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Contingencies of intellectual capitals and financial capital on value creation: Moderation of business cycles

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Moderation of business cycles

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Abstract

Purpose – The purpose of this paper is to investigate the relationship among intellectual capital (IC), financial capital (FC), firm value (V), and value creation (VC) in different business cycles (BC) for the conduct of strategic management that will maintain stable values and further increase V.

Design/methodology/approach – This research cites ICs as "other information" to combine ICs and the Ohlson model. Information provided by various capitals is validated by multiple regression analysis. Multi-group analysis is performed to test whether the coefficient is moderated by BC.

Findings – Results indicate the significant information of ICs and FC, and the contingency perspective of BC. The value relevance of ICs is moderated by BC. Prosperity has more explanatory capacities, and recession ICs yield more incremental information.

Research limitations/implications – VC is influenced by both ICs and FC. Besides, the macroeconomic situation should also be considered in strategic management and VC management.

Practical implications – In addition to ICs and FC, the macroeconomic situation must be taken into account when conducting strategic management, valuation management, investment decision, or industrial policy.

Social implications – Results indicate a contingency of BC, which can be a reference for enterprises to create higher V, for investors to make appropriate investment, as well as for governments to formulate sound industrial policies.

Originality/value – This paper applies BC to explore the value relevance of ICs and FC, leverages two models to represent V and VC, and cites complete four aspects of IC as "other information" to combine ICs and Ohlson model.

Keywords Strategic management, Business cycle, Intellectual capital, Contingencies, Share prices, Value-based management

Paper type Research paper

1. Introduction

With changes in the business cycle (BC) phases and the rapid developments in information technology (IT), competition among firms has become varied and more complex than before. The instruments that corporations used to create value and maintain a competitive edge may be understood through the firm value (V) relevance of each capital. This study therefore explores the relationship of intellectual capital (IC),

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financial capital (FC), V, and value creation (VC) in different BC phases for the implementation of appropriate strategic management that will maintain stable values and further increase V.

In today's knowledge economy, the evaluation of capital markets on corporations is no longer limited to tangible production elements. IC, commonly referred to as intangible assets, has been recognized as a strong driver of performance and V (Wingren, 2004). Chase (1997) revealed that some companies define IC in terms of VC, whereas others in terms of value extraction. Edvinsson and Malone (1997) further classified IC into customer, process, innovation, and human capitals. Several studies on IC revealed that ICs are critical to firm VC (Drucker, 1997; Sullivan, 1999; Guthrie and Petty, 2000a; Guthrie, 2001; Chen *et al.*, 2005; Kristandl and Bontis, 2007; Dumay and Tull, 2007). Beck and Britzelmailer (2011) emphasized that creating shareholder value has become a corporate slogan and management anthem since the 1990s. Some approaches lack a number of essential components to deliver the best value potential for a corporation. Thus, new methods that consider value from the perspective of different stakeholders are needed.

Corporations mainly aim to maximize V, while shareholders expect managers to pursue the maximum wealth of shareholders that is reflected in the evaluation of the capital market by the corporation, known as the share price (P). The model developed by Ohlson (1995), which is renowned for its profound effect on accounting research in the 1990s, serves as the basis for other business valuations in the capital market. However, the empirical study of Ohlson (1995) has yet to yield clear research results with respect to "other information" (Amir and Lev, 1996; Stober, 1999; Trueman *et al.*, 2000). Naidenova and Oskolkova (2012) combined the IC theory with the concepts of value-based and resource-based management to investigate the manner by which intellectual resources of firms transform into valuable resources. This study therefore explores the V relevance of FC and each IC from the value-based management perspective to develop a business valuation model that will help formulate appropriate IC and perform strategic management to maintain stability and increase V.

Over the years, Taiwan has emerged as the leading provider of IT products, and some products account for over half of the global device supply. Despite being a small island with only 22 million inhabitants, Taiwan has attained the status as the main IT supplier to the global market (Claros *et al.*, 2005). According to the Semiconductor Equipment and Materials International (SEMI, 2013), Taiwan is the largest equipment-spending region in the world in 2012. With the country's aggressive investments, Taiwan is expected to remain one of the top equipment spenders for 2013-2014. The experiences of Taiwan are relevant to countries that are still searching for a niche in the global economy and provide these countries with insights for exploring technology-intensive industries or certain areas with particular comparative advantage. The manner by which Taiwanese IT firms have succeeded in maintaining their competitive edge and attracting investments despite stiff international competition is worthy to be examined.

The effects of environment on corporate value are complex and multiple and are cross-disciplinary in nature. Corporate responses to environmental fluctuations can also be understood by the contingency fit between strategy and structural change. Therefore, this study applies the concept of BCs to explore the V relevance of IC and FC, which will serve as the main criterion for the strategic management of business VC. This study leverages two models to represent V and VC. Under the theoretical framework that V equals the sum of FC and non-FC (i.e. IC), the four aspects of IC are

considered (Edvinsson and Malone, 1997) as constituting "other information", and then the Ohlson model (FC) and IC are combined. This study not only examines the validity of the extended Ohlson model but also explores the value relevance of IC among different BC phases for the conduct of strategic management of VC. This research may serve as a reference for enterprises that seek to maintain a competitive edge in the global IT business, for investors who aim to make worthy investments, and for governments that must formulate appropriate policy decisions.

