Impact of Nonfinancial Intellectual Capital Information on Investors: Evidence from Japan

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ABSTRACT

This study focuses on the impact of nonfinancial intellectual capital (IC) information on investor decisions. There are three types of IC—namely, human capital (HC), structural capital (SC), and relational capital (RC). IC is becoming an increasingly important resource for companies, and so IC information—besides that provided in financial statements—should play an important role in serving as complementary data. Japan is one of only a few countries to have introduced guidelines for the disclosure of IC information. Using the large amount of IC information available in Japan, we study the information provided in annual reports and standalone IC reports that adhere to these guidelines. The objective of this study is to determine whether the voluntary disclosure of IC had a material impact on the capital market and equity analysts between 2004 and 2006—and, if so, whether it was favorable for investors and managers. We found evidence that the use of all three categories of IC information leads to a lower cost of capital. These findings imply that all three types of IC information should be disclosed together in order to reduce information asymmetry.

Keywords: Intellectual Capital, Voluntary Disclosure, Cost of Equity Capital, Japan
JEL Classifications: M

1 Introduction

This study examines the impact of nonfinancial intellectual capital (IC)[1] information on investor decisions in the Japanese stock market. IC information is becoming an increasingly important business resource. IC information other than that given in financial statements should play an important role in serving as complementary information. In fact, a global framework for measuring and reporting

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[1] In this paper, the terms "intellectual capital (IC)," "intangibles," and "knowledge" are used interchangeably.

IC information has been discussed by the International Integrated Reporting Council (IIRC) (2013). Despite growing interest in this topic, however, there is a dearth of research on the impact of disclosing nonfinancial IC information. Consequently, what nonfinancial IC information should be disclosed and how to disclose it are actively discussed topics among accounting researchers.

The impact on investors of nonfinancial IC, corporate social responsibility (CSR), and environmental reports has been investigated worldwide. According to the results of previous studies, there are associations between the amount of voluntary disclosure and investor decisions (Aerts et al., 2008; Dhaliwal et al., 2011; Mangena et al., 2014). However, the precise combination of information that contributes to investor decision-making remains a mystery. IC, by definition, is intimately related to the expectation of future cash flows; therefore, focusing on the contents of IC disclosure is relevant to investor decision-making. By classifying IC information in line with accepted academic theory, this study contributes to discussions vis-à-vis an integrated reporting framework.

Japan is one of the few countries to have introduced guidelines for disclosing IC information. From the vast amount of IC information available,[2] given the scope of this study, we selected information from annual reports and standalone IC reports that adheres to these IC reporting guidelines.

We investigate whether the initiation of the voluntary disclosure of IC information from 2004–2006 had a significant impact on the capital markets and equity analysts in Japan, and whether the outcomes were favorable to investors and managers. Furthermore, we provide some evidence regarding the categories of IC information that contribute to reducing information asymmetry between managers and investors and also affect investor decision-making.

Based on the assumption that the IC information disclosed from 2004 to 2006 was not known to investors prior to the disclosure, we expect that the initiation of voluntary IC reporting would reduce information asymmetry between investors and managers. We also examine whether the content of the information matters. MERITUM (2002) classifies IC into three categories: human capital (HC), structural capital (SC), and relational capital (RC). In this context, we examine whether a company should disclose all three categories of IC information. The literature indicates that such disclosures lead to reduced information asymmetry and, consequently, a lower cost of equity capital.

We empirically test the hypotheses using an ordinary least squares regression. We use financial data from Thomson Reuters Data Stream and consensus analyst estimates from the International Financial Information Service (IFIS). Data regarding the content of disclosures were obtained from firms' annual reports and IC reports.

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[2]The available information referred to here includes not only annual reports, but also analyst reports, newspapers, magazines, TV news, and the transcripts of conference calls.

Our study findings provide sufficient but weak evidence that the disclosure of all three categories of IC information leads to a lower cost of equity capital. This finding implies that all categories of IC information should be disclosed simultaneously, in order to reduce information asymmetry.

The remainder of this paper is structured as follows. In section 2, we briefly discuss the concept of IC and its definition. In section 3, we discuss the introduction of the IC reporting practice in Japan, based on prior research. In section 4, we discuss the literature on Japanese IC reporting. In section 5, we describe in detail our research design. In section 6, we present the features of our sample data and the results of our regression analysis. In section 7, we interpret our results and discuss their implications and limitations.

2 Intellectual capital

In the mid-1990s, IC was identified as an increasingly important type of capital, both within and outside businesses (Roslender, 2009). Lev (2001) defines IC as follows.

> Assets are claims to future benefits, such as the rents generated by commercial property, interest payments derived from a bond, and cash flows from a production facility. An intangible asset is a claim to future benefit that does not have a physical or financial (a stock or a bond) embodiment…. Throughout this volume I use the terms intangibles, knowledge assets, and intellectual capital interchangeably. (p. 5)

Unfortunately, there are some confusing similarities among certain terms. Intangible assets such as patents, trademarks, copyrights, and brands were already subject to some accounting treatments in the pre-IC days (e.g., IAS No.9 and IAS No.38). Another term, intellectual property (IP), refers to a legally secure nonphysical claim (Lev, 2001). In this study, we consider both intangible assets and IP as subsets of IC.

We use the following taxonomy for the constituents of IC: HC, SC, and RC (Lynn, 1998; Mouritsen, 1998). This taxonomy has proved to be useful and prevailed over the last decade. HC is defined as the knowledge that employees take with them when they leave a firm (MERITUM, 2002). SC is defined as the knowledge that stays within the firm at the end of the working day (MERITUM, 2002). RC refers to all the resources linked to the firm's external relationships, including customers, suppliers, and research and development (R&D) partners (MERITUM, 2002).

