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The impact of voluntary disclosure on cost of equity capital estimates in a temporal setting

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Abstract

Purpose – This paper aims to investigate the association between the level of voluntary disclosure and cost of equity capital (COEC).

Design/methodology/approach – Two disclosure indices following Botosan and Hail are developed and applied in an OLS regression on 95 listed companies from Austria, Germany, Sweden, and Denmark; the indices are defined according to the temporal context (historical, forward-oriented) of information provided in annual reports.

Findings – An expected negative relationship is found between the level of forward-oriented information and COEC, and an unexpected positive relationship is found between the level of historical information and COEC.

Research limitations/implications – The sample is restricted to 95 listed companies in 2005. The disclosure index and COEC are not directly observable, and thus rely on constructs. Methodological drawbacks might include an endogeneity bias as well as investors not having homogeneous expectations and knowledge about capital markets.

Practical implications – Traditional financial reporting models might not provide enough information in order to reduce information asymmetry and COEC. The findings provide insight into the impact of a required increased level of additional corporate information on corporate metrics, especially to standard setters and academic researchers as well as practitioners.

Originality/value – The current research contributes in three ways: the application of a disclosure index on an international sample; the employment of a new approach to computing COEC, explicitly matching input variables to a pre-specified estimation date; and the provision of evidence on the different impact of the temporal context of voluntarily disclosed information.

Keywords Intellectual capital, Disclosure, Equity capital

Paper type Research paper

Introduction

Voluntary disclosure of decision-useful corporate information is considered to be the first step in solving the alleged problems of traditional financial reporting (Leadbetter, 2000). Its objectives are well defined: closing (or narrowing) the gap between a company's potential intrinsic market value and its current market value (Ruhwedel and Schultze, 2002; Schultze, 2004). The benefits of voluntary disclosure are as follows:

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- it deals with the shortcomings of capital-market oriented traditional financial reporting (including better share pricing); and
- it provides less volatility, less insider trading, and decreases in the cost of equity capital (COEC) (Botosan, 1997; Leadbetter, 2000; Botosan and Plumlee, 2002; Roos *et al.*, 2004; Andriessen, 2004; Riegler and Kristandl, 2004).

Theoretical support comes from two directions:

(1) liquidity-based approaches (i.e. the reduction of information asymmetry increases stock market liquidity (see, for example, Diamond and Verrecchia, 1991; Baiman and Verrecchia, 1995) and estimation risk approaches (i.e. higher disclosure of corporate information lowers estimation risk of unknown corporate parameters; see, for example, Barry and Brown, 1985; Coles and Loewenstein, 1988; Coles *et al.*, 1995); and

(2) the approach espoused by Merton (1987), which states that the uneven distribution of information increases information asymmetry, which leads to higher disclosure levels of the uneven distribution.

Empirical evidence shows that COEC (cost of equity capital) is impacted by variations in disclosure levels, but the inability of observing disclosure level and COEC is a direct hindrance to disclosure-related research (Hail, 2002). Different approaches have included utilising proxies for COEC at first (e.g. bid-ask spreads; see Healy and Palepu, 2001; Welker, 1995), which are directly observable, but might not relate to COEC at all. Botosan (1997) highlighted the direct relationship between COEC and disclosure level, followed by similar studies by Botosan and Plumlee (2002) and Hail (2002). However, lacking direct observability poses a problem for COEC computation in particular, where factor models such as CAPM and the three-factor model by Fama and French (1992) fail to capture risk components related to disclosure (Botosan, 1997; for a general critique, see Black, 1993; Faff, 2004).

In this study, we extend the existing body of literature on the impact of voluntary disclosure on COEC in three ways:

(1) we apply the disclosure index on a sample of four countries (instead of the traditional focus on one market);

(2) we apply a COEC approach that allows for the exact matching of the estimates to a pre-specified date; and

(3) we emphasize the rising importance of context-specific voluntary disclosure research by establishing different temporal settings of voluntarily disclosed information and their impact on COEC.

In the course of this paper, we construct our own disclosure index VRSCORE (i.e. two separate indices referring to either a historical or forward-oriented setting), and then we estimate COEC using an implied approach recently developed by Daske *et al.* (2006). The association between disclosure level and COEC is then tested in a multivariate analysis, controlling for company size and sector affiliation of the sample companies. The results are partly unexpected: whereas the expected negative relation between disclosure quality and COEC is found for forward-oriented information (an increase in the level of forward-oriented information is associated with a decrease in COEC by

0.015 percent), this is reversed for historical information (an increase by 1 percent is associated with an increase in COEC by approximately 0.029 percent).

