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An Examination of the Value Relevance of Intellectual Capital: The Case of Banking Industry

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This study examines the value relevance of intellectual capital (IC) to investors. In this respect, associations of IC with contemporaneous market valuation, stock returns, excess returns and share prices are initially tested. In addition, associations for current IC and future data of the above stock performance indicators are estimated to investigate whether the selected performance indicators have delayed response to IC. Pulic's VAIC™ method is selected to measure IC and fixed effects panel regressions are used to analyse data of 191 NYSE listed banking sector firms over 2000-2011. Results of contemporaneous analysis fail to establish conclusive associations between IC and selected stock performance indicators. Analyses to test the delayed reactions evident that contemporaneous IC relates significantly negatively with market valuation and stock returns, and significantly positively with excess returns and stock prices. This suggests that investors perceive IC as firm-specific risk related investments which account for uncertain future benefits. Evidence for investor relevance based on adopted stock performance indicators in this study, and delayed reaction analysis add new attributes to extant IC performance literature.

JEL Codes: C33, G11, G21, G32 and L25

1. Introduction

Resource-based view (RBV) is a recently emerged alternative approach to understand industrial organizations and their competitive strategies. RBV assumes that firm is equivalent to a broad set of resources (Das & Teng, 2000), meanwhile, resources in both forms of tangible and intangible represent the broad set of resources in the organization (Wernerfelt, 1984). Intellectual capital (IC), broadly, the accumulated knowledge-related intangible assets of the organization can be recognized as the most recent addition to the asset base of the firm. Further, it positions as the fourth production factor and categorizes as the lately emerged strategic asset, which ensures competitive advantage and superior performance for organizations (Miller & Shamsie, 1996) through its idiosyncratic features. According to Das and Teng (2000) and Gibbert (2006) resources with features such as imperfect mobility, simultaneously valuable, rare, costly to imitate, and non-substitutability qualify as strategic assets. In this relation, IC can also be categorized as a strategic asset because it identifies as a firm-specific knowledge-related asset (Stewart, 1997) that bears the characteristics of rarity, inimitability, non-substitutability and non-observability (Riahi-Belkaoui, 2003). Moreover, the RBV emphasizes resources that are idiosyncratic and hard-to-copy as the drivers of the

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firm's strategy and performance (Gibbert, 2006). Apart from competitive advantages, IC may represent as an important determinant in deciding the value of a firm (Yalama & Coskun, 2007) and recognizes as an important determinant for investors in the investment decision-making process. Further, the same argument is almost supported by Dorweiler and Yakhou (2005) as they believe that the future of commerce will heavily depend on the advances of IC. Parallel to the decision support aspect of IC for investors, Tayles et al. (2007) assume, theoretically, the disclosure of value content information of IC reduces the transaction cost and uncertainty among investors.

Having recognized the importance of IC, a quantity of research has been carried out to examine the influence of IC on overall firm performance. In this context, the impact of IC on firm performance measured through traditional financial measures, namely, asset turnover ratio, employee productivity, return on assets, return on equity, and sales growth are given priority. These performance indicators capture the efficiency of internal decision making of the firm and generally useful for all stakeholders of the organization. In addition, several studies in the extant IC literature provide informational support on the relevance of IC to investors by investigating the association of IC with market valuation and stock performance. Market valuation was mostly measured through market-to-book value ratio, whilst, holding period return, earnings per share and capital gain of stocks have been used to assess stock performance. However, results of almost all studies that attempted to establish the association between IC with market valuation and stock performance failed to establish conclusive relationships. Referring to inconclusive evidence as such, we expect to draw evidence on value relevance of IC to investors in the following manner. Firstly, we incorporate additional investor value relevant performance indicators (i.e. expected returns, excess returns and share prices) to explain the association between IC and stock performance. Second, we attempt to find whether the selected performance indicators have delayed reactions to IC investments. This approach to explore the value relevance of IC on external investors may become the pioneering effort not only for listed banking firms on the New York Stock Exchange (NYSE) but also sets an example for enriching the existing research agenda of IC literature to provide informational support on the value relevance of IC to investors.

The remainder of this paper is organized as follows: Section 2 reviews the related prior studies and section 3 elaborates the methodology adopted. The penultimate section unveils the empirical findings of the study and the final section concludes.