The integrated reporting approach, recently applied, has introduced a different type of classification. For example, the IIRC (2013) classifies capital as financial capital, manufactured capital, IC, HC, social and relational capital, and natural capital; it also defines IC as comprising "organizational,

knowledge-based intangibles"—something akin to SC, as defined by MERITUM (2002). Thus, the definition of IC used in this paper incorporates IC, HC, social and relational capital, and natural capital, as per the IIRC (2013).

Although IC information can be found in financial reports, annual reports, and other media, this study focuses on nonfinancial IC information in either annual reports or standalone reports. Standalone reports include intellectual asset management reports and intellectual property reports. Since some of the terms used in practice are different from those used in academia, we interpret the terms in the reports in line with the above definitions.

3 Intellectual capital reporting practice in Japan

Since the mid-1990s, for many enterprises, intangibles have increasingly become the major foundation for value creation and delivery (Roslender, 2009). From the 1990s to the mid-2000s, globally, many researchers have studied IC measurement and reporting issues. While some researchers have discussed whether expenditures related to intangibles should be capitalized (Lev and Zarowin, 1999), others have argued that IC information should be disclosed as nonfinancial information (Edvinsson, 1997; MERITUM, 2002).

In 2002, the Japanese government published the Intellectual Property Policy Outline as the first step of a reform that aimed to revitalize the Japanese economy and make Japan a country based on intellectual assets. In the following year, in order to promote this policy, the government encouraged Japanese firms, universities, and other organizations to commence "intellectual asset-based management" (IABM). In 2004, to facilitate communication between markets and enterprises, the Japanese Ministry of Economy, Trade and Industry (METI) published its Reference Guideline for Intellectual Property Information Disclosure. Subsequently, in 2005, METI introduced the revised Guidelines for Disclosure of Intellectual Assets-Based Management.

According to these guidelines, the objectives of IC reporting are to promote among top management the provision to stakeholders, in a simplified manner, of information on business activities that produce sustainable profits and enhance corporate value, and to share a sense of value with them. The principle rules of IC reporting are summarized as follows:

1. Provide a corporate overview
2. Focus on future value creation
3. Highlight the prerequisites for future value creation
4. Simplify reporting for important stakeholders
5. Provide supplementary and complementary financial information
6. Provide supporting key performance indicators
7. Facilitate historical comparability
8. Explain current business activities on a consolidated basis

Yamauchi (2009) indicates that, between 2004 and 2007, 53 listed firms in Japan disclosed their IC information, in either an annual report or an IC report. Figure 1 shows the number of firms that initiated the disclosure of IC information over the 2004–2006 period, while following the guidelines published in 2004–2005. These data are available from Yamauchi (2009) and the Foundation of Intellectual Asset-Based Management website (http://www.jiam.or.jp/CCP013.html). Since we are interested in the market impact of IC disclosures, we focus in this study on listed firms. Figure 2 shows the breakdown, by industry, of the listed companies that disclosed IC information during the 2004–2006 period. Firms belonging to the electronics and chemical industries in Japan

Figure 1. Number of companies in Japan that initiated the disclosure of IC information in the annual/IC report (2004–2006).

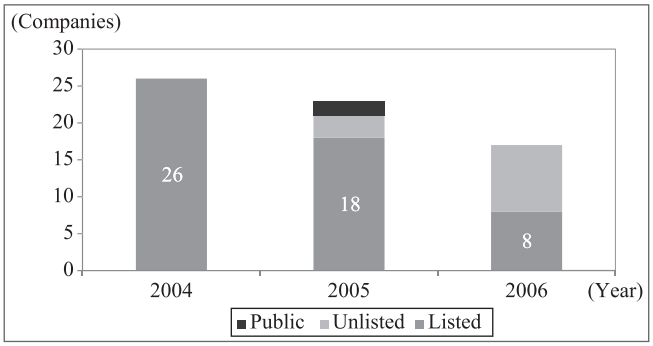


Figure 2. Breakdown of listed companies in Japan, by industry, that disclosed IC information (2004–2006).

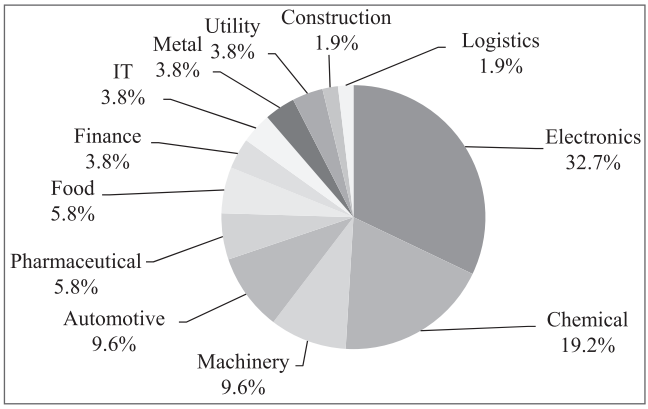
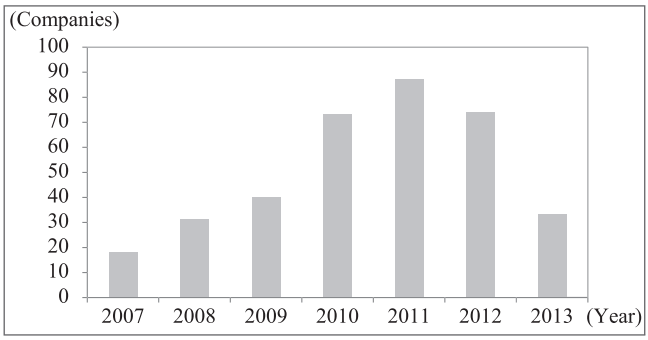


Figure 3. Number of unlisted companies in Japan that disclosed IC information in IC reports (2007–2013).



actively made disclosures during this period. Approximately 10% of all listed firms in Japan belong to these industries; thus, among the firms that actively made such disclosures, the proportions belonging to the electronics and chemical firms—32.7% and 19.2%, respectively—are significantly higher.