Hypothesis development

The deliberations above lead to the following hypothesis:

H1. There is a negative association between COEC and the level of voluntary disclosure.

This again is divided into two sub-hypotheses:

H1a. There is a negative association between COEC and the level of voluntary disclosure dealing with corporate information in a historical context.

H1b. There is a negative association between COEC and the level of voluntary disclosure dealing with corporate information in a forward-oriented context.

Methodology – the disclosure index VRSCORE

Disclosure indices have been applied in academic research since the beginning of the 1970s (see Marston and Shrives, 1991, p. 195; for proof of their extensive use, see also Singhvi and Desai, 1971; Buzby, 1975; Firth, 1979). The first step in developing a disclosure index lies in the methodology of content analysis, which investigates an information carrier such as corporate (annual) reports. Content analysis is a "research technique for making replicable and valid inferences from texts [. . .] to the contexts of their use" (Krippendorff, 2004), where recent disclosure literature has clearly shown its suitability for disclosure-related questions, especially when dealing with narratives rather than financial statements. It becomes apparent that subjective judgement is needed in order to interpret such information (Hail, 2002). Weighting the items in the index is another aspect; whereas early studies have applied weighted indices (e.g. Cerf, 1961; Buzby, 1974; Buzby, 1975), later research used unweighted indices, claiming that weights would add additional noise to the index (e.g. Cooke, 1989; Botosan, 1997; Hail, 2002; Chow and Wong-Boren, 1987 applied both weighted and unweighted indices, arriving at the same results). Since computing weights would infer the need to apply surveys to a target group, and thus depending on their judgement of causality between indicator and decision-usefulness, we computed VRSCORE as an unweighted index, eliminating a further and unnecessary biased outcome.

Description of VRSCORE

The purpose of VRSCORE (see Figure 1) is to measure and rank the level of corporate disclosure on an ordinal scale according to the score achieved. The selection of items to be included stems from 28 different sources dealing with the importance of specified items or list of items to users of corporate information. These contributions were either dealing with voluntary disclosure frameworks (e.g. Schmalenbach Gesellschaft Work

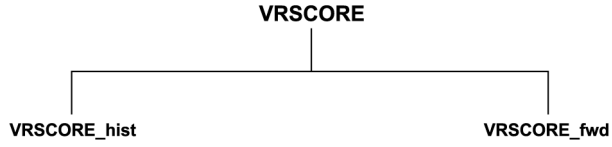

Figure 1.
Components of VRSCORE

Group on Financial Accounting, 2002; Danish Ministry of Science, Technology and Innovation, 2003a, b, c), disclosure indices (e.g. Botosan, 1997), management and measurement systems with a reporting option (e.g. Kaplan and Norton, 1996; Edvinsson and Malone, 1997; Sveiby, 1998; Bontis, 2003), or selected items not represented by financial reporting standards (e.g. Aboody and Lev, 1998; Brynjolfsson and Yang, 1999). After aggregating the suggested items, they were allocated to three main categories following a suggestion of the Schmalenbach Gesellschaft Work Group on Financial Accounting (2002):

(1) capital-market based information relates to the financial and earnings position of a company in order to provide investors with data for their own forecasts as well as the possibility to compare past results;

(2) information about intellectual capital and intangibles consists of a company's innovation capability, intangible assets, customer assets, supplier relationships, location, human capital, investor relations, and process capital; and

(3) information about corporate strategy and performance consists of the value-adding activities and measurements of a company (e.g. value-added reporting performance metrics such as DCF or EVA), and the strategies and competitive advantages of a company (e.g. strategic advantage reporting; SWOT analyses, competitive environment; Müller, 1998; Fischer, 2002).

The master list consisted of a total of 175 items. Within each category, we selected only items that were employed by 14 or more of the 28 sources (i.e. the cut-off at 50 percent within each category), resulting in 19 items as listed in Table I.

