salary for managers would have a more significant influence on compensation for executive officers in low MB ratio firms than in high MB ratio firms. All the findings above are inconsistent with our prediction that intangible assets would have a more significant influence on performance in firms with higher growth opportunities.

In terms of industry category, we predict that the results would be more significant in high-tech or knowledge-intense industries. We find that tech industries shows better association between intellectual capital and accounting performance. Also consistent with our predictions, firms with more advertising expenses and R&D expenses would have higher volatility of stock returns, whereas those with higher salary and bonus for managers would have lower volatility of stock returns.

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