Journal of Intellectual Capital

Drivers for voluntary intellectual capital reporting based on agency theory
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Abstract

Purpose – The purpose of this paper is to investigate the drivers for voluntary intellectual capital (IC) reporting based on agency theory. This study responds to calls for critical investigations of IC reporting utilising Goebel's (2015a) IC measuring approach to investigate the role of IC value and mispricing for IC reporting.

Design/methodology/approach – A mandatory management report offers a unique research setting in Germany. The content analysis results of 428 German management reports are used in a regression analysis with leverage, ownership diffusion, IC value and mispricing. Additionally, a propensity score matching approach examines the relationship between IC reporting and IC value.

Findings – The regression results show that companies use voluntary IC reporting to encounter mispricing. IC reporting is negatively associated with leverage, whereas ownership diffusion and IC value show no significant results. The propensity score matching approach is also not significant.

Research limitations/implications – This study contributes to strengthening and testing agency theory for IC reporting. As mispricing is identified to play an important role for IC reporting, IC research should account for mispricing.

Practical implications – The findings suggest to reopen a discussion on the declared aims of the German management report and the international integrated reporting model to provide information on value creation, as IC value shows no link to IC reporting.

Originality/value – This study innovatively links IC reporting to IC value and mispricing to investigate drivers for voluntary IC reporting.

Keywords Content analysis, Narrative reporting, Voluntary disclosure, Intellectual capital value, Management report, Mispricing

Paper type Research paper

1. Introduction

The aim of this study is to investigate drivers for voluntary intellectual capital (IC) reporting based on agency theory. IC has been characterised to constitute a competitive advantage, consisting of efficient internal structures, beneficial relations to primary stakeholders and human resources (e.g. Stewart, 1997; Brüggen *et al.*, 2009). These features are widely categorised as structural, relational and human capital (e.g. Beattie and Thomson, 2007; Wee and Chua, 2016). Structural capital supports the company in running as going concern and creating innovations (e.g. Guthrie *et al.*, 2007; Dzenopoljac *et al.*, 2017). Relational capital constitutes favourable relations to important stakeholders, such as suppliers, customers, business partners and investors (e.g. Guthrie and Petty, 2000; Catalfo and Wulf, 2016). Human capital represents people working for the company, their skills and development (e.g. Bukh *et al.*, 2005; Li *et al.*, 2012). These intangible aspects may lead to information asymmetries. An agency theory approach suggests that companies report voluntarily on IC to reduce the information asymmetry between managers and owners. Based on this

The author would like to thank Professor Pauline Weetman and Professor Bill Rees for helpful comments on earlier drafts of this paper. Useful feedbacks by the participants of the 48th BAFA Doctoral Conference in Brighton and the 17th Financial Reporting and Business Communication Conference in Bristol, particularly by the discussant Gunnar Rimmel, are gratefully acknowledged.

Journal of Intellectual Capital
© Emerald Publishing Limited
1469-1930
DOI 10.1108/JIC-01-2018-0019

argument, IC reporting is expected to increase with ownership diffusion, leverage, IC value and company mispricing in order to reduce the information gap.

The German management reporting regulation requires managers to report on sustainable value creation to reduce the information gap (GASC, 2010a). Hence, the German setting is particularly interesting for the ideas of agency theory in this study. Furthermore, the German regulation allows distinguishing voluntary IC reporting to apply agency theory. As proxy for IC value and mispricing, the measures for long-run value-to-book (LRVTB) and firm-specific error (FSE), developed by Rhodes-Kropf *et al.* (2005), enable a statistical analysis to test the hypotheses on IC as elaborated by Goebel (2015a). The sample of this study comprises 428 management reports of German listed companies for the accounting year 2010. The results show that voluntary IC reporting is significantly associated with mispricing and leverage. According to the results, companies report less on IC with higher leverage ratios and more when they are mispriced. Ownership diffusion and IC value have no significant association with IC reporting.

The contribution of this study lies in theoretical and empirical aspects of IC reporting research. First, the results contribute to the IC reporting literature, as hypotheses are innovatively tested to investigate corporate motivations for IC reporting with mispricing being identified as previously unconsidered important factor for IC reporting. Second, the findings of this study are of interest for standard setters. The framework for international integrated reporting has the declared aim that companies should provide information on value creation (IIRC, 2013). As this study shows that IC value is unlikely to be a driver of corporate IC reporting, the findings open further discussions on integrated reporting.

The literature on IC reporting and the concepts of agency theory are reviewed in Section 2, linking agency theory to IC reporting. The hypotheses are developed in Section 3. The methods are designed in Section 4 and the results are discussed in Section 5. The concluding discussion is presented in Section 6.

2. Literature review

2.1 IC reporting research

As financial reporting is lacking information on IC (Lev and Zarowin, 1999; Zéghal and Maaloul, 2011), additional narrative information on corporate value creation has been the focus of IC reporting research. In an international approach to integrated reporting, IC reporting has also been highlighted to play an important role in corporate communication (IIRC, 2013). To approach a definition of IC, prior literature applied categorisations with structural, relational and human capital being most widely used (e.g. Bontis, 2003; Bozzolan *et al.*, 2003; Beattie and Thomson, 2007; Brüggen *et al.*, 2009). The variety of previous IC reporting studies have focused on several IC aspects and different countries (e.g. Abeysekera and Guthrie, 2005; Striukova *et al.*, 2008; Campbell and Rahman, 2010; Bellora and Guenther, 2013; Catalfo and Wulf, 2016). In their comparative studies across countries, Vergauwen and van Alem (2005), Guthrie *et al.* (2007) and Lin and Edvinsson (2011) suggest that IC reporting may be influenced by country-specific considerations such as national legislation, traditions, auditor conservatism and technological progress. Prior studies show that companies report most frequently on relational capital, even across countries (Guthrie and Petty, 2000; Vandemaele *et al.*, 2005; Vergauwen and van Alem, 2005).