2. Literature review

2.1 IC

In today's knowledge economy, the evaluation of the capital market by corporations is no longer limited to tangible production elements. Edvinsson and Malone (1997) studied the Swedish corporation Skandia Insurance Company Ltd and produced the first public and most representative IC annual report to be published. The aspects of market value were divided into FC and IC, and a classification framework for IC was developed. IC was further classified into customer, process, innovation, and human capitals. Therefore, the measurement of value has five core aspects, namely, financial, customer, process, innovation, and human aspects. Financial focus, which represents real value, is the most tangible standard in measuring corporate value. Customer focus, which represents real wealth, is the key to corporate VC. Process focus, which represents real work, that is, the role played by the technical instruments of corporations as they support VC. Innovation focus, which represents real future, drives corporations to explore new areas and pursue long-term competitive advantages and continuous growth. Lastly, human focus, which represents real life, executes VC.

Literature on IC includes studies that are currently being conducted. The argument on the influence of IC on V has been supported by many studies (Chase, 1997; Drucker, 1997; Guthrie and Petty, 2000a; Guthrie, 2001; Wingren, 2004; Chen *et al.*, 2005; Kristandl and Bontis, 2007; Dumay and Tull, 2007; Liu *et al.*, 2009). These studies had endeavored to reveal the respective and overall scale of influence of IC on V to arrive at a managerial system for intangible assets (Bontis, 1998; Bontis *et al.*, 2000; Bosworth and Rogers, 2001; Sabri, 2005; Leitner, 2005; Ashton, 2005; Bose and Thomas, 2007; Liu *et al.*, 2009). Liu *et al.* (2009) explored the influence of IC on corporate value and VC and found that IC contains a considerable amount of incremental information in terms of corporate value and VC.

Bose and Thomas (2007) examined various methodologies that determine the value of IC and discovered the need for a new methodology based on underlying value drivers. This value driver valuation has the potential to broaden the understanding on the significance of IC in the knowledge economy. Beck and Britzelmailer (2011) mentioned that the creation of shareholder value has become a corporate slogan and management anthem since the 1990s. With the lack of essential components of some approaches in delivering the best value potential for a corporation, new methods that consider value from the perspective of different stakeholders must be identified. Naidenova and Oskolkova (2012) further combined the theory of IC with the concepts of value-based and resource-based management to investigate the manner by which intellectual resources of firms transform into valuable resources.

The previously mentioned studies on IC revealed that IC is critical to V. Thus, the classification framework of IC (Edvinsson and Malone, 1997), which has been cited broadly in previous research, is adopted in the present study. From the value-based management perspective, this study therefore explores the V relevance of FC and each

IC to develop a business valuation model that will help formulate appropriate IC and perform strategic management to maintain stable V and further create higher value.

2.2 BCs

BCs are also known as economic fluctuations. BC refers to a period of time, usually comprising several years during which general economic activities irregularly occur and recurring fluctuations are observed. The formations of BCs are complex and have multiple effects on a corporation. Schumpeter (1950) proposed the theory of innovation and attributed the fluctuation and destruction of economic equilibrium to business innovation. Kydland and Prescott (1990) proposed a real BC model and reported that random real shocks, primarily in technology and productivity, and transmission mechanism result in persistent fluctuations. Tseng *et al.* (2013) explored the relationships among IC, business strategy, and financial performance, and then observed that the relationships differ during pre- and post-financial crisis and that the effect of IC on financial performance depends on the status of the environment.

The environment-strategy-performance (ESP) framework (Tan and Litschert, 1994; Dobni and Luffman, 2000; Reklitis and Trivellas, 2002; Harrington *et al.*, 2004; Lee, 2010), which regards BCs as part of the environment and have corresponding effects, inspires the current authors to follow and propose the research framework on the relationships among BCs, IC, FC, and VC. Some corporations may incur financial distress, insolvency, or bankruptcy during economic depression, which does not occur under normal conditions. Hence, exploring the effects of BCs may help in understanding V relevance in the formulation of appropriate decisions.

Several scholars had confirmed the validity of the Ohlson model and the importance of IC on the value management of firms in recent years, but only a few studies had simultaneously explored BCs and V relevance of FC and IC in emerging high-tech companies. From the value-based management perspective and following the ESP framework, this study adopts the Ohlson model as a framework and integrates IC to explore the influences of BCs and the V relevance of FC and IC for the conduct of strategic management to maintain stability and increase V.

3. Methodology

3.1 Data sources and variables selection

Over the years, Taiwan has emerged as a leading producer of IT products. Thus, this study focuses on IT corporations listed in the Taiwan Stock Exchange. The research period covers 11 years, that is, from 2001 to 2011. Corporations with insufficient data or undergoing crisis were excluded, resulting in a total of 3,187 companies selected as samples. Data on the IT corporations were obtained from sources that include the *Taiwan Economic Journal*'s data bank, the Taiwan Patent Network, and prospectuses and annual reports of corporations.

For the measurement of the variables, this study used P and the difference between P and book value (BV), that is, P–BV as proxy variables for V and VC. P refers to V and the evaluation of the capital market on the prospective development potential of the corporation. P–BV represents the corporate VC and the values that cannot be listed in the book. BV and residual (excess) income (X^a), as measures of FC variables, explain the current P and P–BV, respectively.