2. Literature Review

The concept IC still has various unattended and complicated issues related to conceptualizing, defining and measuring (Ståhle et al., 2011). Initially, there had been debates amongst interested parties on what had to be recognized as IC. As a result, an array of definitions for IC has been reported in IC literature since the beginning of its research in the early 1980s (Goh, 2005) and no clear definition for IC is in existence in the literature (Marr & Mustaghfir, 2005). Hence, we adopt 'knowledge related intangible assets which generate competitive advantage and superior performance to organization' as the definition for IC in the current study, having highlighted commonalities among wide range of available definitions. Further, we refer human capital, structural capital and relationship capital as components of

IC in this study as Bontis (1998), Chen et al. (2005), Tayles et al. (2007) and Ståhle et al. (2011) emphasized that these components have gained a broad agreement on what constitute IC. Similar to an orthodox definition for IC, finding an appropriate measure for IC is still difficult. According to Chen et al. (2005) and Tan et al. (2007) IC measures are still in the exploratory stage and an appropriate measuring approach or coherent measurement theory for IC has not evolved yet. Therefore, the value added intellectual coefficient (VAIC^{TM}) method [1] is selected to measure IC owing to various favourable arguments available to it as the most appropriate method to measure IC (see Pulic, 2000; Chen et al., 2005; Shiu, 2006; Tan et al., 2007; Yalama & Coskun, 2007; Chan, 2009; Joshi et al., 2010; Zéghal & Maaloul 2010; Chu et al., 2011; Maditinos et al., 2011; Pal & Soriya, 2012).

Review of prior studies that attempted to establish the association between IC and corporate performance sets the platform for this study. Notably, the amount of studies that used traditional financial measures to measure firm performance are higher than studies that adopted any other performance indicators. Studies that used traditional financial measures mostly reported a positive impact of IC on firm performance (i.e. Chen et al., 2005; Tan et al., 2007; Yalama & Coskun, 2007; Zéghal & Maaloul, 2010; Chu et al., 2011). More specifically, such studies provide evidence on the association of IC with productivity and profitability. Productivity was measured using asset turnover ratio (ATO) (see Chan, 2009; Chu et al., 2011; Pal & Soriya, 2012) and empirical results of these studies are mixed. Chen et al. (2005) and Tan et al. (2007) reported a positive association and Chu et al. (2011) a negative association between IC and productivity. Profitability was measured using return on assets (ROA) and return on equity (ROE). Chan (2009), Zéghal and Maaloul (2010), Chu et al. (2011), Pal and Soriya (2012) and Alipour (2012) used ROA to measure profitability while Tan et al. (2007), Chan (2009), Chu et al. (2011), Maditinos et al. (2011) and Pal and Soriya, (2012) used ROE. Among the above studies, Chan (2009) and Maditinos (2011) reported a negative association between IC and profitability in contrast to positive relationship in the remaining studies.

Apart from studies focused on the association between IC and performance measures which are in the interest of general stakeholders, attempts were made to provide evidence on associations that are more useful for external investors. Literature on such associations reveals that market-to-book value ratio (MB) has been used as the proxy measure for market valuation (i.e. Chen et al., 2005; Zéghal & Maaloul, 2010; Chu et al., 2011; Maditinos et al., 2011; Ståhle et al., 2011; Pal & Soriya, 2012; Mehralian et al., 2012). In addition, Tan et al. (2007) provide empirical evidence on the relationship between IC with annual share return and earnings per share. Appuhami (2007) attempted to provide evidence on the impact of IC on capital gains of investors. The key feature of the findings of their studies, which used MB to establish the association between IC and market valuation, is failure to establish a conclusive relationship in almost all attempts. For example, Zéghal and Maaloul, (2010), Chu et al. (2011), Maditinos et al. (2011), Ståhle et al. (2011) and Pal and Soriya (2012) provide inconclusive evidence on the association between IC and market valuation. In contrast to the above inconclusive evidence, Chen et al. (2005) found a positive relationship between IC and MB in Taiwanese context, whereas, Mehralian et al. (2012) recently reported a significantly negative association between IC and market value of selected Iranian firms.