However, Koga et al. (2011) explain that there are two models for IC disclosure—namely, the standalone reporting model and the CSR integrated reporting model. They suggest that since small and medium enterprises (SMEs) do not have communication tools such as annual reports, CSR reports, or sustainability reports, they would likely choose the standalone reporting model. On the other hand, large companies that publish CSR reports tend to incorporate IC information into them (Koga et al., 2011). Thus, it can be expected that after 2005–2006, listed firms would choose to disclose IC information in their CSR or sustainability reports, rather than in standalone IC reports. Figure 3 illustrates the number of unlisted companies that disclosed IC information in IC reports. These data are obtained from the Foundation of Intellectual Asset-Based Management website. As expected from Koga et al. (2011), the number increased until 2011, but decreased after 2012. The reasons for this decrease are not yet clear; however, this issue is beyond the scope of this study, and could be examined in future research.

4 Literature review and research question

4.1 Research on Japanese IC practice

4.1.1 Guidelines content

Johanson et al. (2006) compare the Japanese Guideline for Intellectual Property Information Disclosure (GIPID) published in 2004 with two other guidelines—namely, MERITUM and the Danish Guideline for Intellectual Capital

Statements. They found four major challenges with respect to IC reporting guidelines; these include challenges that pertain to market communication, management control, uniqueness versus comparability, and confidentiality versus accountability. Girella and Zambon (2013) performed a case study on Japanese IC reporting from the viewpoint of political economics. In that study, the relationship between IC recommendations for corporate reporting and contextual linkages is analyzed using a type of discursive analysis. They found that IC is considered not only a management or financing technique deployed by firms, but also as an economic and socially constructed concept that can be used to restimulate a country's growth. Thus, the guidelines are intended to enlighten firms on IC reporting and management.

4.1.2 Communication with investors

Kagaya (2006) studied the impact of IP reporting on the Japanese financial market. The study used the event study approach to test whether excessive stock returns changed after the sample firms disclosed IP information. Kagaya's results provide significant evidence that firms that disclosed IP information sometime after the shareholders meeting have higher stock returns and those that disclosed IP information within fewer pages have higher stock returns. In addition, Sakakibara et al. (2010) studied the current nonfinancial IC disclosure practice in Japan and the extent to which it contributed to analysts' valuations. That study was conducted using questionnaires, and it revealed that there is an information gap between the accessibility and importance of some IC information. In terms of HC, there seems to be an extremely wide information gap with respect to management quality, employee training, satisfaction, and participation. The study concluded that it is very difficult for both analysts and ordinary investors to evaluate companies, given that nonfinancial IC disclosures are insufficient.

4.1.3 Communication with other stakeholders

Johanson et al. (2009) investigated how small and medium-sized high-tech Japanese firms applied the IABM guidelines issued by METI in 2005. They discuss the IABM reports of four newly established Japanese companies, as well as the outcomes of some interviews. The study found that the IABM reports were primarily used for financial purposes and as a vehicle for external communication with existing and potential customers. In addition, Koga et al. (2011) investigated the impact of IABM reports in Japan, in their questionnaire-based research. The sample comprised mostly SMEs, and the study revealed that the disclosure's greatest impact was on employees, followed by those on financial institutions and clients/corporate groups. The study concluded that SMEs publish these reports in order to inform stakeholders of their competitive advantages.

Holland et al. (2012) investigated how Japanese financial firms (JFFs) acquire and use corporate IC information in their investment decisions, how

this activity contributes to knowledge creation among JFFs, and how JFFs affect knowledge creation in the investee company. In this context, four JFFs were examined within the framework of the "theory of knowledge-creating firms," suggested by Nonaka and Toyama (2005). The study found that IC information has an impact on earnings estimates and company valuation, and that knowledge creation by JFFs provides opportunities to increase disclosures and improve accountability between the JFFs and their investee companies.

4.2 Research on the investor impact of IC disclosure

Information asymmetry between managers and investors reduces the market liquidity of the firms' shares; therefore, because investors pay less for shares that bear high transaction costs, asymmetry forces firms to raise capital at a discount (Welker, 1995). Firms can lower that discount by improving disclosure and reducing the cost borne by investors in acquiring private information (Diamond and Verrecchia, 1991). In theory, greater disclosure reduces the estimation risk associated with expected stock returns. As Lambert et al. (2007) point out, lowering the estimation risk results in a lower required rate of return; therefore, in theoretical studies, the expected impact of IC disclosure on the cost of equity capital is negative.

Several empirical studies investigate the relationship between IC disclosure and the cost of equity capital. The results report both positive and negative associations between IC disclosure and the cost of equity capital (Kristandl and Bontis, 2007; Mangena et al., 2014; Orens et al., 2009; Singh and Van der Zahn, 2007). Singh and Van der Zahn (2007) find evidence of a positive relationship between IC disclosure and the cost of capital among initial public offering firms. On the other hand, Kristandl and Bontis (2007), Orens et al. (2009), and Mangena et al. (2014) each provide evidence of a negative association between IC disclosure (i.e., forward-looking disclosures, web-based IC disclosures, and interactions between financial and IC disclosures, respectively) and the cost of equity capital. However, none of these studies investigates what items contribute to higher or lower equity-capital costs.