Given the narrative nature of IC reporting, content analysis has been a main research method in prior studies, as reviewed by Guthrie *et al.* (2004). However, the literature on content analyses of IC reporting has been criticised by Dumay and Cai (2014) as prior studies have been mainly standing alone rather than utilising the content analysis results for critical investigations. Their critique is in line with prior calls by Mouritsen (2006, 2009) and Guthrie *et al.* (2012) for taking IC research further by testing IC-related hypotheses and theories. In order to utilise the results of content analyses for more critical IC reporting

investigations, software-aided coding may provide richer data, as argued by Lee and Guthrie (2010), since they are able to examine larger samples (e.g. Bontis, 2003; Dumay and Cai, 2014). Goebel (2015a) further used the content analysis results from software-aided coding to investigate the relationship between IC reporting and company returns with non-significant results.

Empirical investigations have been conducted on the relationships between IC reporting and certain company criteria, such as company size, industry or ownership structure (e.g. Bukh *et al.*, 2005; García-Meca *et al.*, 2005; Brüggen *et al.*, 2009; Kamath, 2017). The results across these studies diverge but general associations of IC reporting with industry and size seem to exist. Overall, companies report more on IC when they operate in more technologically driven industries. The relationship of IC reporting and ownership structures has been investigated in the light of corporate governance aspects (e.g. Li *et al.*, 2008; Hidalgo *et al.*, 2011). They find that companies with higher share concentration report less on IC as dominant investors may already have access to the relevant information. In a broader IC perspective on IC value measures, Goebel (2015a) found that IC value is significantly positively associated with leverage and motivational payment to employees but significantly negatively associated with company size.

2.2 IC reporting in the German management report

As discussed in prior literature, country-specific considerations define the setting for IC reporting, partly due to regulatory requirements. In this respect, Germany offers a unique research setting for IC reporting research, as a management report is required to be published containing IC-related information regulated by GAS 15 (GASC, 2010a). The declared aim of the regulated management report is to reduce the information gap between managers and users of the report and to focus on sustainable value creation (GASC, 2010a, section 3, pp. 30-35). Hence, two main aspects are considered for IC reporting in the German management report: information asymmetry and IC as part of sustainable value. These considerations offer a research setting to answer the calls for more critical investigations of IC reporting.

The unique research setting for IC reporting due to the German management reporting regulation has been identified in prior literature (Goebel, 2015a; Catalfo and Wulf, 2016). GAS 15 has been examined by Goebel (2015b) utilising the regulatory requirements for the management report to distinguish between required, recommended and voluntary IC reporting. The wording in the management reporting regulation clarifies which IC components are required or recommended (GASC, 2010a). Required IC components mainly refer to structural and relational capital. The recommended IC components cover aspects of all three IC categories: structural, relational and human capital. With a synopsis of IC components from prior studies, Goebel (2015b) identified voluntary IC components, exceeding regulatory requirements and recommendations in Germany. She found that the majority of IC reporting by German companies is voluntary. In line with prior studies on other countries, German companies also voluntarily report most on relational capital with a stronger focus on IC reporting by companies operating in pharmaceutical and technological industries.

2.3 Theory development in IC reporting research

The prevalent lack of direct linkages between theories and IC reporting has been criticised and calls for theory testing have been raised (Mouritsen, 2006, 2009). Mouritsen (2006) argued that different theoretical approaches are possible and he encouraged innovative research designs. Guthrie *et al.* (2004) tried to bridge theories of general disclosure to IC reporting, namely legitimacy theory and stakeholder theory. In their review, they concluded that theoretical developments are needed to enhance IC reporting research. The reporting

theories suggested in the IC literature are theories of general disclosure. The theoretical background for an IC reporting study, based on these general reporting theories, requires further elaborations. This theoretical framework for IC reporting can then be applied to investigate corporate motivations for IC reporting.

Exploratory studies approaching IC reporting through content analysis mostly conducted a manual coding where the sample size is naturally limited given the time-consuming procedures. Larger samples, which may be enhanced by software-aided coding, may provide richer data for inferences and for testing IC-related hypotheses, as is also advocated by Lee and Guthrie (2010). Beattie and Smith (2012) considered general disclosure theories for IC reporting from the perspective of companies. They found in questionnaires to finance directors that market considerations are essential for IC reporting decisions with aspects of stakeholder and legitimacy theory being less important. In a similar approach in a survey with banks, Wee and Chua (2016) identified the responsibility to enable stakeholders to make better decisions as important motivation for IC reporting. Agency theory is of particular interest for this study, as the declared aim of the German regulation applicable to the management report is to reduce the information gap (GASC, 2010a, section 3). Therefore, the concepts of agency theory are further scrutinised for the context of IC reporting.

2.4 Linking agency theory to IC reporting

The main concepts of agency theory can be summarised in the principal agent approach. Due to a separation of management and ownership, information asymmetries exist between managers and owners, where owners as principals bear corporate risks but lack access to complete managerial information (Ross, 1973; Fama and Jensen, 1983). Managers as agents may exploit the situation for their own benefits what causes costs for the company, defined as agency costs by Jensen and Meckling (1976). According to their argument, owners may assume that managers will act in their own interests rather than in the company's interests; hence, they reduce payment to managers and implement monitoring devices to ensure an efficient use of their resources. Watts and Zimmerman (1986) take the argument further and claim that managers are motivated to show that their actions are aligned with the company's aims to encounter payment reduction. Therefore, managers would be motivated to provide additional information where owners are facing an information asymmetry, as summarised by Deegan (2001). However, he also notes that it may be in the company's interests to withhold certain information which may be competitive sensitive.