Regarding the measures of IC variables, this study mainly follows the method by Edvinsson and Malone (1997) who classified IC into customer, process, innovation, and

human capitals. The present research also followed other scholars in adjusting the IC indicator and employing 14 IC proxy variables. The operational definitions of the variables are presented in Table I.

Edvinsson and Malone (1997) discussed the importance of the customer capital, and they cited customers as the "real wealth" that is the key to corporate VC. Chauvin and Hirschey (1993) mentioned the positive evaluation of companies with advertising expenses, while Edvinsson and Malone (1997) mentioned advertising investment. Sveiby (1997) and Dzinkowski (2000) cited the revenue growth indicator, while Van Buren (1999) and Dzinkowski (2000) emphasized on sales returned. Sveiby (1997) specified large-scale customers, while Guthrie and Petty (2000a) and Dumay and Tull (2007) indicated customers and customer relations. This paper has therefore selected marketing expense ratio (MRR), revenue growth rate (RGR), accepted ratio of products (ARP) and proportion of major customers (PMC) as customer capital variables.

Edvinsson and Malone (1997) explained that process capital represents "real work", that is, the role played by technical instruments of corporations in their support of VC. For them, "managerial expenses per employee" is an indicator for process capital. Meanwhile, Lim and Dallimore (2002) considered "administrative expenses per employee" as an indicator for related information on the exposure of intangible assets,

Constructs	Variables	Operational definitions
Firm value	P ($)	Share price of a closing quotation of common stock at the end of the period
Value creation	P–BV ($)	Share price of a closing quotation of common stock – book value of share common stock
Financial capital	BV ($)	Book value of share common stock at the end of the period
	X^{α} ($)	Current EPS – (share BV of the previous period × one-year deposit interest rate of the previous period of Taiwan Bank)
Customer capital	MRR (%)	Marketing expenses/net operating revenues
	RGR (%)	(Current revenues – revenues of the last period)/revenues of the last period
	ARP (%)	100 (sales returned and allowanced/net operating revenues) × 100
	PMC (%)	Accumulated proportion of major customers with sales over 10%
Process capital	EPE (log$1,000)	Log (fixed assets/total numbers of employees)
	MAR (%)	Managerial expenses/net operating revenues
	CAT (times)	Net operating revenues/current assets
Innovation capital	RDD (%)	R&D expenses/net operating revenues
	PAT (numbers)	Numbers of valid patents published in the current period
	YCE (years)	Years of corporation establishment
Human capital	RPE ($ millions)	Net operating revenues/total numbers of employees
	AED (1~3)	Employees are segmented into master or above, college, and high school or below, with the weight of 3, 2, 1 for each category to compute average education degree of employees
	EAY (years)	Employees' average years of working experience
	EAA (years)	Employees' average age

Table I. Operational definitions of variables

Notes: The data for financial performance were obtained from the *Taiwan Economic Journal*'s (*TEJ*) data bank. Meanwhile, the PAT was collected from the Taiwan Patent Network. Finally, PMC, AED, AY, and AA were collected from the prospectus and annual reports of corporations

while Bukh *et al.* (2001) mentioned "equipment per employee (EPE)". Stewart (1997) and Wang and Chang (2005) cited "current capital turnover rate" as an indicator, which refers to the capacity of businesses to generate net sales by the current capital. From the suggestions, the present study chose EPE, managerial expenses ratio (MAR), and current assets turnover rate (CAT) as process capital indicators.

Edvinsson and Malone (1997) stated that innovation represents the "real future" because with the aim to achieve innovation, corporations are driven to search for new ideas, pursue for long-term competitive advantages, and sustain growth. Chauvin and Hirschey (1993) highlighted the positive evaluation of companies with R&D expenses. Edvinsson and Malone (1997), Aboody and Lev (1998), and Bosworth and Rogers (2001) regarded "R&D density (RDD)" as an indicator for innovation. However, Edvinsson and Malone (1997), Lev and Sougiannis (1996), Dzinkowski (2000), Guthrie and Petty (2000a), and Bosworth and Rogers (2001) used "number of patents (PAT)" as indicator, while Sveiby (1997) used "years of corporation establishment (YCE)". Therefore, the current study selects RDD, PAT, and YCE as innovation capital variables.

According to Edvinsson and Malone (1997), the human capital is the "life" of organizations and is the "heart, wisdom, and soul" of the firm because all fields in the organization are operated by humans. An increase in the revenue per employee (RPE) means that the employees contribute to the corporation and enhance the corporate value. This effect is the reason behind the proposition of Sveiby (1997), Dzinkowski (2000), and Liu *et al.* (2009) on RPE as an indicator for human capital. By contrast, Edvinsson and Malone (1997) cited the "percentage of managers with high educational background" as an indicator for human capital, whereas Sveiby (1997), Guthrie and Petty (2000a b), and Dumay and Tull (2007) considered education. Employees' average years (EAY) of work experience and employees' average age (EAA) were regarded by Edvinsson and Malone (1997) as indicators. Service year is the indicator for human capital according to Sveiby (1997) and Dzinkowski (2000), while staff member's average years of work experience and average age of management and operational staff according to Lim and Dallimore (2002). This study therefore selects RPE, average education degree (AED) of employees, EAY, and EAA as indicators for human capital.