Category I: capital market based information	Market capitalisation
	Price-earnings ratio
	Relative performance of stock
	Stock return
	Stockholder pattern
Category II: intellectual capital	Sales of and revenues from patents, new product, and services (innovation capital)
	Qualification of employees (human capital)
	R&D expenses (innovation capital)
	Portfolio of patents and similar intellectual property rights (innovation capital)
	Fluctuation (human capital)
	Customer satisfaction (customer capital)
	Market share (customer capital)
	Training costs (human capital)
	Customer retention (customer capital)
	Employee satisfaction (human capital)
	Listing of (relevant) brands, brand portfolio (innovation capital)
Category III: strategy and performance	Description of value drivers
	Profitability measures
	Description of corporate strategy

Table I.
Components of VRSCORE

Following *H1*, we computed two disclosure indices, containing the same items, but with a different time reference, thereby following recent results of studies by Beattie *et al.* (2002) and Beattie and Thomson (2005).

Coding these items on a scale from 1 (qualitative, unspecified) to 4 (quantitative, specified), VRSCORE measures disclosure level as the sum of scores earned by a company, and is computed as follows:

$$\text{VRSCORE}_{k,n} = \sum_{m=1}^{M} \text{score}_{k,n,m}, \tag{1}$$

where score k,n is the score for time-reference k (past, forward) referring to company n for any indicator in VRSCORE. The scores for m reported indicators are then added up to a sum within each time-reference. In line with Botosan (1997) and Hail (2002), a fractional disclosure rank DRANK is computed for each temporal context by dividing the resulting rank of a company by the number of companies within the sample, with the lowest score being awarded rank number 1. This ensures that DRANK is increasing in disclosure level.

The application of DRANK rather than VRSCORE is justified for the following reasons (Botosan, 1997; Hail, 2002):

- It cannot be stated for sure that the absolute VRSCORE values are related to COEC in a straight-line; such a statement would be highly doubtful. Thus, it makes sense to replace VRSCORE by a DRANK, where the underlying scoring model merely determines the basis for the ranking procedure.
- This triggers two debatable but necessary assumptions: there needs to be an ordinal relation between COEC estimates and the disclosure level as depicted by DRANK; and the differences between any two values of DRANK is not as important as a higher disclosure rank. This allows for an easier interpretation of the coefficients on DRANK: a company achieving a higher disclosure level (with a higher rank) is expected to show a decrease in its COEC.
- Results are less biased by the underlying scoring model, merely providing the basis for the ranking; a rank variable is less sensitive to outliers and improves the explanatory value of the resulting coefficients.
- DRANK is the only disclosure measure so far which has been applied by two different disclosure studies (Botosan, 1997; Hail, 2002); applying DRANK enables a higher degree of comparability to previous research.
- DRANK increases in disclosure level. A company has therefore three alternatives in order to improve its rank: disclose more information (quantity); disclose information with a higher quality; or combine quantity and quality. This improves a company's rank, thus creating a strategic incentive to disclose on an improved level.

Both indices can thus be defined as follows:

- VRSCORE is an international, unweighted voluntary disclosure index, following the value reporting structure suggested by the Schmalenbach Gesellschaft, and is not directed toward any specific user group. Its purpose is to produce a cross-sectional ranking with regards to disclosure quality and quantity in annual

reports of listed companies. VRSCORE comprises two time-related, exclusive sub-indices, measuring voluntary disclosure level with regards to historical and forward-oriented settings.

- DRANK is the fractional disclosure rank resulting from each VRSCORE (historical, forward-oriented). It increases in disclosure level, and is less sensitive to outliers. In addition, it controls for the notion that there might not be a straight-line relationship between disclosure level and COEC.

Descriptive statistics for VRSCORE and DRANK

Table II provides information on descriptive statistics of VRSCORE and DRANK for the full sample. From the final sample of 95 companies, the least forthcoming provide a disclosure level for information in a historical and forward-oriented context, respectively, of at least 16/0, with a mean of 57/6 and a maximum disclosure level of 118/25.

Validity of VRSCORE and DRANK

Since the scoring procedure depends largely on subjective judgement and perception by the coder (Hail, 2002), proving the validity of VRSCORE is crucial. In the absence of multiple coders, we show its validity using Cronbach's alpha (see, for example, Botosan, 1997), which measures the internal consistency of the items enclosed in VRSCORE. As a rule of thumb, its value should be greater than 0.7 as evidence of reliable results (e.g. Bernardi, 1994). Categories I and II were within the abovementioned range with 0.95 and 0.73, respectively. Category III posed a problem with an alpha of only 0.232, indicating a potential invalidity in this category. According to Streiner (2003), this must not necessarily be the case since "one must not assume that all measures must exhibit homogeneity among the items" (Streiner, 2003); if the items selected can depict the universe of possible items, they should be positively correlated to each other, which is the case for category III (Streiner, 2003). Additionally, we run the univariate and multivariate regression analysis with VRSCORE indices excluding category III, causing R^2 to drop from 16.5 percent to 8.2 percent, indicating a high contributory value to the whole index, and justifying the inclusion of category III. Nevertheless, the results need to be interpreted with caution.