4.3 Research question

The results reported in the literature on the relationship between IC disclosure and the cost of equity capital appear to be controversial. International evidence on the relationship between IC disclosure and the cost of equity capital is divergent. In studying the Japanese market, Kagaya (2006) finds a relationship between excess returns and IP information, but Sakakibara et al. (2010) concludes that because nonfinancial IC disclosures are insufficient, it is very difficult

for both analysts and ordinary investors to evaluate companies. Differences in the findings may be due to the scope of the studies. Kagaya (2006) focused on firms that began to publish IP reports; the sample in that study thus consisted of firms with a positive attitude towards voluntary disclosures. On the other hand, Sakakibara et al. (2010) examined analysts' responses to a questionnaire. It is expected that analysts would answer the questionnaire by considering not only the firms that publish IP reports, but also the other firms under coverage. Moreover, the scope of the information examined differed among these studies. Kagaya (2006) examined IP information, while Sakakibara et al. (2010) studied IC information. As Sakakibara et al. (2010) point out, discrepancies may be due to the use of IC information, rather than IP information. Whether or not the discrepancy would resolve once firms disclose such information remains unclear. Therefore, it is important to investigate the firms that disclose IC information and identify what information actually contributes to communication between managers and investors.

Specifically, our research question pertains to whether IC reporting actually reduces information asymmetry, and what content should be disclosed in order to achieve this.

5 Hypotheses and research design

In this study, we examine the impact on the Japanese capital market of the initiation of IC disclosures that are informed by METI guidelines. By focusing on the initiation of IC disclosure, we can identify incremental IC disclosure in a reasonable manner. Our study also validates the narrative approach employed by the guidelines.

The relationship between disclosures and market response is often measured in terms of the cost of equity capital (Botosan, 1997; Botosan and Plumlee, 2002; Diamond and Verrecchia, 1991; Dhaliwal et al., 2011). For instance, Dhaliwal et al. (2011) point out that a reduction in firms' cost of equity capital explains the trend of increased CSR disclosure. Although the causality between disclosure and a reduction in the cost of equity capital is still under discussion, we believe that reduced information asymmetry between managers and investors should make some impact. It is possible to examine the market impact by using various indices. We begin with the cost of equity capital, as it is considered one of the reasons managers voluntarily disclose additional information.

Do additional IC disclosures impact investors? In Japan, we find that the manner in which IC information is disclosed varies across companies. First, we test whether the initiation of any IC disclosure has statistically significant effects on investors. As mentioned, we analyze the cost of equity capital in order to determine the impact of disclosure. In the current study, we employ an empirical method to test the following hypotheses.

Hypothesis 1: Companies that disclose any additional IC information will have a lower cost of capital than they would otherwise, due to reduced information asymmetry.

In order to test the above hypothesis, we construct the following regression model:

$$\begin{aligned}&|\text{Cost of Equity Capital}|\\&= \alpha + \beta_1 Post + (Market\ Book\ Ratio) + (Analyst\ Error) + (SDROE)\\&\quad + (Debt\ Ratio) + (Year\ Dummy) + (Industry\ Dummy)\\&\quad + (Scale\ Dummy) + \varepsilon \qquad (1)\end{aligned}$$

In equation (1), the explained variable is the cost of equity capital, obtained using Easton's (2004) modified price earnings growth model. We use the following equation to calculate the implied cost of equity capital[3]:

$$|\text{Cost of Equity Capital}| = \sqrt{\frac{(Expected\ Accounting\ Earnings\ at\ Year\ 2) - (Expected\ Accounting\ Earnings\ at\ Year\ 1)}{(Share\ Price\ at\ present)}}$$

We use consensus analyst estimates from IFIS as the expected accounting earnings, and stock price data from Thomson Reuters Data Stream to derive the present share price. The explanatory variable *Post* is a dummy variable with the value 1 if the firm has disclosed any additional IC information, and the value 0 otherwise. Based on certain criteria and assumptions, we determine whether a firm has started to disclose IC information. We assume that firms did not disclose the IC information provided in either the annual reports or the IC reports, until those reports were actually published. We also assume that the study by Yamauchi (2009) provides a sample of all the relevant listed firms between 2004 and 2006. We define a firm that disclosed IC information as one that explained at least one of its IC forms from Table 1 in a narrative form, and that this information was supported by certain indices. Thus, IC information that failed to meet these criteria was not considered disclosed IC information, *per se*. The classification of IC information based on the METI guidelines is shown in Table 1.

[3] There are several other methods by which to calculate an implied cost of equity capital (e.g., Clause and Thomas, 2001; Gabhardt et al., 2001; Ohlson and Juettner-Nauroth, 2005). However, in order to preclude multiple solutions, I make use of the equation from Easton (2004), and assume there is neither any expected dividend next year nor any unique perpetual rate of change in the abnormal growth in earnings. In addition, Botosan and Plumlee (2005) also indicate that the costs of capital obtained from the other approaches are similar and positively correlate.

Table 1. Categorization of IC.

Category	Content	Examples
HC	Education/training Experience Motivation R&D (human resources) Core technology	Qualifications, degrees Number of years in related jobs Employee satisfaction Number of R&D employees Special skills of employees
SC	Management philosophy Business model R&D concentration Employee evaluation Compliance Litigation risk New product development Intellectual property Core technology	Extent of employee involvement Investment allocation R&D rate for core segments Awards for high performers Compliance check system Compensation Future R&D expense Patents, trademarks Technology accumulated
RC	Customer loyalty Brands License contract Cooperation Customer satisfaction Environmental contribution Social responsibility	Market share Reputation Technological licensing contracts Joint projects with the government Fulfillment of medical needs Environmental accounting Community service

The remainder of the explanatory variables are control variables. Fama and French (1992) found that the market-to-book ratio (*Market Book Ratio*; *MB*) has a significant impact on the cost of equity capital. *Analyst Error* (*AE*) is a surrogate variable for the quality of private information disclosures; it is calculated by dividing the absolute value of the difference between the realized income and the expected income by the book value. The standard deviation (SD) of return on equity (*SDROE*) is a control variable for the estimation risk in accounting numbers (Muramiya, 2005). *Debt Ratio* (*DR*) is a control variable for the effect of leverage (Mangena et al., 2014; Orens et al., 2009). We used data from the five previous years; the *Year Dummy* represents the unique effect for each year. The industry and scale dummies are based on the classifications of the Tokyo Stock Exchange.