For IC reporting, the agency theory view means that information on IC is voluntarily provided by managers to reduce the level of information asymmetry and to assure owners of the company's use of resources for its IC. Particularly, as IC comprises intangible resources, which are not sufficiently presented in financial reporting (Lev and Zarowin, 1999; Zéghal and Maaloul, 2011), IC constitutes information asymmetries between managers and owners. Following the ideas of agency theory, managers have incentives to voluntarily provide additional information to assure owners of the creation and utilisation of IC. Mouritsen *et al.* (2001) argue that managers are encouraged to report on corporate IC to reduce the information gap by outlining how IC adds value to the company. Li *et al.* (2008) interpret the link between agency theory and IC reporting from the perspective of reducing uncertainty about intangible values for investors. In their study, they investigate corporate governance characteristics based on this argument. They conclude that an increasing number of independent directors monitor IC reporting to reduce the information gap. Based on agency theory, Garanina and Dumay (2017) investigate IC reporting in IPO prospectuses. They find that reducing information asymmetries by IC reporting may positively influence post-issue stock performance.

According to the agency view, IC reporting is actively used to explain the role of IC in the value creation process, considering the associated costs, as discussed by Beattie and Smith (2012).

As IC is argued to constitute an important competitive advantage (Hall, 1993; Goebel, 2015a), the information published in IC reporting may be competitive sensitive. In their study, Singh and Van der Zahn (2008) found that companies are reluctant to report on IC in their IPO prospectuses when they enter highly concentrated markets. Hence, IC reporting is reduced with increasing proprietary costs in the situation of IPOs. On the other hand, IC reporting may reduce proprietary costs by providing a monitoring device for owners. Mangena *et al.* (2010) show a significant negative association of IC reporting with cost of capital. However, they admit that their approach may be limited because the univariate analysis does not account for other factors which may influence cost of capital. These studies show that the relationship is not clear between IC reporting and its associated costs.

3. Hypothesis development

3.1 IC reporting to reduce information asymmetry towards owners and debtors

To investigate information asymmetry, one aspect suggested in the literature on agency theory is ownership structure. With highly spread share ownership, information asymmetry increases with a higher percentage of owners who require information. Hence, managers are likely to increase reporting with owner diffusion in order to reduce agency costs involved in the information asymmetry as investors have an increasing need for additional information. IC reporting research has looked at increasing percentage of free float shares to represent an increased level of information asymmetry which entails increased IC reporting. Brüggen *et al.* (2009) use ownership diffusion as measure of information asymmetry for IC reporting with no significant results. Li *et al.* (2008) interpret a high level of ownership concentration to reduce the information asymmetry with expected decreasing IC reporting. Their results show a significant negative association for owner concentration. Overall, prior studies use ownership structure as an indicator for information asymmetry to be related to IC reporting. The first hypothesis of this study follows the ownership diffusion approach to test information asymmetry on voluntary IC reporting:

H1. The extent of voluntary IC reporting is higher for companies with a higher percentage of outside shareholders.

Another aspect of information asymmetry can be seen for the position of debtors as influential stakeholders with a high proportion of debt. Keenan and Aggestam (2001) argued that debtors as influential stakeholders may increase the fiduciary responsibility to monitor intangible investments. Following this line of thought, companies may voluntarily report more on their IC to inform debtors about IC investments. Leverage ratios have been investigated in prior IC reporting studies with different results (Williams, 2001; White *et al.*, 2007; Brüggen *et al.*, 2009). While Williams (2001) and White *et al.* (2007) found a significant positive relationship between IC reporting and leverage, the results by Brüggen *et al.* (2009) were not significant. The aspect of leverage may be particularly distinctive for insider governance systems, as discussed by Dignam and Galanis (2009), where debtors have strong influential power with increasing debt to equity ratios. They describe the traditional governance system in Germany as insider governance system with a relatively strong focus on stakeholder concerns. Hence, IC reporting may increase with leverage leading to the second hypothesis:

H2. The extent of voluntary IC reporting is higher with increasing leverage ratios.

3.2 IC reporting to explain IC value

The creation of IC value causes information gaps because IC value is not obvious from the financial statements. Based on this reasoning and following the concept of agency theory to reduce information asymmetry, voluntary IC reporting serves the purpose of explaining the actions taken by managers to create IC value. Williams (2001) attempted to investigate the

relationship between IC performance and IC reporting. His results show no significant associations which may be due to the weaknesses of the chosen measure for IC value (Ståhle *et al.*, 2011; Goebel, 2015a). According to the concepts of agency theory and based on the argument that IC value constitutes an information gap, managers have incentives to use IC reporting to explain IC value creation. The information gap between managers and owners increases with a higher corporate IC value representing an indicator for the information gap. Furthermore, the declared aim of the German management reporting regulation is to report on sustainable value creation (GASC, 2010a, sections 30-35). Hence, companies are expected to report on IC in their value creation process to fulfil the regulatory requirement. Therefore, the third hypothesis states that voluntary IC reporting increases with the level of corporate IC value:

H3. The extent of voluntary IC reporting is higher for companies with higher IC value.

3.3 IC reporting to correct mispricing

Another reason why a company may voluntarily report on IC is mispricing of company value. Mispricing is seen as the deviation of the company's market value from its underlying long-run intrinsic value (Rhodes-Kropf *et al.*, 2005; Hertzel and Li, 2010; Doukas *et al.*, 2010). Potential reasons for mispricing are manifold, such as market inefficiencies (Jensen, 2005). In this manner, Pantzalis and Park (2009) suggest that the market is not able to correctly assess company value partly due to incomplete reporting on intangible resources. Since IC consists of intangible resources, an appropriate evaluation of IC is difficult for market participants given the incomplete reporting. This may lead to mispricing which is argued by Jensen (2005, p. 7) to "almost certainly destroy value" due to misallocation of resources. Taking Jensen's (2005) suggestion further, the idea of current mispricing allows bridging the concepts of agency theory to IC reporting as mispricing can be interpreted as a form of information asymmetry.