Dependent variable – cost of equity capital

Previous empirical evidence has added to the notion that a higher level of voluntary disclosure does influence COEC (e.g. Botosan, 1997; Botosan and Plumlee, 2002; Hail, 2002). In order to compute COEC, we apply the approach of Daske *et al.* (2006). As

Table II. Descriptives of VRSCORE and DRANK (sub-indices and full index)

	n	Minimum	Maximum	Mean
VRSCORE historical	95	16	118	57
DRANK historical	95	0.0105	1	0.4996
VRSCORE forward	95	0	25	6
DRANK forward	95	0.0105	1	0.4659
VRSCORE full	95	17	201	76
DRANK full	95	0.0105	1	0.5017

opposed to factor approaches like CAPM, implied COEC approaches do not need to deal with identifying all the risk factors with a potential influence on COEC. These approaches might not be suitable for questions regarding disclosure issues at all.

These estimates use forecasted data instead of historical data (for *ex ante* approaches, see Gebhardt *et al.* 2001; Reese, 2005). Putting forecasted data into company valuation models, the implied COEC equals "the discount rate the market applies to a firm's expected future cash flows to arrive at current stock price" (Botosan and Plumlee, 2002), where this rate is not directly observable. These models are in better accordance with the definition of COEC than factor models, including the valuation purpose of a company (e.g. Botosan and Plumlee, 2002; Reese, 2005).

Methodology – cost of equity capital estimation

The model we apply is a residual income valuation model (RIVM), starting with a basic dividend discount model (DDM), i.e.:

$$P_t = \sum_{\tau=1}^{\infty} \frac{E_t[\mathrm{dps}_{t+\tau}]}{(1+r_e)}, \tag{2}$$

where $E_t[\mathrm{dps}_{t+\tau}]$ is the expected dividend per share at time t, r_e is the return on equity (COEC estimate), P_t is assumed to be the "best available empirical proxy for a stock's intrinsic value", and the discounted expected dividends are equal to the present value of P_t.

Ohlson (1995) and Feltham and Ohlson (1995) introduced the clean-surplus relation (CSR), where the book value in period t consists of the book value in the previous period modified by the difference in earnings and dividends paid at the end of period t:

$$bv_t = bv_{t-1} + x_t - d_t, \tag{3}$$

where bv_t is the book value of equity in period t, x_t is the earnings for period t, and d_t is the dividends paid for period t.

Using the CSR in equation (3), the DDM can be remodelled into the Edwards-Bell-Ohlson equation, where P_t equals the current book value of equity b_t in addition to the present value of discounted residual income ($x_t - r_e{*}bv_{t-1}$), i.e. the difference between current book and market value is explained with the present value of residual income (Fischer, 2003), expressed as:

$$P_t = bvps_t + \sum_{\tau=1}^{T} \frac{E_t[x_{t+\tau} - r_e{*}bvps_{t+\tau-1}]}{(1+r_e)^{\tau}} + \frac{E_t[TV_T]}{(1+r_e)^{T}}, \tag{4}$$

where bv_t is the book value of equity in period t, xt is the earnings for period t, and r_e is the COEC.

Equation (4) represents the basis for all RIVM for the calculation of cost of capital. The approach relies on residual income and is therefore dependent on information coming from the balance sheet and income statements rather than dividends (Fischer, 2003).

Apparently, the equation in its infinite form is empirically not feasible, triggering the need to replacing infinity with a terminal value estimate after the detailed forecast period (for an in-depth discussion, see Botosan and Plumlee, 2002). We follow the approach suggested by Daske *et al.* (2006) in a modification of Gebhardt *et al.* (2001),

stating that it relies on "measures of ex ante (expected) returns" (Gebhardt *et al.*, 2001) instead of average realized returns.

In order to solve the infinity problem, the authors divide the RIVM as depicted in equation (4) into three stages:

(1) an explicit forecast period, where detailed earnings per share forecasts for the next five years are necessary;

(2) a fading period from period 6 to 11, where future earnings per share and future book value per share are computed with the CSR; and

(3) the terminal value, where the present value of residual income in period 12 is assumed to be growing with a constant growth rate – any growth after year 12 is assumed to be value neutral, assuming that no company is able to outperform its industry peers in the long run (Daske *et al.*, 2006; Gebhardt *et al.*, 2001).