Looking at the empirical findings of studies cited above from the perspective of an external investor highlights a number of limitations on what extent the available evidence provides information on the value relevance of IC to judge the role of IC in creating value for external investors. The unavailability of studies that tested the impact of IC beyond market valuation, holding period return, earnings per share and capital gain of stocks can be highlighted as a key limitation. Having reported inconclusive associations between IC and contemporaneous MB, no attempts were made thus far to test whether there is a delayed reaction from investors on IC can be identified as another drawback in the IC literature. Undoubtedly, the associations of IC with firm performance measured using traditional accounting ratios have important informational conveyance about how managers use IC resources to improve productivity and profitability of the firm. Chen et al. (2005) stated that ROE is generally an important financial indicator for investors. However, establishing additional relationships by introducing performance indicators that more specifically assist investors would address the issue of lack of evidence on value relevance of IC to investors. In addition, as highlighted earlier, the failure in almost all studies that attempted to estimate the relationship of IC with MB and holding period return also reveal the necessity of introducing alternative models with different stock performance indicators. Further, the proposition of whether IC has delayed response would also become important to research as the IC investments are intangible in nature and mostly own uncertain benefits with a potential time lag.

3. Methodology

3.1 Sample and Data

Listed banking sector firms in the NYSE are initially selected to represent the sample of the study. However, data of some companies have been omitted because they are not fulfilling the sampling requirements of the study. Under such requirements, companies should have held their listing status throughout first quarter of 2000 to second quarter of 2011 and should have published financial statements. In line with these requirements, 58 firms have been excluded from the sample and 191 retained. Data is extracted from published quarterly financial statements and Table 1 provides summary statistics of variables used in developing regression models in the succeeding sub-section of the paper.

Table 1
Summary statistics

Year	VAIN		VACA		MKTCAP ($mn)		EPS		MB		R		ER		P	
	Mean	Med.	Mean	Med.	Mean	Med.	Mean	Med.	Mean	Med.	Mean	Med.	Mean	Med.	Mean	Med.
2000	5.91	5.48	0.018	0.018	401.8	94.4	0.414	0.255	1.465	1.296	0.062	0.062	-0.04	-0.052	18.17	11.02
2001	5.90	5.39	0.020	0.018	511.3	118.2	0.450	0.279	1.607	1.424	0.062	0.060	-0.05	-0.051	21.42	12.77
2002	4.90	4.58	0.015	0.015	600.1	155.5	0.542	0.322	1.838	1.629	0.061	0.060	-0.05	-0.052	26.63	15.93
2003	4.46	4.20	0.014	0.014	633.5	194.3	0.613	0.356	1.916	1.789	0.057	0.054	-0.05	-0.053	30.96	18.59
2004	4.26	4.04	0.013	0.013	731.4	241.9	0.662	0.375	2.096	1.909	0.061	0.058	-0.05	-0.057	40.51	22.93
2005	4.57	4.28	0.014	0.014	725.7	265.6	0.716	0.401	1.976	1.851	0.091	0.087	-0.09	-0.083	43.92	24.13
2006	5.05	4.78	0.016	0.015	779.7	289.8	0.758	0.410	1.949	1.830	0.095	0.093	-0.09	-0.086	47.04	24.53
2007	5.03	4.75	0.011	0.016	703.1	234.4	0.659	0.376	1.624	1.536	0.096	0.092	-0.09	-0.087	46.12	24.04
2008	4.08	4.00	0.011	0.013	520.6	168.7	-0.74	0.269	1.192	1.085	0.107	0.095	-0.09	-0.09	29.20	18.17
2009	2.81	3.11	0.007	0.010	387.8	110.8	-1.78	0.142	0.788	0.665	0.122	0.104	-0.11	-0.10	17.54	12.69
2010	2.26	2.90	0.008	0.009	531.6	140.0	-0.24	0.18	0.857	0.805	0.128	0.105	-0.12	-0.10	15.10	11.92
2011	2.85	2.85	0.008	0.009	582.9	160.2	0.184	0.214	0.864	0.895	0.108	0.089	-0.10	-0.09	16.01	13.08

Note: Statistics are calculated for 764 observations during 2000 to 2010 and 382 in 2011.

A steady decline in VAIN [1] (intellectual capital efficiency), the proxy measure for IC in the study, and VACA [1] (physical capital efficiency) levels, approximately by 50%, across the sample period can be highlighted as a key reflection in the table. Inability of both tangible and intangible resources to increase the value addition of the firm in consequent to revenue declines especially during the subprime mortgage crisis and its recovery stage could be stated as the most possible reason behind the above declines. The mean values for VAIN in the table are higher than its median values until 2008, indicating that the sample firms consist of a small number of very large IC values. Parallel to increasing the magnitude of the average IC value decline in 2009, effects of the subprime mortgage crisis in the US economy may have created a discrepancy in the IC level among firms since 2009. In this respect, an alteration in the pattern of previously identified less number of firms with very large IC values is revealed in higher medians for IC in 2009 and 2010.