From the perspective of capital markets, IC reporting also offers a tool to support realistic evaluations. As Beattie and Smith (2012) discuss, IC reporting may be motivated to correct mispriced share prices. Their study suggests that IC reporting is used to "correct undervalued share prices and prevent the creation of unrealistic expectations" (Beattie and Smith, 2012, p. 474). Accordingly, mispriced companies use corporate reporting to address this issue of information asymmetry, with voluntary IC reporting offering a great scope to defend or justify the allocation of intangible resources. This argument leads to the fourth hypothesis:

H4. The extent of voluntary IC reporting is higher for mispriced companies.

4. Research design

4.1 Sample of German companies

German listed companies are required to publish a management report with IC information being partly required and partly recommended (GASC, 2010a). The management reporting regulation with the declared aim to reduce the information gap between managers and owners creates a unique research setting in Germany. For this study, management reports are investigated for the accounting year 2010 as a revision of GAS 15 in 2010 where additional IC-related recommendations may have renewed awareness of IC reporting. The sample comprises 428 companies located in Germany and listed on the German Stock Exchange on December 30, 2010, with available and comparable financial reports. As all sample companies are required to publish the management report in German, the management reports are investigated in German as the original language version.

Prior literature suggests that IC reporting may be more important in certain industries (Bozzolan *et al.*, 2003; Bukh *et al.*, 2005; Brüggen *et al.*, 2009). However, industry classifications differ across previous IC reporting studies. This study suggests that simplifications are needed for industry groupings as many diversified firms operate in various industries.

For this study, the companies are grouped into four industries based on the overall corporate sector according to the Datastream item "Industry Classification Benchmark": consumer, finance, pharmaceutical and technology and industrial. For companies within one industry group, similar IC categories are assumed to be important within corporate IC reporting, as a relative importance across industries is also suggested by Beattie and Smith (2012). Therefore, the industry grouping safeguards comparability of IC reporting.

4.2 Measures of IC value and mispricing

For estimating IC value, this study follows the suggestion by Goebel (2015a) that IC value shows characteristics of a company's long-run intrinsic value. Therefore, this study applies the approach developed by Rhodes-Kropf *et al.* (2005) to estimate IC value by LRVTB. Their approach decomposes market-to-book ratios into three components: FSE, time-series sector error and LRVTB. This decomposition provides the LRVTB measure as indicator of IC value and at the same time offers a measure of current mispricing. The relative valuation approach comparing a company to its industry peers allows identifying which companies are underpriced or overpriced (Doukas *et al.*, 2010). For the measures of IC value and mispricing, this study applies model 2 by Rhodes-Kropf *et al.* (2005), using book value of equity and income as accounting information. The other two models have been tested with the same results for the investigation of this study.

4.3 Content analysis of IC reporting

This study conducts a content analysis of IC reporting in narratives of German management reports in German as the original language. Words serve as units of analysis and measurement, including repetition. Numerical information, graphs and tables are not considered apart from related narrative information. The score for voluntary IC reporting is then scaled by number of pages of the management report to account for reporting length. Alternatively, IC scores are investigated as absolute occurrences and scaled by total words with the same results which are not shown here. A computer-aided analysis is conducted, using the software "atlas.ti", since it enables processing high volumes of narratives at a high level of consistency, as argued by Krippendorff (2004). The use of content analysis software can be justified for this study since in the German language compound words inherently indicate their context. This language-dependent situation ensures a relatively high level of reliability for coding within the IC context on the word level, as also discussed by Goebel (2015b).

The German management reporting regulation refers to IC on different levels (GASC, 2010a). The regulation allows distinguishing IC components into three groups of reporting types: required, recommended and voluntary reporting, as reviewed by Goebel (2015b). The research framework of this study focuses on the voluntary IC components in her framework as agency theory represents a theory of voluntary corporate disclosure. Recommended IC reporting is not considered as being part of voluntary reporting for two reasons. First, these IC components mainly elaborate on aspects which are covered by IC reporting requirements. Hence, companies are likely to add these aspects when they report on required IC components. Second, companies may feel obliged to refer to these components as they are explicitly stated in the management reporting regulation (Suchman, 1995; Bebbington *et al.*, 2008). Therefore, this study considers only the remaining components as voluntary IC reporting. The applied research framework for IC reporting is presented in Table I.

4.4 Regression analysis of IC reporting

To test the proposed hypotheses based on agency theory, a regression analysis is conducted. The reporting scores from the content analysis on voluntary IC reporting and the IC categories structural, relational and human capital, respectively, provide the dependent

Structural capital	Relational capital	Human capital
Strategic planning	Customer involvement	Apprentices, graduates
Strategic orientation	Customer training	Educational concept
Systems	Distribution channels	Education quality
Information system	Sales force	Know-how + knowledge
Reporting	Logistical competencies	Core/key competencies
Technological systems	Supplier know-how	Skills, soft skills
Corporate policy	Marketing strategy	Experience, experts
Philosophy	Unique selling point	Team work
Communication	Bestseller, trend setter	Working environment
Sharing of knowledge	Brand awareness + image	Working climate
Know-how transfer	Brand strategy	Work life balance
Product competencies	Public relations	Diversity
Innovation	Corporate design	Employees
Creativity	Pioneer, specialist	Involvement
Functionality	Investor relations, IR	Motivation, enthusiasm
Processes	Financial contacts	Security of employment
	Production partner	Recruitment policies
		Talent management
		HR management
		Attractive employer
		Career opportunities

Table I. Research framework for content analysis of voluntary IC reporting

Notes: This table shows the IC components of the research framework for voluntary IC reporting applied in this study. The research framework is based on Goebel (2015b). IC components are classified as voluntary reporting when they are neither required nor recommended in the German regulation on the mandatory management report according to GAS 15 (GASC, 2010a)

variable, representing reporting behaviour by managers as agents. Ownership diffusion and leverage serve as independent variables to test *H1* and *H2* based on the aspect of information asymmetries towards owners or debtors, respectively. The LRVTB measure for IC value allows testing *H3* to investigate IC reporting behaviour given the presence of underlying corporate IC value. To test *H4*, the measure of FSE indicates current mispricing to examine whether companies report on IC trying to correct mispricing. Control variables for company size and industry are added to the model since prior studies found an association with IC reporting for these company characteristics.