3.2 Empirical model

Ohlson (1995) combined the residual income valuation and linear information to arrive at the valuation model that is expressed as Equation (1). The model employs BV, X^a, and other information (v) to explain factors affecting the movement of P. Compared with other valuation models, the Ohlson model studies the accounting data cited in balance sheets and income statements, treats BV as the basis of fair V, predicts the future dividend based on accounting income, and provides a basis to test the reasonable P:

$$P_{it} = BV_{it} + \alpha_1 X^a_{it} + \alpha_2 v_{it} + \varepsilon_{it} \tag{1}$$

The validity of the Ohlson model has been explored and affirmed by many studies (Bernard, 1995; Penman and Sougiannis, 1998; Kristandl and Bontis, 2007). While Ohlson (1995) did not clearly define the "other information" in the model, some scholars strove to determine the content of this information (Amir and Lev, 1996; Stober, 1999; Trueman *et al.*, 2000). However, it is interesting to note that obtaining consistent data on "other information" under the Ohlson model remains elusive.

Considering the said premise, this study adopts the Ohlson model (1995) as its basic research model, with BV and X^a as "proxy variables" of FC. Given the theoretical framework that V is equal to the sum of IC and FC, the Ohlson model and IC are combined in this study. Each aspect of IC is integrated as proxy variables of "other information (v)" for examination of the influences of IC and FC on V. Given that most of the information is biased accounting, the model in which Ohlson had set BV as an intercept must be modified (Feltham and Ohlson, 1995). Thus, this study considers BV as independent variable and utilizes IC to acquire other information to arrive at the share price (P) model:

$$P_{it} = \alpha_0^* + \alpha_1^* BV_{it} + \alpha_2^* X_{it}^a + \alpha_3^* v_{it} + \varepsilon_{it} \quad (2)$$

The above equation represents the evaluation of capital markets on corporations, which is affected by BV, X^a, and IC (v). If Equation (1) is transposed and the intercept is added, the difference between P and BV (P–BV) can be acquired:

$$P_{it} - BV_{it} = \alpha_0 + \alpha_1 X_{it}^a + \alpha_2 v_{it} + \varepsilon_{it} \quad (3)$$

P refers to V and the evaluation of capital markets on the prospective development potential of the corporation. P–BV represents VC of the firm and the additional price willingly paid by shareholders as well as the value that cannot be recognized in the book. This paper analyzes both P (Equation (2)) and P–BV (Equation (3)) models to represent V and VC, respectively. The validity of the extended Ohlson model is not only examined but also the significant information on IC. The goal is to further understand V relevance of FC and each IC, which would serve as managerial criterion of IC and FC to maintain a stable and increasing V.

3.3 Hypotheses and conceptual framework

This study utilizes two models to represent V and VC and cites the complete four aspects of IC, referred to as "other information", for the integration of ICs and the Ohlson model. The samples are further split into three groups to determine existing relationships in BC phases. Descriptive statistical analysis and ANOVA are utilized to discover patterns in data. Information content provided by various capital sources are validated by multiple regression analysis. Multi-group analysis is performed to test whether the coefficient is moderated by the BC phases.

According to the extended Ohlson model, firm value (V; P) is determined by BV, residual income, and other information. The validity of the model has been confirmed by a number of researchers (Bernard, 1995; Penman and Sougiannis, 1998; Stober, 1999; Karathanassis and Spilioti, 2003; Kristandl and Bontis, 2007) whose findings propose *H1*, with the expectation that FC would disclose significant information for V and VC:

H1. FC reveals significant information for V and VC.

This research adopts the Ohlson model as a framework basis and combines it with IC to discuss the V relevance of FC and IC in Taiwan's IT industry. The argument on the influence of IC on V has been supported by many studies (Drucker, 1997; Guthrie and Petty, 2000a; Guthrie, 2001; Chen *et al.*, 2005; Kristandl and Bontis, 2007; Dumay and Tull, 2007). The validity of the Ohlson model has also been explored and affirmed by many studies (Bernard, 1995; Penman and Sougiannis, 1998; Karathanassis and Spilioti, 2003; Kristandl and Bontis, 2007). Under the framework that the creation of

V can be formed by FC and IC, the present paper therefore selects the variables from each aspect of IC as proxy variables of "other information". In the extended Ohlson model, the Ohlson model is combined with IC, expecting the involvements of ICs and then compared with FC to reveal significant information on V and VC. Thus, (*H2, H2a-H2d*) are proposed:

H2. ICs reveal significant information for V and VC.

H2a. Customer capital reveals significant information for V and VC.

H2b. Process capital reveals significant information for V and VC.

H2c. Innovation capital reveals significant information for V and VC.

H2d. Human capital reveals significant information for V and VC.

Considering that the capital market can respond and rapidly evaluate V, this study uses Taiwan's weighted stock index as proxy for BC in the further analysis. Regarding cluster classification, Kelly (1939) and Cureton (1957) studied the significance of the differences between sample clusters and found that values < 27 percent or > 73 percent have statistically significant meanings. Therefore, the quartile of the stock index is selected in this study as a basis for classification. That is, less than and equal to the first quartile as recession (expressed as B1 model), larger than the first quartile and less than the third percentile as stability (expressed as B2 model), and greater than or equal to the third quartile as prosperity (expressed as B3 model). The characteristics of a firm under three phases, namely, recession, stability, and prosperity, are also explored. Significant differences among the constructs among the phases are assumed to exist, and thus, (*H3*, *H3a-H3c*) are proposed:

H3. Significant differences exist in the constructs among BC phases.