The steady increase in the market capitalization (MKTCAP) of the sample firms until 2006 has overturned in 2007 as a result of share price collapse began in the brink of the subprime mortgage crisis. The average MKTCAP however started to increase in 2010 as the crisis effects are easing out. Moreover, the mean values of MKTCAP in all financial years are substantially higher than its median values. This is an indication for less number of firms with relatively very large market capitalization. Distribution of balance sheet leverage ratio [2] is almost consistent with a value around 11.25 across years (not tabulated). Similarly, the behaviour of firm productivity (ATO) is also steady with equal mean and median values (approximately 0.18) throughout the sample period (not tabulated). Collapse of revenue began in 2007 has caused a profitability decline in the sample firms and most of the firms had reported heavy losses during the crisis period. A drastic turnaround of earnings per share (EPS) in 2008 and which prevailed in subsequent financial years is a clear evident for the diminution in available profits to owners of the firm. The financial imbalance measured through credit to deposit (CD) ratio (not tabulated) is behaved with relatively equal means and median values (around 0.85), and a discernible trend for the behaviour of the variable cannot be spotted during the sample period. Further, the ratio indicates that deposit volume of selected firms is also higher, in average, than loans granted to customers.

Non-diversifiable risk (Beta) of the sample firms has increased (mean value is approximately 0.50 until 2004 and 0.90 thenceforth) over the sample period (not tabulated). Simultaneously, expected stock returns (R) of the firms holds a similar pattern thus conforming to theoretical expectation of higher risks results higher returns. The increase in average R caused a decline in excess returns (ER) of the firms as reflected in average values of ER measured through the Jensen measure. Reported ER in Table 1 is negative throughout and also increases the degree of the negative mean values since 2005. This pattern further indicates that the sample firms, in average, generated 5% less returns until 2005 and approximately 10% less in the rest of the years than what was expected under the risk level pertained in each financial year. Market valuation (MB) of the sample firms has improved until the middle of the sample period. Afterwards, the average MB has reportedly decreased in consequent to two most affiliated reasons. First, constant share price decreases in the latter phase of the sample period as evident in share price (P) column of Table 1. Equity reduction in the same period because of subsequent losses in conjunction to revenue deteriorations after 2007 can be stated as the second reason.

3.2 Hypotheses and Regression Models

We examine the value relevance of IC using two approaches. First, associate IC with market valuation, stock returns, excess returns and share prices. Second, examine predictive ability of IC with respect to subsequent values of above variables to ascertain whether the variables have delayed reactions to IC. Subsequently, we develop two hypotheses to test in this study, namely:

H1 IC relates positively with contemporaneous market valuation, stock returns, excess returns and share prices.

H2 Market valuation, stock returns, excess returns, and share prices have a delayed response to IC.

First model (panel regression) of our study estimates the association of IC with market valuation. As discussed in the literature review, this association has been tested in a number of previous studies in a way to assess the overall response of investors on IC. Having observed almost all studies reporting inconclusive evidence, we also attempt to establish the same association as the basic model for our sample as no evidence available for this context. Our effort to test the delayed response of market-to-book value ratio (MB) on IC would conclude whether the failure to establish a conclusive association between IC and market valuation was in consequent to delayed response on IC information. We use MB as a proxy measure for market valuation. However, we use MB in subsequent quarters considering the information delay as IC information flow to general public through financial statements. The model is expressed as:

$$MB_{i,t+n} = \alpha_{01} + \beta_{11}VAIN_{it} + \beta_{21}\Delta VAIN_{it} + \beta_{31}VACA_{it} + \beta_{41}Size_{it} + \beta_{51}Lev_{it} + \beta_{61}ATO_{it} + \beta_{71}Beta_{it} + \beta_{81}CD_{it} + \varepsilon_{it} \quad (1)$$

Where, MB of subsequent quarter (t+1) is used to establish the initial association and MB of eleven subsequent quarters is used to test the delayed response. The main outcome of applying the VAIC^{TM} method [1] to data of the sample, intellectual capital efficiency (VAIN), is the proxy measure for IC of the firm. Quarterly change in intellectual capital (ΔVAIN) and efficiency of physical capital VACA [1] computed through the VAIC^{TM} method are among the control factors of the equation (1). Natural logarithm of market capitalization denominates the firm size; balance sheet leverage ratio [2] in D'Hulster (2009) is used to measure the firm leverage; Assets turnover ratio (ATO) is the proxy measure for productivity; Earnings per share (EPS) measures the profit allocation for shareholders; firm beta controls the systematic risk of the firm; and credit to deposit ratio (CD) accounts for build-up financial imbalance of banks.