The primary sample includes all those listed firms that disclosed additional IC information between 2004 and 2006 that adheres to the guidelines and satisfies our criteria. The control sample comprises previous-year data that are paired with the main sample. For the control sample, we considered selecting firms that did not make any disclosure and pairing them with those from the

Table 2. Mean of each numerical explanatory variable, for the main and control samples.

	Main	Control	Difference	*t*-value	*p*-value
MB	1.925	1.734	0.191	1.126	0.260
AE	0.010	0.014	–0.004	–1.220	0.226
SDROE	0.073	0.082	–0.009	–0.494	0.621
DR	2.200	2.569	–0.369	0.752	0.453
				χ^2-value	*p*-value
Mahalanobis distance	–	–	–	41.867	0.834

Note: ***MB*** is the market-to-book ratio at the end of the quarter in which firms release the annual report. ***AE*** is the absolute value of the difference between the analyst consensus and the actual value, divided by book value. ***SDROE*** is the standard deviation of the return on equity over the past five years. ***DR*** is the debt ratio at the end of the quarter in which firms release the annual report.

main sample, based on industry and scale; however, since most of the top 20 electronics firms had disclosed IC information, it was difficult to select their counterparts. Since almost half of the companies that disclosed IC information belonged to the electronics industry, we decided to use data from before the disclosure as the control sample.

Table 2 presents the mean value of the explanatory variables, the results of *t*-tests of differences in the means of the main and control samples, and the Mahalanobis distance between the main and control samples. No *p*-value is lower than 0.10; therefore, in terms of numerical factors that influence the cost of equity capital, differences between the main sample and the control sample are not statistically significant. Since the control sample comprises previous-year data paired with the main sample, the numbers of firms in each industry and scale are the same as those in the main sample. Although the time-series trend is not adjusted through the matching method, it can be partially controlled by *Post* or *Year Dummy* variables. In summary, the control sample can be assumed to be an appropriate matching sample.

The variable of interest in the regression models is *Post*. We expect the coefficient of this variable to be negative and significant. Firms disclose IC information partly because they want to reduce the cost of equity capital. The results of our regression analyses will provide some significant evidence of whether or not investors value any IC information disclosure.

In the current study, we also examine the impact of the content of disclosures on the capital market. We categorize the content of IC disclosures as HC, SC,

and RC (Lynn, 1998; Mouritsen, 1998). While many researchers have attempted to explain the process of value creation in firms (Holland, 2001; Nonaka and Takeuchi, 1995), there has been no consensus. Although this process is a "black box," we can assume that the disclosure of all three categories of IC would lead to value creation. If investors consider IC disclosures relevant information only if all three categories of IC information are provided, then a reduction in the cost of equity capital will be observed only among those firms that disclose all three categories of information. Therefore, we construct the following hypothesis.

Hypothesis 2: Companies that disclose all three categories of additional IC information will have a lower cost of equity capital than they would otherwise, due to reduced information asymmetry.

In order to test the above hypothesis, we construct the following regression model:

$$
\begin{aligned}
&|\text{Cost of Equity Capital}| \\
&= \alpha + \beta_1 SC + \beta_2 RC + \beta_3 HCSC + \beta_4 SCRC + \beta_5 HCSCRC \\
&\quad + (\textit{Market Book Ratio}) + (\textit{Analyst Error}) + (\textit{SDROE}) + (\textit{Debt Ratio}) \\
&\quad + (\textit{Year Dummy}) + (\textit{Industry Dummy}) + (\textit{Scale Dummy}) + \varepsilon
\end{aligned} \tag{2}
$$

In equation (2), the explained variables are the same as those in equation (1). Again, we use consensus analyst estimates from IFIS and stock price data from Thomson Reuters Data Stream. Regarding the explanatory variables,[4] *SC* (*RC*) is a dummy variable with the value of 1 if the firm discloses only SC information that is supported by quantitative indices, and the value of 0 otherwise. *HCSC*, *SCRC*, and *HCSCRC* are dummy variables. For instance, the value of *HCSCRC* will be 1 if the firm discloses HC, SC, and RC information that is supported by quantitative indices, and 0 otherwise. *HCSC* and *SCRC* are defined similarly. The control variables and assumptions are the same as those in equation (1).

The variable of interest in the regression model is *HCSCRC*. We expect the coefficient of this variable to be negative and significant. Since IC comprises HC, SC, and RC, any of them can be easily mobilized as befits the situation (Mouritsen, 2006). We expect that firms can reduce the cost of equity capital only if they make disclosures for all three categories of IC. Since value creation is a spiral process that begins with the individual employee and involves internal resources and external resources, investors require narratives from all three categories (Nonaka and Takeuchi, 1995). If investors consider only IC information that satisfies certain conditions, the coefficients of the corresponding variables will be significant.

[4]There is no firm in the sample that disclosed solely HC (or HC and RC) information. It is for this reason that there is no explanatory variable for HC or HCRC.

6 Results

6.1 Sample

52 listed firms in Japan took the initiative to disclose IC information between 2004 and 2006. However, data for only 39 firms are available. Therefore, the sample size including the control sample is 78. Table 3 shows the summary statistics of the numerical variables in the regression models. Table 4 shows the Pearson product-moment correlation coefficients. There is a weak correlation

Table 3. Summary statistics.

	Minimum	Maximum	Mean	Median	SD
COEC	0.03835	0.1492	0.08690	0.08572	0.02391
MB	0.670	5.330	1.884	1.845	0.82970
AE	0.000009	0.06318	0.01154	0.00624	0.01303
SDROE	0.008991	0.607645	0.078576	0.07857	0.09099
DR	0.2237	6.7666	2.0080	1.3170	1.654247

Note: ***COEC*** is the implied cost of equity capital calculated by using Easton's (2004) method. ***MB*** is the market-to-book ratio at the end of the quarter in which firms release the annual report. ***AE*** is the absolute value of the difference between the analyst consensus and the actual value, divided by book value. ***SDROE*** is the standard deviation of the return on equity over the past five years. ***DR*** is the debt ratio at the end of the quarter in which firms release the annual report.