H3a. Significant differences exist in V and VC among BC phases.

H3b. Significant differences exist in FC among BC phases.

H3c. Significant differences exist in ICs among BC phases.

Some scholars considered the environment-strategy fit as a key determinant of the performance of business (Tan and Litschert, 1994; Dobni and Luffman, 2000; Reklitis and Trivellas, 2002; Harrington *et al.*, 2004; Lee, 2010). This study adopts the perspective of the environment-strategy fit. The formation of FC and IC may be influenced by the BC phases, and BCs, in turn, have an influence on V and VC. Therefore, BCs have a role as moderator between IC (or FC) and V and VC. The V relevance of FC and IC may be influenced by the effect of BCs. Exploring the role of BCs may be helpful in understanding the V relevance of capitals for the formulation of appropriate IC and the conduct of strategic management. To understand the V relevance and the BC analysis of FC and IC, *H1, H2* and *H3* are examined in their application in the recession, stability, and prosperity phases, respectively. Moreover, the strategies for FC and IC are assumed

to vary among phases. To explore the contingency perspective of VC on BCs, *H4* and *H5* are proposed:

H4. The value relevance of FC is moderated by BCs.

H5. The value relevance of ICs is moderated by BCs.

Based on the *H4* and *H5*, the conceptual framework of this paper is developed as follows (Figure 1).

4. Empirical results

4.1 Descriptive statistics and BC analyses

The study explores the characteristics of a firm under three phases, namely, recession, stability, and prosperity phases of a BC. The results show that significant differences are observed in all the constructs explored among the BC phases. Many significant differences in the indexes of V, VC, FC, and ICs also exist (see Table II). Accordingly, *H3a-H3c* and *H3* are proven.

In the three phases of the BC, increases in P of V, P–BV of VC, BV and X^a of FC, PMC of customer capital, YCE of innovation capital, and EAA, AED, EAY, and RPE of human capital were observed. Therefore, V, VC, BV, and X^a of FC, accumulated PMC, YCE, EAA, AED, EAY of work experience, and per employee operating revenues of human capital increase in the BCs. By contrast, EPE of process capital decreases, while MRR of customer capital, MAR of process capital, RDD of innovation capital, and CAT of process capital decrease initially and then increase in the BCs. Meanwhile, the RGR of customer capital and PAT of innovation capital increased initially and then eventually decreased.

4.2 Multiple regression and multi-group analyses

This research used the P model and the P–BV model (extended model) to analyze V relevance of FC and IC, respectively. P refers to V, while P–BV represents VC. Both models have produced almost the same measurement indicators and empirical results, demonstrating that both corporation valuation models of the Taiwanese IT industry are suitable and capable of validating one another.

4.2.1 The extended Ohlson models are applicable to the Taiwanese IT industry. As shown in the results of the multiple regression analyses (Tables III and IV, panel A), all indices of FC, BV, and X^a of the models reveal significant correlation with P and P–BV, which means that BV and X^a are important and significant and that FCs comprise the

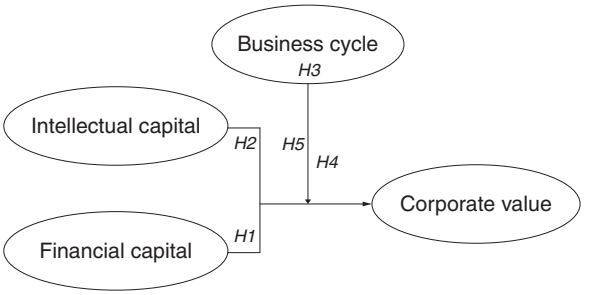

Figure 1.
Conceptual framework

Constructs	Variables	All samples Min.	Max.	Ave.	SD	Recession (B1) Ave.	SD	Stability (B2) Ave.	SD	Prosperity (B3) Ave.	SD	ANOVA *F*-value	*p*-value	Sig.
Firm value	P	0.48	900.00	41.21	56.69	33.03	41.33	39.39	55.05	50.20	67.16	21.24	0.00	***
Value creation	P–BV	−25.39	807.52	21.37	48.74	14.32	36.94	20.22	47.33	28.50	57.16	19.04	0.00	***
Financial capital	BV	0.26	169.12	19.84	11.79	18.71	9.02	19.17	11.43	21.70	13.82	18.22	0.00	***
	X^a	−18.55	72.27	1.99	4.18	1.30	3.40	2.07	4.40	2.41	4.32	15.69	0.00	***
Customer	MRR	0.00	444.31	4.59	9.21	4.71	4.89	4.32	4.60	4.90	15.02	1.21	0.30	
	RGR	−99.39	782.27	11.38	41.60	6.98	34.31	13.02	36.05	12.34	52.68	5.62	0.00	***
	ARP	−5.79	100.00	98.12	4.06	98.14	2.79	98.12	3.08	98.12	5.79	0.01	0.99	
	PMC	0.00	100.00	37.55	26.10	35.35	25.49	36.74	26.01	40.44	26.48	9.48	0.00	***
Process capital	EPE	0.28	4.91	3.17	0.47	3.21	0.45	3.17	0.45	3.13	0.49	5.58	0.00	***
	MAR	0.00	314.78	4.37	8.98	4.15	5.04	4.01	6.57	5.07	13.33	4.39	0.01	***
	CAT	0.08	17.23	1.93	1.07	1.94	1.12	1.91	1.04	1.94	1.08	0.30	0.74	
Innovation capital	RDD	0.00	80.34	4.24	5.46	4.33	5.59	4.06	5.17	4.44	5.76	1.58	0.21	
	PAT	0.00	1768.00	20.59	85.65	18.57	80.49	21.86	83.49	20.25	92.42	0.38	0.69	
	YCE	2.00	62.00	20.97	9.40	19.76	9.12	20.74	9.33	22.25	9.55	16.01	0.00	***
Human capital	EAA	20.80	49.00	33.86	3.13	33.13	3.04	33.63	3.12	34.76	3.01	68.07	0.00	***
	AED	1.00	3.00	1.85	0.33	1.80	0.33	1.84	0.32	1.90	0.33	21.28	0.00	***
	EAY	0.78	24.19	4.94	2.36	4.59	2.33	4.77	2.35	5.44	2.32	35.18	0.00	***
	RPE	−13.07	56.19	0.98	2.72	0.85	2.50	0.95	2.38	1.11	3.30	2.15	0.12	
Samples			3,187			756		1,448		983				