We expect β_{11}, β_{21} and β_{31} to be positive but β_{31} higher than β_{11}. Our reasoning is that physical assets are still dominating in the asset base of organizations though intangibles are increasingly becoming important. β_{41}, β_{61} and β_{71} are expected to be positive and remaining coefficients in the model to become negative as they explain the firm leverage, risk and financial imbalance.

Expression (1) provides an overall assessment on the value relevance of IC. An association between IC and expected stock returns indicates the extent to which IC information is relevant to investors. We examine the following panel regression in this respect:

$$R_{i,t+n} = \alpha_{02} + \beta_{12}VAIN_{it} + \beta_{22}\Delta VAIN_{it} + \beta_{32}VACA_{it} + \beta_{42}Size_{it} + \beta_{52}Mom_{it} + \beta_{62}Beta_{it} + \varepsilon_{it} \quad (2)$$

Where, $R_{i,t+n}$ is expected quarterly stock return computed using Capital Asset Pricing Model (CAPM). Return expected in the subsequent quarter (t+1) is used to estimate the intended association, and expected returns of eleven subsequent quarters to examine the delayed response. Expected signs and computations for VAIN, ΔVAIN and VACA remain same as in equation (1). In addition, we include MB, beta and recent return to control size, risk and momentum of returns, respectively.

Das and Teng (2000) stated that resources with characteristics of firm-specific and imperfect mobility or inimitability enable a firm to form a heterogeneous resource base. Furthermore, the heterogeneity of resources of a firm acts as a source of competitive advantage which then leads to report above normal returns to the firm (Das & Teng, 2000). IC has been identified as a strategically important resource and, thus, proved the criteria that prerequisite to gain the heterogeneous status. IC can also be identified as a resource which gives competitive advantage and above normal returns to the firm. Therefore, we replace excess returns in the place of dependent variable of equation (2) and construct the following regression to estimate the association between IC and excess return.

$$ER_{i,t+n} = \alpha_{03} + \beta_{13}VAIN_{it} + \beta_{23}\Delta VAIN_{it} + \beta_{33}VACA_{it} + \beta_{43}Size_{it} + \beta_{53}Mom_{it} + \beta_{63}EPS_{it} + \beta_{73}Beta_{it} + \varepsilon_{it} \quad (3)$$

We use Jensen's Measure to calculate excess return (ER) and ER of the subsequent quarter to explain the association for contemporaneous data. Future returns up to eleven subsequent ER are used to test the delayed reaction on IC.

To provide more evidence on value relevance (in the association sense) of IC we use the following regression:

$$P_{i,t+n} = \alpha_{04} + \beta_{14}VAIN_{it} + \beta_{24}\Delta VAIN_{it} + \beta_{34}VACA_{it} + \beta_{44}Size_{it} + \beta_{54}EPS_{it} + \beta_{64}Beta_{it} + \beta_{74}CD_{it} + \varepsilon_{it} \quad (4)$$

Where, stock price (P) of three months after the quarter-end represents the dependant variable and P of subsequent eleven quarters used to assess the delayed reaction. Natural logarithm of firm's total assets represents the size variable of the model.

4. Findings

Table 2 presents regression results of all models developed to estimate the value relevance of IC to investors using contemporaneous data, and Figure 1 illustrates coefficients and *t*-values of VAIN in model 1 – 4 for each of the eleven quarters following quarter *t*.

Table 2
Regression estimates *(t-value in parentheses)*

Panel A

Model 1: $MB_{i,t+1} = \alpha_{01} + \beta_{11}VAIN_{it} + \beta_{21}\Delta VAIN_{it} + \beta_{31}VACA_{it} + \beta_{41}Size_{it} + \beta_{51}Lev_{it} + \beta_{61}ATO_{it} + \beta_{71}Beta_{it} + \beta_{81}CD_{it} + \varepsilon_{it}$

Dependent variable	β_{11}	β_{21}	β_{31}	β_{41}	β_{51}	β_{61}	β_{71}	β_{81}	Adjusted R^2
Market valuation	-0.002	-0.0007	0.297	0.44	-7.69	63.32	-0.149	-0.10	0.74
	(-0.950)	(-0.448)	(3.283)	(15.83)	(-12.00)	(11.37)	(-5.35)	(-3.66)	