Table 4. Pearson's product-moment correlation coefficient.

	COEC	***MB***	***AE***	***SDROE***	***DR***
COEC	1.000				
MB	0.034	1.000			
AE	0.460	–0.043	1.000		
SDROE	0.229	–0.101	0.248	1.000	
DR	0.322	–0.327	0.272	0.383	1.000

Note: ***COEC*** is the implied cost of equity capital calculated by using Easton's (2004) method. ***MB*** is the market-to-book ratio at the end of the quarter in which firms release the annual report. ***AE*** is the absolute value of the difference between the analyst consensus and the actual value, divided by book value. ***SDROE*** is the standard deviation of the return on equity over the past five years. ***DR*** is the debt ratio at the end of the quarter in which firms release the annual report.

between *DR* and the other numerical control variables; however, the correlation is less than 0.4, and so we assume that they are independent of each other in the regression models.

Table 5 shows the number of firms, by industry, in terms of the content disclosed. A majority of the firms in the sample disclosed a combination of SCRC information. With regard to SC and RC, firms in the manufacturing industry had a more positive outlook than those in the other industries; however, trends regarding HC are still ambiguous. Similarly, Tables 6 and 7 show the number of firms and their type of content disclosure, by *Year* and *Scale* matrices, respectively. No companies in the sample initiated

Table 5. IC content disclosed, by industry.

	SC	RC	HCSC	SCRC	HCSCRC	Total
Electronics	3	2	0	9	1	15
Chemical	2	1	1	4	1	9
Machinery	0	1	0	2	0	3
Automotive	1	0	0	2	0	3
Pharmaceutical	0	0	0	2	0	2
Food	1	0	0	2	0	3
IT	0	0	1	0	0	1
Utility	0	0	0	1	0	1
Construction	0	0	0	0	1	1
Logistics	0	0	0	1	0	1
Total	7	4	2	23	3	39

Table 6. Content disclosed, by year.

	SC	RC	HCSC	SCRC	HCSCRC	Total
2004	3	1	0	13	0	17
2005	4	3	2	6	2	17
2006	0	0	0	4	1	5
Total	7	4	2	23	3	39

Table 7. Content disclosed, by scale.

	SC	RC	HCSC	SCRC	HCSCRC	Total
Core 30	1	0	0	7	2	10
Large 70	1	0	0	8	0	9
Mid 400	5	4	2	8	1	20
Total	7	4	2	23	3	39

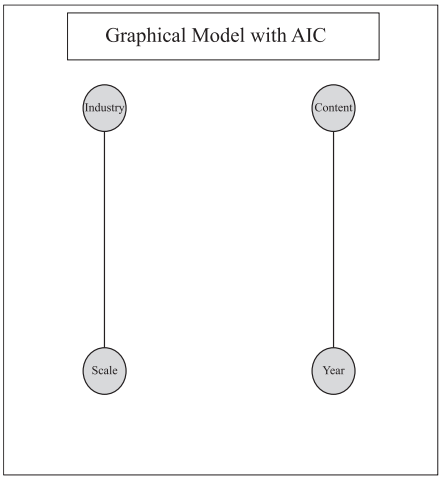
Note: Core 30, **Large 70, and Mid 400** represent a scale classified in terms of total market value and liquidity by TSE. The largest is **Core 30** followed by **Large 70** and then **Mid 400**.

the disclosure of HC information prior to 2005. It was observed that the larger the company, the greater the probability that it would disclose IC information.

To determine whether these dummy variables are independent of each other, we use the hierarchical log-linear model and R software. This method generates graphical models with multivariate discrete data. The graph comprises vertices and edges; the vertices represent each discrete random variable, and the edges depict the partial correlation between two random variables given that the rest of the variables are fixed. Therefore, if there is no edge between any two variables, then the two variables are conditionally independent, provided that the remainder of the variables are constant. (For a detailed theoretical explanation of R instruction, we refer to Edwards (1995) and Højsgaard et al. (2012).) The dummy variables are *Content*, *Year*, *Industry*, and *Scale*. *Content* is a categorical variable with the following levels: No, SC, RC, HCSC, SCRC, and HCSCRC. *Year*, *Industry*, and *Scale* are the same as those defined in the Research Design section. We begin with the saturated model and implement model selection by using a stepwise function. For the penalty parameter, both the Akaike information criterion (AIC) and the Bayesian information criterion (BIC) are used. The BIC penalizes complex models more heavily than does the AIC, and thus tends to select a simpler model (Højsgaard et al., 2012).

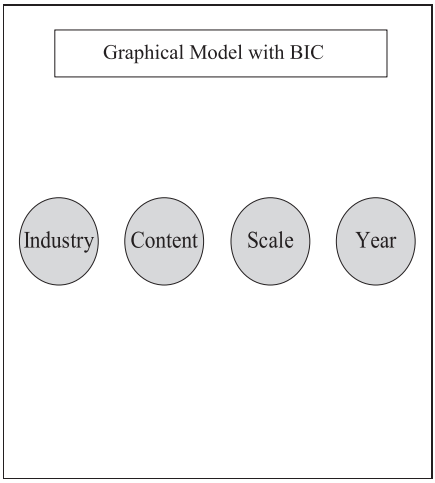
Figures 4 and 5 show the results of the graphical models with AIC and BIC, respectively. The AIC graph indicates that there are two edges; the notable one is that between *Year* and *Content*. It is reasonable for there to be some relationship between *Year* and *Content*, given the differences between the guidelines released in 2004 and 2005. However, the BIC graph shows that there is no edge between any two vertices. This can be interpreted thus: each variable is conditionally independent. Although there are weak relationships between some variables, we can assume that they are independent of each other.