The control variables for size and industry in the statistical analysis of this study are seen to capture features of proprietary costs for publishing IC-related information which is potentially competitive sensitive. Singh and Van der Zahn (2008) use a Herfindahl index as a measure to proxy for proprietary costs. This measure of industry concentration compares a company's sales to the sales of all companies within an industry. Alternatively, an industry sales concentration ratio of the four largest companies within an industry is used as proxy for proprietary costs in disclosure research (Luo *et al.*, 2006). Overall, these proxies can be summarised to account for a company's sales and industry. A company's sales can also be interpreted as a measure of size. As size and industry serve as control variables, proprietary costs are not included separately in the analysis of this study. The following equation shows the regression model:

$$ICpp_j = \beta_0 + \beta_1\, owner_j + \beta_2\ leverage_j + \beta_3 IC\ value_j + \beta_4\, mispricing_j + \beta_5\, size_j + \sum \alpha_i\, industry_j + \varepsilon_j. \quad (1)$$

ICpp is the reporting score for voluntary IC reporting scaled by page numbers of the management report to account for reporting length. For the IC categories, the regression is

performed with *SCpp*, *RCpp* and *HCpp* as reporting score for voluntary structural, relational and human capital reporting scaled by page numbers, respectively. The variable *owner* is the percentage of free float shares. *Leverage* is the ratio of debt to total capital. The variable *IC value* represents the antilog of LRVTB. *Mispriced* indicates current corporate mispricing measured by FSE. The control variable *size* is measured by the natural logarithm of total assets and *industry* represents dummy variables for the four industry groups: consumer, finance, pharmaceutical and technology and industrial. The industry group consumer serves as base industry. Table II shows definitions, descriptive statistics and correlation coefficients of the regression variables.

4.5 Propensity score matching approach

As the relationship between IC reporting and IC value is of particular relevance for this study, given the declared aim of the management reporting regulation to focus on sustainable value creation, an additional test is reasonable. Therefore, this study applies propensity score matching to examine whether IC value is related to voluntary IC reporting.

Panel A: definition of variables

Variable	Definition	Function
ICpp	Voluntary IC reporting score from content analysis	Dependent variable
SCpp	Voluntary structural capital reporting score from content analysis	Dependent variable
RCpp	Voluntary relational capital reporting score from content analysis	Dependent variable
HCpp	Voluntary human capital reporting score from content analysis	Dependent variable
owner	Percentage of free float shares	Test *H1*
leverage	Percentage of debt to total capital	Test *H2*
IC value	Antilog of LRVTB as measure of IC value	Test *H3*
mispricing	FSE as measure of mispricing	Test *H4*
size	Natural logarithm of total assets	Control variable
industry	Dummy for industry groups: consumer, finance, pharma and tech, industrial; consumer as base industry	Control variable

Panel B: descriptive statistics

	n	Mean	SD	Min	Max
ICpp	428	6.15	2.74	0.00	25.67
SCpp	428	1.90	0.93	0.00	7.25
RCpp	428	2.93	1.68	0.00	15.27
HCpp	428	1.33	0.67	0.00	4.41
owner	428	0.53	0.29	0.00	1.00
leverage	416	0.54	0.22	0.02	1.00
IC value	418	1.75	1.33	0.33	26.52
mispricing	418	0.00	0.62	−3.13	2.74
size	428	12.65	2.40	6.79	21.36

Panel C: correlations

n = 416	*ICpp*	*SCpp*	*RCpp*	*HCpp*	*owner*	*leverage*	*IC value*	*mispriced*	*size*
ICpp	1				0.03	−0.09	0.24*	0.10*	0.07
SCpp		1			0.00	−0.09	0.21*	0.09	0.02
RCpp			1		0.04	−0.06	0.19*	0.06	0.05
HCpp				1	0.08	−0.04	0.16*	0.12*	0.26*
owner	0.04	0.00	0.04	0.09	1	−0.05	0.02	−0.08	0.13*
leverage	−0.09	−0.08	−0.06	−0.06	−0.05	1	−0.06	0.11*	0.47*
IC value	0.07	0.07	0.05	0.02	−0.02	0.08	1	−0.02	−0.06
mispriced	0.13*	0.12*	0.07	0.12*	−0.06	0.10*	0.19*	1	0.15*
size	0.10*	0.06	0.04	0.22*	0.14*	0.51*	−0.07	0.06	1

Notes: These tables show definitions, descriptive statistics and correlations of variables used in the regression analysis of voluntary IC reporting. In the correlation table, Pearson correlations are given in the lower left-hand corner and Spearman correlations are shown in the upper right-hand corner. The low correlation values between regression variables do not imply multicollinearity. *Significant at the 5 per cent level

Table II.
Descriptive statistics of regression variables

Propensity score matching is developed in experimental and observational studies (Caliendo and Kopeinig, 2008; Rosenbaum and Rubin, 1983). To test the effect of IC value on voluntary IC reporting, first, the probability is estimated to have a high level of IC value in the reporting year under review. The logistic regression to estimate the probability of having a high IC value uses variables which have been reviewed to be associated with IC value in prior literature (Goebel, 2015a). These variables are intangible assets, expenses for research and development (R&D), company age, motivational payment to employees, ownership concentration, leverage, company size and industry group.