Panel B

Model 2: $R_{i,t+1} = \alpha_{02} + \beta_{12}VAIN_{it} + \beta_{22}\Delta VAIN_{it} + \beta_{32}VACA_{it} + \beta_{42}Size_{it} + \beta_{52}Mom_{it} + \beta_{62}Beta_{it} + \varepsilon_{it}$

Dependent variable	β_{12}	β_{22}	β_{32}	β_{42}	β_{52}	β_{62}	Adjusted R^2
Stock return	-1.29	-0.006	-0.17	-0.35	0.489	5.96	0.87
	(-0.19)	(-0.405)	(-2.411)	(-3.56)	(4.11)	(4.20)	

Panel C

Model 3: $ER_{i,t+1} = \alpha_{03} + \beta_{13}VAIN_{it} + \beta_{23}\Delta VAIN_{it} + \beta_{33}VACA_{it} + \beta_{43}Size_{it} + \beta_{53}Mom_{it} + \beta_{63}EPS_{it} + \beta_{73}Beta_{it} + \varepsilon_{it}$

Dependent variable	β_{13}	β_{23}	β_{33}	β_{43}	β_{53}	β_{63}	β_{73}	Adjusted R^2
Excess return	0.127	-0.026	0.24	0.45	0.21	0.02	-9.14	0.72
	(1.54)	(-0.84)	(3.07)	(2.49)	(4.40)	(2.24)	(-8.36)	

Panel D

Model 4: $P_{i,t+1} = \alpha_{04} + \beta_{14}VAIN_{it} + \beta_{24}\Delta VAIN_{it} + \beta_{34}VACA_{it} + \beta_{44}Size_{it} + \beta_{54}EPS_{it} + \beta_{64}Beta_{it} + \beta_{74}CD_{it} + \varepsilon_{it}$

Dependent variable	β_{14}	β_{24}	β_{34}	β_{44}	β_{54}	β_{64}	β_{74}	Adjusted R^2
Stock price	0.03	-0.25	0.83	17.90	1.80	-13.82	-3.05	0.68
	(0.174)	(-0.904)	(3.13)	(8.69)	(3.15)	(-2.95)	(-2.53)	

Notes: Regression results in Panel A, Panel B, and Panel C are based on 8213 observations. Panel D results are based on 8404 observations. Lower correlations between explanatory variables confirmed the absence of multicollinearity issue. Estimations are drawn for balanced panel using fixed effects models. Selection of fixed effects models is based on Hausman Specification Test (Hausman, 1978) and reported *t*-values are based on White (1980) standard errors.

Figure 1
Coefficients and *t*-values of VAIN in model 1- 4 on subsequent quarterly data

Figure 1A: Market valuation (Model 1)

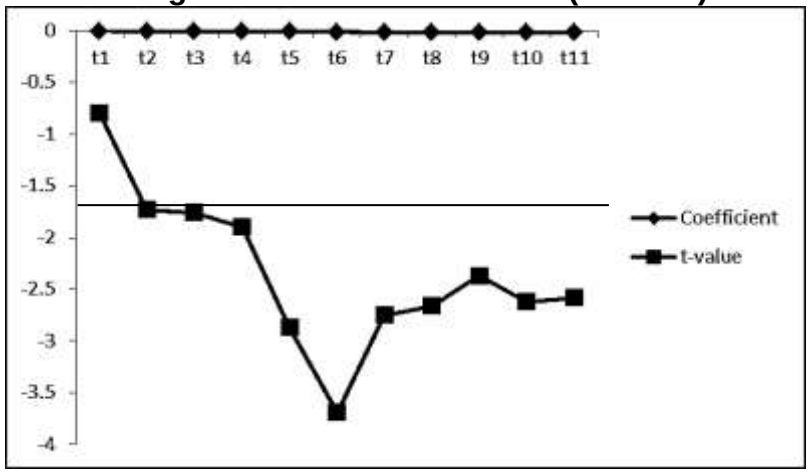


Figure 1B: Stock returns (Model 2)