All the information needed stems from public sources at a specific estimation date:

$$
\begin{aligned}
P_t = {} & bvps_0{*}(1 + E_t[\mathrm{ROE}_1])^{\frac{\mathrm{days}(0,t)}{365}} \\
& + \frac{feps'_t\left[(1+r_e)^{\frac{\mathrm{days}(t,\ \text{fiscal year end 1})}{365}} - 1\right]{*}bvps_0{*}(1 + E_t[\mathrm{ROE}_1])^{\frac{\mathrm{days}(0,t)}{365}}}{(1+r_e)^{\frac{\mathrm{days}(t,\ \text{fiscal year end 1})}{365}}} \\
& + \sum_{n=2}^{5} \frac{feps_{t,n} - r_e{*}E_t[bvps_{n-1}]}{(1+r_e)^{\frac{\mathrm{days}(t,\ \text{fiscal year end}\ n)}{365}}} + \sum_{n=6}^{11} \frac{(E_t[\mathrm{ROE}_n] - r_e){*}E_t[bvps_{n-1}]}{(1+r_e)^{\frac{\mathrm{days}(t,\ \text{fiscal year end}\ n)}{365}}} \\
& + \frac{(E_t[\mathrm{ROE}_{12}] - r_e){*}E_t[bvps_{11}]}{r_e{*}(1+r_e)^{\frac{\mathrm{days}(t,\ \text{fiscal year end 11})}{365}}},
\end{aligned}
\tag{5}
$$

where $E_t[.]$ is the expectations operator based on information available at time t; P_t is the price per share at estimation date t; $E_t[bvps_n]$ is the expected book value per share for the nth full fiscal year after t at estimation date t; $feps'_t$ is the adjusted forecast earnings per share for the current fiscal year at estimation date t; $feps_{t,n}$ is the forecasted earnings per share for the nth full fiscal year after estimate date t; r_e is the COEC; days (t, year(n)) is the number of days between estimation date t and the nth full fiscal year's end; and ROE_1 is the return on equity for period 1.

The approach of Daske *et al.* (2006) requires some modifications in the explicit forecast and fading period in order to match the forecasted earnings per share and the book value per share data in year 1 to the estimation date; we followed the specifications as provided by Daske *et al.* (2006), and computed COEC estimates for the five month ends following the fiscal year end and took the median for two reasons:

(1) all of the sample companies have published their annual reports by the end of month five; and

(2) since it is assumed that information about the company leaks out before the publication date, the full effect of the information disclosed on capital markets should be observable in share prices within these five months – the median controls for extreme outliers and is assumed to have incorporated any information which might be provided in the annual report (see Table III).

Table III. Residual income valuation model for AdidasSalomon, estimation date 31 May 2005

Annual report	31 Dec 2004	31 Dec 2005	31 Dec 2006	31 Dec 2007	31 Dec 2008	31 Dec 2009				
Input parameters per share										
FEPS as of 31 May 2005	5.36									
BVPS as of 31 Dec 2004	35.83									
BVPS as of 31 Dec 2005	39.22									
Estimation	1	2	3	4	5	6	7	8	9	10
			Forecast period					Fading period		
	31 Dec 2005	31 Dec 2006	31 Dec 2007	31 Dec 2008	31 Dec 2009	31 Dec 2010	31 Dec 2011	31 Dec 2012	31 Dec 2013	31 Dec 2014
FEPS	8.75	9.87	10.86	11.68	12.40	14.03	15.83	17.81	19.98	22.33
FDPS	1.83	1.98	2.48	2.00	1.77	2.00	2.25	2.54	2.84	3.18
FBVPS	42.95	50.84	59.22	68.90	79.53	91.57	105.15	120.42	137.55	156.70
FROE (percent)	24.42	22.98	21.36	19.72	18.00	17.65	17.29	16.94	16.59	16.24
Residual return (ROE $-$ r) (percent)	14.94	13.50	11.88	10.25	8.52	8.17	7.81	7.46	7.11	6.76
Residual income	3.22	5.80	6.04	6.07	5.87	6.50	7.16	7.85	8.56	9.29
Discount factor	0.95	0.87	0.79	0.72	0.66	0.60	0.55	0.50	0.46	0.42
PV of residual income as of 31 May 2005	3.06	5.02	4.78	4.38	3.87	3.92	3.94	3.95	3.93	3.90
Sum of residual income	88.18									
Fundamental value of residual income model as of 31 May 2005	127.40									
Cost of equity capital r (percent)	9.48									
Risk premium (r $-$ risk free rate of return)	5.44									
Data										
Book value of equity	1,628.45									
Number of shares outstanding	45.45									
Days until year end from 31 May 2005	214	365								
Year	2005	2006	2007	2008	2009					
FEPS	8.75	9.87	10.86	11.68	12.4					
DPS	1.63	1.98	2.48	2.00	1.77					
Payout ratio (percent)	14.24									
TROE (percent)	15.53									
Riskless rate of return (percent)	4.04									
Long-term growth rate	10									
Share price as of 31 May 2005	127.40									