Notes: The significance of ANOVA represents that the variables used by cluster analysis indicate significant differences among various groups as well as the appropriateness of cluster analysis. ***Indicates that the significance level reaches 1 percent

Table II.
Descriptive statistics and business cycle analyses

Table III.
Regression analyses of the share price (P) models

Model variable		All samples Coef.	*t*-value	Sig.	Recession (B1) Coef.	*t*-value	Sig.	Stability (B2) Coef.	*t*-value	Sig.	Prosperity (B3) Coef.	*t*-value	Sig.
Panel A: financial capital													
Financial capital	BV	0.28	20.74	***	0.12	3.53	***	0.28	14.03	***	0.29	12.97	***
	X^a	0.62	45.50	***	0.66	19.66	***	0.63	31.55	***	0.64	28.34	***
Adj R^2 (%)			71.74			55.26			72.51			77.78	
F-value			4,044.36			467.27			1,909.04			1,719.34	
p-value			0.00			0.00			0.00			0.00	
Panel B: financial capital and intellectual capital													
Financial capital	BV	0.27	19.60	***	0.08	2.44	**	0.27	13.54	***	0.28	12.19	***
	X^a	0.63	42.96	***	0.60	15.94	***	0.63	28.69	***	0.66	28.63	***
Customer capital	MRR	−0.05	−3.49	***	−0.01	−0.59		−0.03	−1.71	*	−0.07	−2.62	***
	RGR	0.02	1.87	*	0.04	1.57		0.00	0.24		0.03	2.13	**
	ARP	−0.04	−3.57	***	−0.10	−4.28	***	−0.04	−3.23	**	−0.02	−1.21	
	PMC	0.03	2.64	***	−0.01	−0.49		0.02	1.36		0.04	2.60	***
Process capital	EPE	0.02	2.38	**	0.03	1.17		0.01	0.92		0.02	1.52	
	MAR	0.03	2.44	**	−0.01	−0.53		0.04	2.36	**	0.03	1.23	
	CAT	−0.02	−1.80	*	−0.05	−1.93	*	−0.01	−0.80		0.00	0.17	
Innovation capital	RDD	0.07	6.00	***	0.09	2.98	***	0.05	2.68	***	0.12	5.56	***
	PAT	0.01	1.55		0.05	2.06	**	0.03	1.94	*	−0.01	−0.37	
	YCE	−0.01	−1.15		−0.03	−1.04		−0.02	−0.92		−0.02	−0.91	
Human capital	EAA	−0.04	−2.43	**	−0.12	−3.19	***	−0.04	−1.56		−0.02	−0.74	
	AED	0.02	1.69	*	0.04	1.27		0.01	0.39		0.01	0.63	
	EAY	−0.02	−1.07		0.02	0.47		−0.02	−1.07		−0.02	−0.74	
	RPE	−0.01	−0.94		0.12	4.10	***	0.00	0.20		−0.05	−2.89	***
Adj R^2 (%)			73.27			60.29			73.60			79.76	
F-value			546.71			72.65			253.12			242.79	
p-value			0.00			0.00			0.00			0.00	

Notes: The author additionally performs diagnostics for multicollinearity by examining VIFs. The diagnostics shows that there is no VIF value >10. This means that there is no severe or serious multicollinearity. ***,**,*Significance reaches 1, 5, and 10 percent levels, respectively