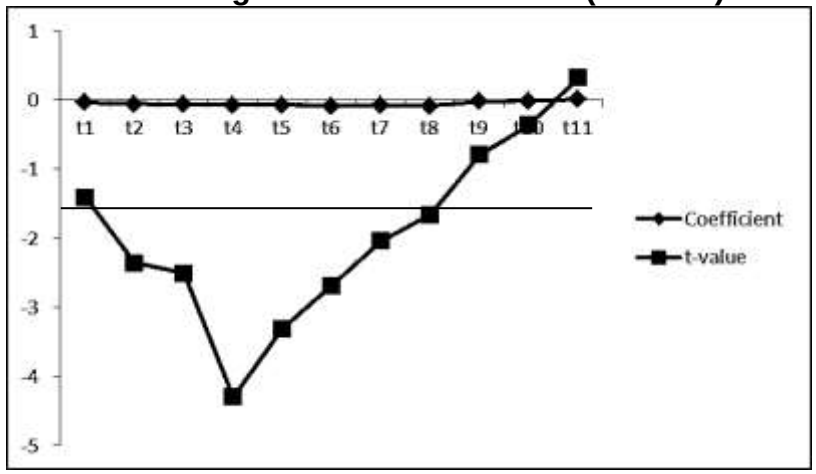


Figure 1C: Excess returns (Model 3)

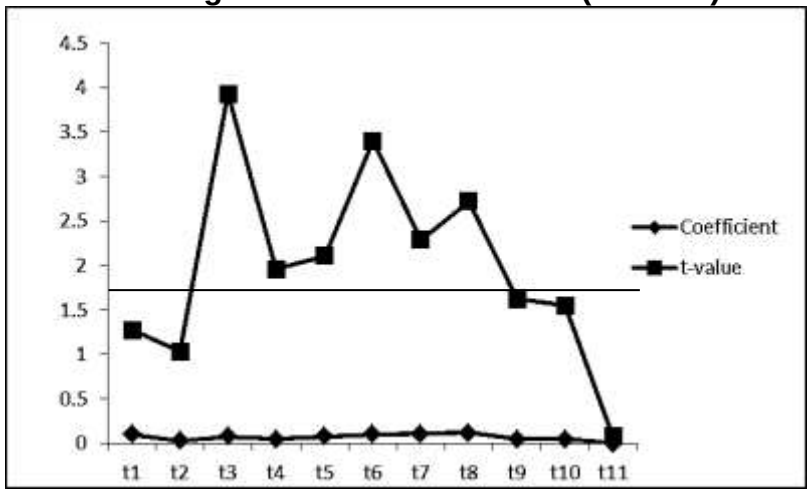
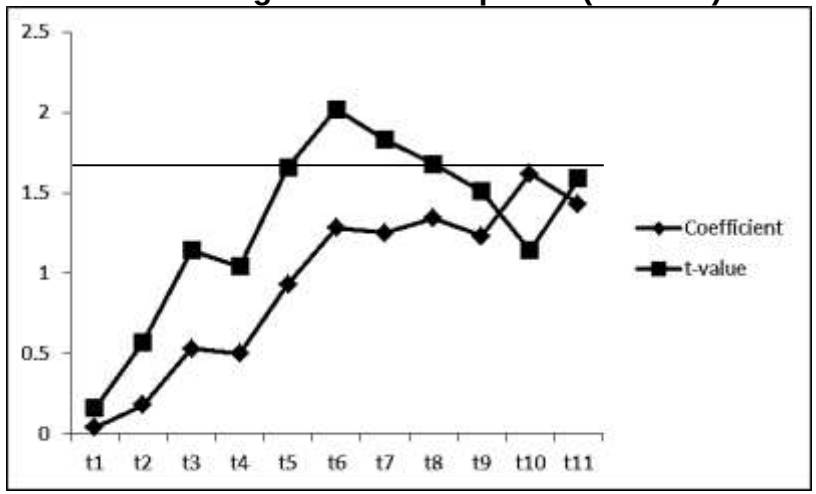


Figure1D: Stock prices (Model 4)



Coefficients for IC (VAIN) and change in IC (ΔVAIN) in panel A of Table 2 do not have expected signs and not statistically significant. Hence, model 1 provides inconclusive evidence on the projected positive association between IC and market valuation. The finding supports the previously highlighted observation that the failure of extant IC literature (i.e. Zéghal & Maaloul, 2010; Chu et al., 2011; Maditinos et al., 2011; Ståhle et al., 2011; Pal & Soriya, 2012) to provide a conclusive relationship between contemporaneous IC and MB of the firm. All other variables in the model namely VACA, firm size (size), firm leverage (Lev), productivity (ATO), risk (beta) and financial imbalance (CD) show expected signs and they are highly statistically significant. Figure 1A exhibits significantly negative associations between IC and future market valuations starting from t+2.