Figure 4. Relationship among dummy variables, with the Akaike information criterion.



Note: ***Industry*** refers to one of 33 industry classifications on the Tokyo Stock Exchange (TSE). ***Content*** is a categorical variable describing the content of the annual report as SC, RC, HCSC, SCRC, or HCSCRC. ***Scale*** is a four-degree classification of TSE stocks (i.e., core, large, medium, or small). ***Year*** is a year dummy variable (2004, 2005, 2006).

Figure 5. Relationship among dummy variables, with the Bayesian information criterion.



Note: ***Industry*** refers to one of 33 industry classifications on the Tokyo Stock Exchange (TSE). ***Content*** is a categorical variable describing the content of the annual report as SC, RC, HCSC, SCRC, or HCSCRC. ***Scale*** is a four-degree classification of TSE stocks (i.e., core, large, medium, or small). ***Year*** is a year dummy variable (2004, 2005, 2006).

6.2 Regression results

Table 8 shows the results of regression model (1). The adjusted R^2 (0.4412) indicates that the model itself is not weak. However, the *p*-value of the coefficient of the variable *Post* is 0.19986. Hence, we do not have sufficient evidence to conclude that any IC disclosure will reduce the cost of equity capital. Thus, at this stage, we are unsure of the impact of any IC disclosure. In other words, this regression analysis does not provide any evidence in support of Hypothesis 1. However, this does not imply that any IC disclosure has *no* significant impact on investor decision-making.

Table 9 shows the results of regression model (2). The adjusted R^2 (0.4613) indicates that the model is reasonably sound. We find that the coefficient of *HCSCRC* is negative and statistically significant: the *p*-value is 0.0995 in this two-tailed test. This result is in line with our expectations. Specifically, at the 10% significance level, we have sufficient evidence that firms that disclose all

Table 8. Results of regression model (1).

Coefficients	Estimate	Std. Error	*t*-value	*p*-value
(Intercept)	0.067287	0.012568	5.354	1.54e-06***
Post	0.006881	0.005307	1.297	0.19986
MB	0.004342	0.002877	1.509	0.13672
SDROE	–0.017605	0.030906	–0.570	0.57111
AE	0.414035	0.194182	2.132	0.03724**
DR	0.002538	0.001925	1.318	0.19256
Year Dummy	Yes			
Industry Dummy	Yes			
N	78			
Adjusted R^2	0.4412			

*Two-tailed significance at the 10% level.
**Two-tailed significance at the 5% level.
***Two-tailed significance at the 1% level.
Note: ***Post*** is an indicator variable that takes the value of 1 if the firm discloses IC information in its annual report, and 0 otherwise. ***MB*** is the market-to-book ratio at the end of the quarter in which firms release the annual report. ***AE*** is the absolute value of the difference between the analyst consensus and the actual value, divided by book value. ***SDROE*** is the standard deviation of the return on equity over the past five years. ***DR*** is the debt ratio at the end of the quarter in which firms release the annual report.

three categories of IC information will reduce their cost of equity capital by about 2.2%. Therefore, this regression analysis provides statistical evidence that supports Hypothesis 2. However, the coefficients of the other content variables are not significant. We discuss the implications of the findings in the next section.

Table 9. Results of regression model (2).

Coefficients	Estimate	Std. Error	*t*-value	*p*-value
(Intercept)	0.0682694	0.0126450	5.399	1.54e-06***
SC	0.0094369	0.0082561	1.143	0.2581
RC	0.0056406	0.0107199	0.526	0.6009
HCSC	–0.0025255	0.0156789	–0.161	0.8726
SCRC	0.0086827	0.0059144	1.468	0.1479
HCSCRC	–0.0220099	0.0131327	–1.676	0.0995*
MB	0.0046706	0.0028753	1.624	0.1101
SDROE	–0.0159902	0.0307071	–0.521	0.6047
AE	0.4540306	0.1966003	2.309	0.0248**
DR	0.0023613	0.0019307	1.223	0.2266
Year Dummy	Yes			
Industry Dummy	Yes			
N	78			
Adjusted R^2	0.4613			

*Two-tailed significance at the 10% level.
**Two-tailed significance at the 5% level.
***Two-tailed significance at the 1% level.
Note: ***SC*** is an indicator variable that takes the value of 1 if the firm discloses only SC information in its annual report, and 0 otherwise. ***RC*** takes the value of 1 if the firm discloses only RC information in its annual report, and 0 otherwise. ***HCSC*** takes the value of 1 if the firm discloses both HC and SC information in its annual report, and 0 otherwise. ***SCRC*** takes the value of 1 if the firm discloses both SC and RC information in its annual report, and 0 otherwise. ***HCSCRC*** takes the value of 1 if the firm discloses all three categories of IC information in its annual report, and 0 otherwise. ***MB*** is the market-to-book ratio at the end of the quarter in which firms release the annual report. ***AE*** is the absolute value of the difference between the analyst consensus and the actual value, divided by book value. ***SDROE*** is the standard deviation of the return on equity over the past five years. ***DR*** is the debt ratio at the end of the quarter in which firms release the annual report.

6.3 Robustness test

In the previous regression models, we assume that the sample errors have equal variance and are independent. Under the more general assumption that the regression errors are independent but have distinct variances, we use White's (1980) estimator (sometimes referred to as a heteroskedasticity-consistent estimator). Table 10 shows the result of the regression with heteroskedasticity-consistent

Table 10. Results of regression (2) with heteroskedasticity-consistent estimator.