Table IV.
Regression analyses of the P-BV models

model variable		All samples Coef.	*t*-value	Sig.	Recession (B1) Coef.	*t*-value	Sig.	Stability (B2) Coef.	*t*-value	Sig.	Prosperity (B3) Coef.	*t*-value	Sig.
Panel A: financial capital													
Financial capital	X^a	0.78	71.23	***	0.66	24.09	***	0.79	49.11	***	0.83	46.64	***
Adj R^2 (%)			61.42			43.42			62.49			68.89	
F-value			5073.96			580.30			2411.96			2175.05	
p-value			0.00			0.00			0.00			0.00	
Panel B: financial capital and intellectual capital													
Financial capital	X^a	0.78	62.16	***	0.56	16.88	***	0.78	41.48	***	0.83	42.71	***
Customer capital	MRR	−0.05	−3.52	***	−0.01	−0.40		−0.03	−1.73	*	−0.08	−2.67	***
	RGR	0.02	1.56		0.06	1.93	*	0.00	0.02		0.03	1.96	**
	ARP	−0.04	−3.64	***	−0.11	−4.01	***	−0.05	−3.25	***	−0.02	−1.23	
	PMC	0.03	3.02	***	−0.02	−0.73		0.03	1.51		0.05	3.01	***
Process capital	EPE	0.03	2.80	***	0.02	0.68		0.02	1.22		0.03	1.82	*
	MAR	0.04	2.33	**	−0.01	−0.47		0.04	2.20	**	0.04	1.20	
	CAT	−0.02	−1.96	**	−0.06	−1.94	*	−0.02	−0.92		0.00	−0.05	
Innovation capital	RDD	0.08	5.86	***	0.10	3.07	***	0.05	2.46	***	0.14	5.51	***
	PAT	0.02	2.09	**	0.05	1.68	*	0.04	2.32	**	0.00	0.11	
	YCE	−0.02	−1.18		−0.03	−1.01		−0.02	−0.83		−0.02	−1.10	
Human capital	EAA	−0.05	−2.77	***	−0.11	−2.65	***	−0.05	−1.75	*	−0.03	−1.05	
	AED	0.02	1.83	**	0.04	1.10		0.01	0.66		0.01	0.54	
	EAY	−0.01	−0.83		0.01	0.22		−0.02	−0.93		−0.01	−0.56	
	RPE	−0.01	−0.94		0.14	4.20	***	0.00	0.12		−0.06	−2.75	*
Adj R^2 (%)			63.64			49.16			64.05			71.81	
F-value			372.69			49.66			172.89			167.75	
p-value			0.00			0.00			0.00			0.00	

Notes: The author additionally performs diagnostics for multicollinearity by examining VIFs. The diagnostics shows that there is no VIF value > 10. This means that there is no severe or serious multicollinearity. ***,**,*Significance reaches 1, 5, and 10 percent levels, respectively

critical evaluation information in all BC phases. The extended Ohlson models are applicable to the Taiwanese IT industry, thereby supporting *H1* that FC reveals significant information for V and VC.

The *F*-values of the P model (Table III, panel A, all samples) and the P–BV model (Table IV, panel A, all samples) are 4,044.36 and 5,073.96 (when *p*-values are 0.00 and 0.00), which means that the model is suitable. Adj R^2-values of the two models are 71.74 and 61.42 percent, respectively. At 1 percent significance level, BV and X^a exhibit significant positive correlation with P and P–BV. All the P models (Table III, panel A) show that X^a and BV have significant positive correlation with P, and all P–BV model (Table IV, panel A) likewise show that X^a has significant positive correlation with P–BV. The results, therefore, support *H1*. BV has explanatory capacity for V, while X^a has explanatory capacity for V and VC. Moreover, FC reveals significant information for V and VC, which means that the residual income and BV of the financial statements reflect V and VC. The V relevance of FC is also illustrated by the results. FC serves as the important evaluation information. These research findings are consistent with the Ohlson model (1995).

4.2.2 ICs reveal significant information for V and VC. According to the results of the multiple regression analyses (Tables III and IV, panel B, all samples), the *F* and *p*-values of the models indicate the suitability of the model. The models also show that all ICs reveal at least one variable or all four variables, demonstrating significant correlation with P and P–BV. Therefore, all ICs are important and are critical evaluation information for V and VC in the Taiwanese IT industry. The involvements of ICs present significant information for V and VC. The results, therefore, support *H2a-H2d*, and *H2*.

Compared with the extended Ohlson models (Tables III and IV, panel A), the explanatory capacities of the models (Tables III and IV, panel B) increased after adding the "IC" variables. Adj R^2 of all samples on the P model (Table III, panel B) increased from 71.74 to 73.27 percent. Adj R^2 of all samples on the P–BV model (Table IV, panel B) increased from 61.42 to 63.64 percent.

Moreover, the results of the multiple regression analyses of all models (Tables III and IV, panel B) show that ICs reveal significant correlation with P and P–BV in all BC phases. Therefore, ICs influence V and VC. The four IC constructs separately indicate significant information for V and VC. The involvements of ICs present significant information for V and VC in the context of the Taiwanese IT industry.

4.2.3 The value relevance of FC is moderated by BCs. After applying the BC analyses method, the explanatory capacities are shown differ among phases (Tables III and IV, panel A). B2 and B3 (stability and prosperity) on the P model (Table III, panel A) have more explanatory capacities, whereas those of the explanatory capacity of B1 (recession) are low. The explanatory capacities of B2 and B3 on the P–BV model (Table IV, panel A) are higher than B1. Adj $R^2$of B3 (Prosperity) on the P model (Table III, panel A) increased from 71.74 (all samples) to 77.78 percent, which means that the explanatory capacity of the model has similarly increased. By contrast, Adj R^2 of B1 (recession) decreased to 55.26 percent. Adj R^2 of B3 (prosperity) on the P–BV model (Table IV, panel A) increased from 61.42 (all samples) to 68.89 percent, and then decreased to 43.42 percent.

The study further performed the multi-group analysis to test whether the coefficient is moderated by the BC phases or not. The results show that the coefficients of BV on P models are different and that the coefficients of X^a on the P and P–BV models are also different among BC phases.