Sample selection and description

The sampling procedure focused on countries within the European Union, including listed companies from Austria, Germany, Sweden, and Denmark. These countries have been selected as being considered at the forefront of voluntary disclosure initiatives, providing high standards in financial reporting, as well as an abundance of suggestions on voluntary disclosure frameworks (Danish Ministry of Science, Technology and Innovation, 2003a, b, c; Schmalenbach Gesellschaft Work Group on Accounting and Reporting of Intangible Assets, 2003; Leitner, 2005). The sectors selected for this analysis are materials, industrials, consumer discretionary, consumer staples, health care, and the combined sector telecommunication/information technology (TS/IT). The financial sector was discarded due to different accounting rules applying for this sector only (see Stromann, 2003; Hail, 2002).

The analysis is limited to one year, including annual reports from 2004, published in 2005 (see Botosan, 1997; Fischer, 2003; Hail, 2002). This is justifiable since companies keep their disclosure levels relatively constant over time (Botosan, 1997). Annual reports were selected following the empirical results in Lang and Lundholm (1993), who found a significant rank-order correlation between annual reports and other venues of corporate information (Lang and Lundholm, 1993; Botosan, 1997; Hail, 2002); however, since the correlations are not 1, the annual report might not be a powerful enough proxy for overall corporate disclosure (Botosan, 1997). This leads to the final sample shown in Table IV, while Table V provides the descriptive statistics for the COEC estimates. There were no cases with negative COEC estimates, which is in line with the results of Daske *et al.* (2006).

Empirical results – univariate and multivariate results

Table VI provides Spearman correlation coefficients between COEC, the disclosure indices, and several company characteristics. In order to be valid, COEC should be

Description	No.	Percent
Full sample for Austria, Germany, Sweden and Denmark according to MSCI	123	100
Shares outstanding data missing	−2	1.62
Share price data missing	−4	3.25
Book value missing	−3	2.43
Companies without two to five future EPS estimators, two future EPS estimators and long-term growth	−11	8.94
Insolvency forecasts/negative book value of equity	−1	0.81
Sample after COEC estimates	102	82.93
Eliminated outliers in multivariate regression analysis	−7	5.69
Final sample	95	77.24

Table IV.
Sample after elimination due to COEC requirements

	Descriptive statistics				
	n	Minimum	Maximum	Mean	SD
Cost of equity capital	95	0.042	0.166	0.10069	0.022792

Table V.
Descriptive statistics for sample firms for COEC estimates

increasing in beta (Botosan, 1997; Hail, 2002). Although the correlations are not significant they are positive, as expected (see Gebhardt *et al.*, 2001; Hail, 2002; Daske *et al.*, 2006). The correlation coefficient of 0.061 is comparable to those derived by Daske *et al.* (2006), i.e. 0.060.

Also in step with the results from Daske *et al.* (2006), beta shows no significant correlation with the other company characteristics. This might stem from both the beta measure itself, the capital structure in the sample countries (Hail, 2002), or the methodology of implied COEC estimates in general.

The correlation between COEC estimates and the disclosure indices show the expected negative correlation with DRANK forward-looking; however, the positive correlation between DRANK historical information and the COEC was unexpected (Botosan and Plumlee, 2002, arrived at a comparable result). This will be addressed again below. The signs of all other correlations (including risk premium lag) with COEC turned out as expected.