Coefficients	Estimate	Std. Error	*t*-value	*p*-value
(Intercept)	0.0682694	0.0096222	7.095	2.89e-09***
SC	0.0094369	0.0085127	1.109	0.272530
RC	0.0056406	0.0073691	0.765	0.447346
HCSC	–0.0025255	0.0047832	–0.528	0.599668
SCRC	0.0086827	0.0054526	1.592	0.117133
HCSCRC	–0.0220099	0.0140092	–1.571	0.121999
MB	0.0046706	0.0025553	1.828	0.073110*
SDROE	–0.0159902	0.0186544	–0.857	0.395131
AE	0.4540306	0.1423428	3.190	0.002372***
DR	0.0023613	0.0015159	1.558	0.125158
Year Dummy	Yes			
Industry Dummy	Yes			
N	78			

*Two-tailed significance at the 10% level.
**Two-tailed significance at the 5% level.
***Two-tailed significance at the 1% level.
Note: ***SC*** is an indicator variable that takes the value of 1 if the firm discloses only SC information in its annual report, and 0 otherwise. ***RC*** takes the value of 1 if the firm discloses only RC information in its annual report, and 0 otherwise. ***HCSC*** takes the value of 1 if the firm discloses both HC and SC information in its annual report, and 0 otherwise. ***SCRC*** takes the value of 1 if the firm discloses both SC and RC information in its annual report, and 0 otherwise. ***HCSCRC*** takes the value of 1 if the firm discloses all three categories of IC information in its annual report, and 0 otherwise. ***MB*** is the market-to-book ratio at the end of the quarter in which firms release the annual report. ***AE*** is the absolute value of the difference between the analyst consensus and the actual value, divided by book value. ***SDROE*** is the standard deviation of the return on equity over the past five years. ***DR*** is the debt ratio at the end of the quarter in which firms release the annual report.

standard errors. The *p*-value for the coefficient of *HCSCRC* is 0.121999, which is no longer significant at the 10% level. Therefore, the result of regression (2) might not be robust, and shows instead a somewhat weak trend.

7 Implications and limitations

This study examines the impact of nonfinancial IC disclosures on investor decision-making. It is controversial how IC information should be recognized or disclosed. Some researchers assert that it should be capitalized if it satisfies certain conditions (Lev and Zarowin, 1999). However, in practice, it is almost impossible to recognize every IC on the balance sheet. Many previous studies have highlighted the increasing demand for IC information from various interested parties. Consequently, research on the impact of IC disclosures made in annual reports or IC reports is of great import.

In the current study, we employ an empirical approach to investigate the impact of IC disclosures. In some countries, some firms have started to disclose IC information in their annual reports or standalone reports, but there is no sufficient evidence in the case of Japan that voluntary IC disclosures reduce information asymmetry. By using actual data to test hypotheses regarding IC disclosures, we found some evidence regarding the impact of IC disclosures that can be used as evidence in future research.

We found statistically significant but weak evidence that allows us to conclude that firms that disclose all three categories of IC information enjoy a lower cost of equity capital. We discuss the implications of this finding as follows. Botosan (1997) explains that "greater disclosure enhances stock market liquidity thereby reducing cost of equity capital either through reduced transaction costs or increased demand for a firm's securities" (p. 324). In our regression analysis, we found significant but weak evidence only for those firms that disclosed all three categories of IC information; however, this does not indicate whether the firms that did not make disclosures had any impact on investor decision-making. Our findings suggest that it is advisable for a manager to disclose all three categories of IC information, if the aim is to reduce the cost of equity capital. We are unsure whether the categories of IC should relate to each other, since the criteria for IC data do not specify that they be related. In other words, when we collected the data, we did not set the criteria that all three categories should be related in order to create value.

However, Nonaka and Takeuchi (1995) explain that the knowledge-creation process is a spiral process where knowledge is mobilized from individuals to groups of people and firms. Since knowledge is the most important resource in a knowledge economy, we consider it valuable. In terms of the knowledge-creation process, we conclude that all three categories of IC are essential to explaining a firm's value creation process. As in Holland's (2001) explanation of the relationship between IC and the value-creation process, HC, SC, and RC interact with each other and constantly generate innovation, albeit in a chaotic manner.

There are two rationales as to why disclosing all three categories of IC would have an impact on corporate value. The Danish Ministry of Science, Technology and Innovation (DMSTI) (2003) suggests disclosing all three categories, because disclosure encourages firms to manage the value-creation process by considering IC. Through IC management, future cash flows can be expected to increase. On the other hand, METI (2004) points out that communicating IC initiatives to investors facilitates financial analysis and signals the excellence of those initiatives. If, as a result, corporate value increases, the cost of equity capital should decrease. Thus, our finding is consistent with the theoretical expectation, and it is significant for Japanese managers in terms of decisions regarding the content and manner of IC information disclosures. Moreover, our finding encourages firms to follow the integrated reporting approach suggested by the IIRC (2013).

We would like to highlight some limitations to our study. First, for some, the sample size may be too small to obtain appropriate results from the regression models. We have used all the available samples to the greatest extent possible; however, further analysis that uses a larger sample should be considered in future research. In particular, should a sufficient sample size be available, a difference-in-differences analysis would be an appropriate means of testing causality between disclosure and the cost of capital. Second, criteria regarding whether a firm has started to disclose additional IC information may not be realistic. We assume that a firm discloses additional IC information only once it publishes an IC report that adheres to the guidelines. It is possible that a firm has already disclosed this information through other channels, prior to report publication. In any case, the possibility that a firm has voluntarily disclosed additional IC information prior to the guidelines is low, as doing so would incur for the firm a higher information cost. Therefore, our assumption should not lead to bias in the final result.

Finally, this study focuses on the benefit of disclosing additional IC information, but it does not thoroughly investigate the cost of disclosing it. Two kinds of cost—namely, a direct cost and an indirect cost—will be incurred. A direct cost is the cost of collecting and disclosing data (e.g., expenses related to introducing new IT software or human resources to work on the disclosure task). An indirect cost is a negative consequence of the disclosure (e.g., losing a competitive advantage in product design, human resources, or marketing). This topic, along with the decision to disclose information, poses an important question for future research.

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