According to the previously mentioned empirical results of the BC and multiple regression analyses, V, VC, and FC indices among recession, stability, and prosperity

phases significantly differ (Table II) and the V relevance of FC varies among phases. The results, therefore, support *H4*. The value relevance of FC is moderated by BCs.

4.2.4 The value relevance of ICs is moderated by BCs. The value relevance of ICs differs among BC phases. After adding the "IC" variables, regression analysis of the recession, stability, and prosperity phases (Tables III and IV, panel B) are performed. The model of prosperity (B3) reveals the largest explanatory capacity (79.76 and 71.81 percent) of P and P–BV by the ICs and FC constructs (Tables III and IV, panel B, B3), whereas the that of recession (B1) demonstrated the smallest explanatory capacity (60.29 and 49.16 percent) (Tables III and IV, panel B, B1).

The incremental explanatory capacities of ICs also vary among phases. The involvements of ICs can increase some explanatory capacities on the models of all samples and of the prosperity phase (Tables III and IV, panel B, all samples and B3). The involvement of ICs can increase the small explanatory capacities (Δ1.09 percent) in the stability phase (Tables III and IV, panel B, B2). Adj R^2 of B2 (stability) in the P model increased from 72.51 percent (Table III, panel A) to 73.60 percent (Table III, panel B). By contrast, more variables reveal significant correlation and the addition of ICs increased more explanatory capacities in the recession phase (Tables III and IV, panel B, B1). Adj R^2 of B1 (recession) on the P–BV model increased from 43.42 (Table IV, panel A) to 49.16 percent (Table IV, panel B). At low explanatory capacity of FC, the involvement of ICs has the most incremental information (Δ5.74 percent). If the firms intend to sustain V or to revolve around VC during the recession phase, the management and enrichment of ICs are of utmost importance.

The significance of IC variables therefore varies among phases. Four indices, namely, PMC of customer capital, EPE, and MAR and CAT of process capital are significant only in one phase of the BC (Table IV, panel B). By contrast, six indices, namely, MRR, RGR and ARP of customer capital, PAT of innovation capital, and EAA and RPE of human capital are significant in two BC phases and not significant in the other phase.

These empirical results of the BC and multiple regression analyses indicate the significant differences among the indices of V, VC, and ICs in the recession, stability, and prosperity phases (Table II) and that V relevance of ICs is different among phases (Tables III and IV). *H5* is subsequently proven. The value relevance of ICs is therefore moderated by the BCs.

5. Conclusion

This paper not only examines the validity of the Ohlson (1995) model, but also explores the information of each IC in terms of V and VC in different BC phases. Under the theoretical framework that V equals the sum of FC and a non-FC (i.e. IC), four aspects of IC (Edvinsson and Malone, 1997) are considered as constituting "other information", in combining the Ohlson model and IC. The P and P–BV models are used to analyze the V relevance and the strategies of ICs and FC. Both models produced consistent empirical results, which show that V and VC are influenced by both ICs and FC. In general, FC is the critical evaluation information, and the involvements of ICs have significant information for V and VC. The four IC constructs separately reveal significant information for V and VC.

Moreover, the results indicate the managerial contingency perspective of BCs. Significant differences in FC, IC, V, and VC in BC phases exist. The value relevance and variable significance of ICs and FC vary among BC phases in Taiwan's IT industry, as well as the explanatory capacities of FC and the incremental explanatory capacities of

ICs. Therefore, the strategies of ICs and FC differ among BC phases, with the value relevance of ICs and FC being moderated by the BCs.

Aside from ICs and FC, the macroeconomic situation must be considered for enterprises in the conduct of strategic management and valuation management. To maintain stability and increased V, corporations must formulate their strategies for ICs and FC based on the macro-economic situation. The prosperity models have more explanatory capacities than the other models, and the contributions of ICs to the recession models yield more incremental information. If the firms intend to sustain V or to revolve around VC during the recession phase, the management and enrichment of ICs must be accounted for.

The findings of this study can serve as a reference for investors in making more appropriate investment decisions. The value relevance and variable significance of ICs and FC vary among BC phases. Prosperity reveals the largest explanatory capacity, whereas recession reveals the smallest. The incremental explanatory capacities of ICs and the significance of variables also differ among phases. The involvement of ICs can increase small explanatory capacities on stability. By contrast, more variables reveal significant correlation and the addition of ICs can increase more explanatory capacities on recession.

The findings in this study can also serve as a reference for governments in formulating sound industrial development policies. If governments intend to mitigate bad economic fluctuations or to support good economic fluctuations, the management and enrichment of ICs must be considered. The value relevance of ICs is moderated by BCs. Prosperity models have more explanatory capacities, and ICs during the recession phase yield more incremental information.

We have described the specification and extraordinary of Taiwan's IT industry, but have not compared the said industry with traditional manufacturing, which is the limitation of this research and findings. We emphasize the extremely important of Taiwan's IT industry. It is of great worth to examine how Taiwan's IT firms have succeeded in maintaining their competitive edge and attracting investments despite stiff international competition. Aside from obtaining quantitative data, further studies can collect more qualitative data by conducting survey and questionnaire that will derive latent variables undisclosed by firm managers. Lastly, they can also classify the firms into two groups, namely, those that have their own brand and those that do not, and then compare the differences.

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