The logistic regression model to compute the propensity score is presented in Equation (2). To ensure robust results, several matching estimators are applied with replacement: radius, kernel and nearest neighbour with one to five neighbours (Caliendo and Kopeinig, 2008). For this study, the treatment group is considered to consist of companies with a high IC value based on LRVTB. In order to allow a bigger control group compared to the treatment group, high IC value is defined as the three upper deciles of LRVTB. Consequently, the control group consists of companies within the lower seven deciles of LRVTB. The same approach was applied with the upper five deciles with similar results which are not shown here. The IC reporting scores for voluntary reporting are considered as the output under review:

$$\begin{aligned} IC\ value\ dummy_j = {} & \beta_0 + \beta_1\ intangibles_j + \beta_2 R\&D_j + \beta_3 age_j + \beta_4\ payment_j \\ & + \beta_5\ concentrated\ ownership_j + \beta_6\ leverage_j + \beta_7\ size_j \\ & + \sum \alpha_i\ industry_j + \varepsilon_j. \end{aligned} \tag{2}$$

IC value dummy represents the binary variable to distinguish between treatment and control group whether a company has a high level of IC value, measured as the three upper deciles of LRVTB. *Intangibles* shows recognised intangible assets scaled by total assets. *R&D* is a dummy variable taking the value 1 if a company declares expenses in R&D in the income statement, 0 otherwise. The variable *age* measures the company age as the years since the company was founded. For motivational payment, *payment* is a dummy variable that takes the value 1 if the average payment per employee is above the industry average, 0 otherwise. *Ownership* captures the percentage of shares closely held by family members and employees. *Leverage* is the percentage of debt compared to total capital and *size* is the natural logarithm of total assets. The control variable *industry* is a dummy variable for the four industry groups: consumer, finance, pharmaceutical and technology and industrial. Table III shows descriptive statistics for the logistic regression variables.

5. Results

5.1 Reporting scores for voluntary IC reporting

The results of the content analysis for voluntary IC reporting by categories and industries are shown in Table IV. For total voluntary IC, on average 6.15 words per page refer to IC, varying between 0 and 25.67 words per page. Relational capital shows the highest proportion of IC reporting across all industry groups, accounting for about 48 per cent of total voluntary IC reporting. This finding is in line with prior literature, as relational capital was also found to be most dominant across countries (Vandemaele *et al.*, 2005; Vergauwen and van Alem, 2005; Guthrie *et al.*, 2007). Additionally, the results indicate that industry differences exist for mean IC reporting scores. The average occurrences of voluntary IC reporting per page are highest for pharmaceutical and technology, compared to other industry groups, for all three categories structural, relational and human capital. This is consistent with the findings in prior literature on IC reporting (Bozzolan *et al.*, 2003;

Panel A: definitions of variables for logistic regression

Variable	Definition
IC value dummy	Dummy variable: 1 if LRVTB in upper 3 deciles, 0 otherwise
intangibles	Intangible assets scaled by total assets
R&D	Dummy variable: 1 if R&D expenses declared, 0 if no R&D expenses
company age	Company age as years since company was founded
payment	Dummy variable: 1 if payments per employee above industry average, 0 otherwise
ownership	Percentage of shares held by family members and employees
leverage	Percentage of debt to total capital
size	Natural logarithm of total assets
industry	Dummy for industry groups: consumer, finance, pharma and tech, industrial; consumer as base industry

Panel B: descriptive statistics

		Continuous variables				Dummy frequency	
	n	Mean	SD	Min	Max	0	1
IC value dummy	428					293	135
intangibles	428	0.17	0.18	0	0.95		
R&D	428					236	192
company age	428	16.31	17.67	1	252		
payment	417					220	197
ownership	428	19.45	25.75	0.00	96.00		
leverage	416	0.54	0.22	0.02	1.00		
size	428	12.65	2.40	6.79	21.36		

Panel C: correlations

$n = 406$	*IC value*	*intangibles*	*R&D*	*age*	*payment*	*ownership*	*leverage*	*size*
IC value dummy	1	0.09	0.07	−0.05	0.07	0.09	−0.05	−0.05
intangibles	0.06	1	0.19*	−0.14*	0.07	0.04	−0.13*	−0.11*
R&D	0.09	0.09	1	0.09	0.12*	−0.09	−0.14*	0.16*
company age	−0.08	−0.15*	0.09	1	−0.02	−0.24*	0.25*	0.38*
payment	0.05	0.09	0.12*	−0.02	1	0.01	−0.04	−0.04
ownership	0.10*	0.03	−0.11*	−0.16*	0.01	1	−0.23*	−0.31*
leverage	−0.05	−0.12*	−0.13*	0.16*	−0.05	−0.19*	1	0.46*
size	−0.06	−0.07	0.15*	0.28*	−0.04	−0.29*	0.51*	1

Notes: These tables show definitions, descriptive statistics and correlations of variables used in the logistic regression analysis for propensity score matching to estimate the probability of having a high underlying IC value. In the correlation table in Panel C, Pearson correlations are given in the lower left-hand corner and Spearman correlations are shown in the upper right-hand corner. The correlation level between variables is low and does not imply multicollinearity *Significant at the 5 per cent level

Table III. Descriptive statistics for propensity score matching approach

Bukh *et al.*, 2005; Brüggen *et al.*, 2009; Bellora and Guenther, 2013). The industry group pharmaceutical and technology comprises companies with business models relying on intangible rather than tangible assets, such as software and pharmaceutical companies. Therefore, a higher level of voluntary IC reporting compared to other industries may intrinsically be required by their business model.

Companies operating in the financial sector voluntarily report least on IC for every category. As the financial sector is not necessarily expected to be particularly reliant on IC, this result may not be surprising. However, two potential reasons exist for the low level of voluntary IC reporting in the financial sector among German companies, as also discussed by Goebel (2015b). On the one hand, additional regulation for risk reporting exists in Germany for companies operating in the financial sector GAS 5-10 and GAS 5-20 (GASC, 2010b, c). This regulation with particular requirements on risk reporting may encourage the companies to focus on risk rather than IC reporting. The findings by Wee and Chua (2016) support this view as compliance was found to be of major importance for banks. On the other hand, the sample for financial companies is relatively small compared to the other industry groups which may cause limited results.