Estimates of (2) are reported in panel B in the table. Similar to model 1, VAIN and ΔVAIN in panel B do not possess the expected signs and not statistically significant too. In addition, VACA reported a significantly negative association with stock returns and that also in contrast to our expectations. In reasoning out this unexpected association, the steady decline in VACA over the study period (50% decline by 2011 from its initial value in 2000) and substantial increase in returns especially in crisis recovery stage (2009 onwards) may stand as forefront reasons. The size (MB), risk (Beta) and recent returns (price momentum) testified significant associations with expected directions. Graphical representation of coefficients and their statistical significance of VAIN in model 2 in the delayed reaction analysis depicts (Figure 1B) a statistically significant negative association between IC and stock returns during two quarters following t and eight quarters following t. Panel C provides another inconclusive evidence for the value relevance of IC. The VAIN coefficient reports a positive and expected sign in model 3 though it statistically insignificant. ΔVAIN does not report the expected sign (insignificant as well) and all other control factors appeared as expected. Figure 1C to elaborate the relationship between IC and future returns reveal the ability of IC to generate excess returns during t+3 and t+8. Panel D of Table 2 presents estimates of model 4, which attempted to provide value relevance of IC by selecting stock price as dependent variable. Coefficients for VAIN, VACA, firm size (natural logarithm of total assets), earnings for shareholders (EPS), risk (beta), and CD (financial imbalance) reported with expected signs and statistically significant (expect for VAIN). Coefficient for ΔVAIN is negative and not significant. The coefficients and *t*-values for the relationship of IC with stock prices in subsequent quarters (in Figure 1D) provide evidence for IC is related positively during t+5 and t+8. Moreover, the coefficients of VAIN have increased parallel to the increase in *t*-values of model 4 over the subsequent quarters.

The results presented above do not provide supportive evidence for the first hypothesis of the study, which expects a positive association between IC with contemporaneous market valuation, stock returns, excess returns and share prices. In contrary, the estimates of IC with future market valuation, stock returns, excess returns and share prices supports H_2 and hence we conclude that selected performance indicators have a delayed reaction on IC. More specifically, contemporaneous IC relates significantly negatively with market valuation (from t+2 onwards) and stock returns (during t+2 and t+8); and significantly positively with excess returns (during t+3 and t+8) and stock price (during t+5 and t+8).

5. Conclusion

This study attempted to provide evidence on the value relevance of IC to investors. Our analysis on contemporaneous data failed to establish conclusive associations between IC and selected stock performance indicators. However, associations between IC and future data of selected stock performance indicators provide important information on the value relevance of IC. Reported delayed responses on IC information in this study are relatively quick (2-3 quarters) and sustain for minimum eight subsequent quarters. Probable cause for delayed response patterns identified in the study could be because investors perceive IC as firm-specific risk related investments that accounts for uncertain future benefits. This reflects in the negative association of IC with market valuation. Investor preference on the lowering firm's IC investments is further reflected in negative association of IC with future stock returns and positive association with future excess returns. The reported association between IC and future stock prices further implies the cautiousness of investor response on IC as this association stands as the most delayed, least sustained as significant and explained with a relatively low level of significance compared to other estimates.

This study is not without its limitations. First, we used VAIC^{TM} as the proxy measure for IC considering it as the widely used measure for IC and the study has not attempted to provide extended analyses by replicating alternative measures for IC. Second, a comparative analysis using traditional financial measures (especially for the delayed reaction) would provide additional evidence. Finally, a replication study for firms with different characteristics in the same sample, different industries and contexts would enhance the validity of the current study.

Endnotes

1. Key steps to compute VAIC^{TM} .
   VA = Wages and salaries + Interest paid + Depreciation + Tax paid + Dividend paid + Retained earnings.
   CA = Capital employed = Shareholders' fund – Deferred expenses.
   HU = Human capital = Total staff cost.
   SC = Structural capital = VA – HU (VAIC^{TM} model assumes that there is a reversal association between HU and SC).
   VACA (Value creation efficiency of physical capital) = VA/ CA.
   VAHU (Value creation efficiency of human capital) = VA/ HU.
   STVA (Value creation efficiency of structural capital) = SC/ VA.
   VAIN (Intellectual capital efficiency) = VAHU + STVA.
   VAIC^{TM} (Value added intellectual capital coefficient) = VACA + VAHU + STVA.

2. Balance sheet leverage ratio.
   Equity + Reserves – Intangible Assets = Tier 1 Capital
   Total Assets – Intangible Assets = Adjusted Assets
   Tier 1 capital / Adjusted Assets = Leverage Ratio

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