	Total voluntary IC	Structural capital	Relational capital	Human capital
Total voluntary IC (n = 428)				
Mean	6.15	1.90	2.93	1.33
% of total		30.8	47.6	21.6
SD	2.74	0.93	1.68	0.67
Min	0.00	0.00	0.00	0.00
Max	25.67	7.25	15.27	4.41
Consumer (n = 123)				
Mean	6.23	1.80	3.20	1.24
% of total		28.8	51.4	19.8
SD	3.15	0.86	2.07	0.66
Min	0.92	0.37	0.39	0.13
Max	25.67	6.00	15.27	4.41
Finance (n = 62)				
Mean	4.24	1.40	1.94	0.90
% of total		33.0	45.7	21.3
SD	1.82	0.60	1.24	0.44
Min	0.00	0.00	0.00	0.00
Max	9.13	3.50	5.91	2.06
Pharma and tech (n = 116)				
Mean	7.49	2.40	3.54	1.55
% of total		32.1	47.3	20.7
SD	2.67	1.14	1.57	0.69
Min	2.85	0.14	0.77	0.36
Max	16.33	7.25	9.11	3.82
Industrial (n = 127)				
Mean	5.79	1.78	2.59	1.42
% of total		30.7	44.8	24.5
SD	2.03	0.67	1.21	0.64
Min	1.83	0.00	0.13	0.26
Max	12.58	3.82	6.42	3.62

Table IV.
Descriptive results of content analysis on voluntary IC reporting

Notes: This table shows descriptive results of the content analysis for voluntary IC reporting conducted on 428 German management reports for the accounting year 2010. The findings represent occurrences of voluntary IC reporting per page for IC categories, structural, relational and human capital, for the industry groups, consumer, finance, pharmaceutical and technology and industrial

5.2 Regression results for voluntary IC reporting

The regression results for voluntary IC reporting are presented in Table V with the IC reporting scores per page for total voluntary IC and the IC categories structural, relational and human capital as dependent variables. The independent variables *owner* and *leverage* test *H1* and *H2* on the relationship between IC reporting and information asymmetries towards owners and debtors. Based on the concepts of agency theory, IC reporting is expected to increase with higher proportions of ownership diffusion and leverage, as investors have an increasing need for additional information on IC. The variable *owner* shows no significant results for any IC category and the variable *leverage* only slightly significant results for total voluntary IC reporting, being only significant for human capital reporting. Moreover, ownership diffusion and leverage show negative coefficients which are in opposition to the stated hypotheses and the results of prior literature (Li *et al.*, 2008; Hidalgo *et al.*, 2011). Alternatively, closely held shares by family and employees or block holdings by government or institutional investors have been tested with similar results, which are not shown here. A potential reason for these non-significant results may lie in the

	Total voluntary IC	Structural Capital	Relational Capital	Human Capital
Constant	3.054***	1.784***	1.060***	0.211
owner	−0.095	−0.001	0.000	0.000
leverage	−1.111*	−0.664	−0.001	−0.446***
IC value	0.009	0.029	−0.010	−0.010
mispricing	0.518**	0.295**	0.098	0.124**
size	0.308***	0.143***	0.061***	0.104***
industry				
finance	−2.251***	−1.375***	−0.462***	−0.414***
pharma and tech	1.478***	0.434**	0.698***	0.347***
industrial	−0.734**	−0.746***	−0.085	0.097
Model summary				
R^2	0.217	0.158	0.169	0.209
Adj. R^2	0.202	0.142	0.152	0.193
n	416	416	416	416

Notes: This table shows results for the regression analysis on voluntary IC reporting scores and the IC categories structural, relational and human capital, respectively. IC reporting is measured as occurrences in German management reports related to IC scaled by the number of pages as dependent variable. *,**,***Significant at 10, 5 and 1 per cent levels, respectively

$$ICpp_j = \beta_0 + \beta_1\, owner_j + \beta_2\, leverage_j + \beta_3 IC\ value_j + \beta_4\, mispricing_j + \beta_5\, size_j + \sum \alpha_i\, industry_j + \varepsilon_j$$

Table V.
Regression results for voluntary IC reporting

dominant insider governance system in Germany where debtors have strong influential powers. Therefore, high leverage ratios may encourage active monitoring of IC by lenders without an increased need for additional IC reporting, also discussed by Goebel (2015a).

The variable *IC value* investigates voluntary IC reporting in the light of a company's underlying long-run IC value, testing *H3*. The findings show that IC value is not significantly associated with voluntary IC reporting for any IC category and the coefficients are close to 0. Given the aim of the management reporting regulation to focus on sustainable value creation, this result is in contrast to expectations. This means that IC reporting by German companies is not driven to explain underlying IC value. On the other hand, the variable *mispricing* shows a strong significant association with voluntary IC reporting being relevant for structural and human capital reporting. Hence, the results support *H4* that companies voluntarily report more on IC under the threat of being currently mispriced. The findings support the view of agency theory where IC reporting is used to avoid unrealistic expectations and to justify the allocation of resources in order to encounter mispricing, as suggested by Beattie and Smith (2012). The control variables for size and industry groups are significant for all IC categories, indicating that bigger companies and companies operating in technological industries voluntarily report more on IC.

5.3 Propensity score matching results

In addition to the regression analysis, a propensity score matching is conducted to compare voluntary IC reporting for companies with similar characteristics for developing a high level of IC value across a treatment and a control group, where the treatment group consists of companies within the upper three deciles of LRVTB. This additional test is applied as IC value was expected to be an important driver for voluntary IC reporting, given the regulatory aim to focus on sustainable value creation. The findings of the propensity score matching in Table VI show that there is no significant difference in voluntary IC reporting for high and low IC value. The voluntary IC reporting of companies with a similar

Matching estimators	Treatment	ATT Control	Difference	*t*-statistics (ATT)	*n* Treatment	Control
Radius, calliper $\delta = 0.01$	6.914	6.540	0.374	0.99	122	283
Radius, calliper $\delta = 0.001$	6.851	6.379	0.472	0.80	58	283
Kernel	6.914	6.578	0.336	0.96	122	283
1 nearest neighbour	6.916	6.576	0.340	0.79	123	283
2 nearest neighbours	6.916	6.741	0.175	0.45	123	283
3 nearest neighbours	6.916	6.616	0.300	0.79	123	283
4 nearest neighbours	6.916	6.641	0.275	0.75	123	283
5 nearest neighbours	6.916	6.650	0.266	0.74	123	283

Notes: This table shows the results of the propensity score matching to investigate the association of IC value with voluntary IC reporting. The binary dummy variable for IC value is based on the upper three deciles of LRVTB to determine the treatment group. The average treatment effect on the treated (ATT) shows the difference in IC reporting between the treatment and control group. To ensure robust results, several matching estimators are applied: radius, kernel and nearest neighbour matching. The findings show no significant association between matched units from the treatment and control groups at a 5 per cent significance level. To estimate the propensity score, the following logistic regression model is applied:

$$IC\ value\ dummy_j = \beta_0 + \beta_1\ intangibles_j + \beta_2 R\&D_j + \beta_3 age_j + \beta_4\ payment_j + \beta_5\ ownership_j + \beta_6\ leverage_j + \beta_7\ size_j + \sum \alpha_i\ industry_j + \varepsilon_j$$

Table VI. Propensity score matching results for voluntary IC reporting and IC value

probability to have a high level of IC value is compared across the treatment and the control group. No significant differences in voluntary IC reporting can be found for having a high or low level of IC value. For different matching estimators, the findings remain non-significant. This is consistent with the results of the regression analysis above that the level of IC value is not significantly associated with voluntary IC reporting. Therefore, this propensity score matching approach supports the interpretation that voluntary IC reporting is not provided to explain the actual IC value, although the German management reporting regulation requires reporting for sustainable value creation.

6. Conclusion

The aim of this study is to investigate the drivers of corporate voluntary IC reporting based on the concepts of agency theory. This study accepts the challenge to statistically test hypotheses on IC reporting, thereby contributing to IC research. Germany offers a unique research setting to test the ideas of agency theory for voluntary IC reporting as the German management reporting regulation has the declared aim to reduce the information gap between managers and owners and to focus on sustainable value creation (GASC, 2010a). This study distinguishes voluntary IC reporting given the requirements and recommendations in the management reporting regulation. The results of a software-aided coding content analysis on voluntary IC reporting in German management reports offers a rich data set for hypothesis testing. The content analysis is utilised to investigate the drivers for voluntary IC reporting in a regression analysis and an additional propensity score matching approach.

The findings suggest that mispricing and leverage are significantly associated with voluntary IC reporting. Ownership structure and IC value show no significant relationships to voluntary IC reporting. Given the regulatory requirement to focus on sustainable value creation, IC value was expected to be an important driver for voluntary IC reporting in Germany. However, the non-significant results of the regression analysis and the additional propensity score matching approach indicate that companies do not report on IC in order to

explain underlying IC value. The main driver for voluntary IC reporting seems to be the threat of being mispriced. Corporate IC reporting is apparently used to justify the use of intangible resources to encounter corporate mispricing.

The contribution of this study lies in analysing IC reporting in the light of agency theory. On the one hand, this study elaborates how agency theory as theory of general disclosure can help to explain IC reporting motivations. Prior IC reporting literature has called for testing theories on IC reporting. The theoretical elaborations contribute to the IC literature by linking agency theory to IC reporting. On the other hand, this study contributes to the IC reporting literature by elaborating on an empirical approach for hypothesis testing. The quantitative measures for IC value and mispricing are utilised to investigate drivers for voluntary IC reporting based on agency theory contributing to IC reporting literature.

This study has implications for IC reporting research. As mispricing is found to be a relevant driver for IC reporting research, this study supports Beattie and Smith's (2012) suggestion that companies may report on IC with the intention to correct misvalued share price. Therefore, IC research should consider mispricing to investigate IC reporting. The findings of this study also have practical implications regarding the international framework for integrated reporting (IIRC, 2013). The results show that companies are unlikely to follow the framework's declared aim to report on IC in order to explain value creation. This study may provide a basis for further discussions regarding the aims and motivations of reporting on other forms of capital in the international integrated reporting model.

This study is subject to limitations. The findings indicate that companies are motivated to use voluntary IC reporting under the threat of being mispriced to justify the allocation of resources being used for IC creation. However, an alternative interpretation is possible. Alternatively, the association may imply that markets misinterpret IC reporting which results in mispricing. The causation of reporting and market reactions cannot be concluded from this study. Some results may be particular for the German setting with its insider governance system, as the significantly negative association of leverage and voluntary IC reporting.

The findings of this study lead to suggestions for future research. First, further investigations are needed why companies are not motivated to increase IC reporting in order to reduce the information gap. To find reasons why companies do not use IC reporting to explain IC value, a separate study with a different research design is needed. Potential reasons may be that the owners do not actively demand IC reporting because they may rely on the management reporting regulation. Investigating the reasons may shed light on the needs of IC reporting users and their evaluation of IC reporting. Second, the area of mispricing in IC reporting research requires further investigations. The interpretation of the findings of this study suggests that IC reporting may conversely influence mispricing, leading to other applicable theories, such as behavioural finance approaches. The relationship of IC reporting and mispricing with regard to market reactions offers research opportunities which could be conducted in a long-run study.

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