Interpretation – *H1*

A multivariate analysis is necessary in order to analyse the combined influence of the variables on COEC (Gebhardt *et al.*, 2001):

$$rp_i = \beta_0 + \beta_1 \text{DRANK\_HIST} + \beta_2 \text{DRANK\_FWD}_i + \beta \text{LNSIZE}_i + \beta_4 + \text{RPLAG} + \varepsilon_i. \quad (6)$$

Table VII shows the estimated coefficients for the year 2005. Every model includes adjusted R^2, F-statistics, and the standard error of residuals as well as the number of observations after the elimination of outliers. Model 1 includes the two time-related disclosure indices DRANK historical and DRANK forward-oriented.

DRANK forward-oriented shows a negative relationship with COEC. As the results from Model 1 imply, a one-unit improvement in forward-oriented disclosure quality is associated with a decrease in COEC of approximately 0.015 per cent. This effect is mitigated in comparison to Fischer (2003), who found that an increase in disclosure index would result in a decrease of COEC by 0.08 percent, and Hail (2002), who found a decrease of 0.1 percent for every unit increase in his disclosure index DISC. Botosan (1997), on the other hand, found that a one-unit increase in her DSCORE index would is associated with a decrease in COEC of 0.28 percent.

DRANK historical confirms the unexpected positive relationship with COEC found above. A one-unit increase of DRANK historical is associated with an increase in COEC by 0.029 percent. We find a reversed effect of a higher disclosure level, a result also

	COEC	DRANK historical	DRANK forward-oriented	ln_size	Risk premium lag
DRANK historical	0.206				
DRANK forward-oriented	−0.143	0.320			
ln_size	−0.088	0.271	0.167		
Risk premium lag	0.215	−0.048	−0.205	0.020	
Beta	0.061	−0.020	−0.025	−0.019	0.381

Table VI.
Spearman correlation coefficients

Table VII.
Linear regression of COEC estimates on time-related DRANKs, company size, and risk premium lag (Model 1)

	Dependent variable: cost of equity capital
Intercept	0.108***
DRANK_hist	0.029***
DRANK_fwd	−0.015*
LNSIZE	−0.003**
RPLAG	0.639**
Adjusted R^2 (percent)	16.5
F	5.636
SE	0.0208
n	95

Notes: $\text{coec}_i = \beta_0 + \beta_1\text{DRANK\_HIST}_i + \beta_2\text{DRANK\_FWD}_i + \beta_3\text{LNSIZE}_i + \beta_4\text{RPLAG}_i + \varepsilon_i$.
*Significance p-value < 0.1; **significance p-value < 0.05; *significance p-value < 0.01

found by Botosan and Plumlee (2002). Explanations for this result need to be searched for outside the model, both theoretically and methodologically. One explanation might be an interaction of historical and forward-oriented information. Forward-oriented information consists mainly of projected information with uncertain outcomes. Whereas the capital-market has awarded a lower cost of equity to companies with a higher level of forward-oriented information (an *ex ante* bonus), it might penalise the company when the projected outcome did not occur as reported in an earlier period. Thus, historical information which "admits" an erroneous projection might be awarded with a higher cost of capital, correcting for the previous benefit. Another explanation might be found in liquidity-based theory, where a higher disclosure level reducing information asymmetry has been challenged by research. Certain circumstances yet to be discovered might reverse the assumed effect of voluntary disclosure, namely increase information asymmetry, resulting in higher COEC. Kim and Verrecchia (1994) suggest that public disclosure that may have no private alternative source, and may lead to different interpretations of a company's performance by capital market participants, may lead to an increase in information asymmetry (Kim and Verrecchia, 1994). Due to different information processing activities by investors, they seem to differ in their incentives for processing public into private information. Investors who own the ability of making their own (informed) judgements about a company's performance based on publicly available information in addition to the low cost of doing so increase information asymmetry between them and those investors who are either unable to make informed judgements or who have a higher threshold cost of engaging in such activities.

Methodologically, Nikolaev and Van Lent (2005) find a reason for a general empirical inconsistency in a possible endogeneity bias, where the disturbance term is correlated with one or more independent variables in the equation. Hail (2002) and Nikolaev and Van Lent (2005) find that within the endogeneity bias, omitted unobservable variables may partially cause empirically inconsistent results. First, an unobservable omitted variable might impact both sample company and the dependent variable alike, violating the randomness of the sample (self-selection bias) (see also Leuz and Verrecchia, 2000). Hail (2002) attempted to control for this self-selection bias

by introducing disclosure level as an endogenous variable in a 2SLS regression, trying to express disclosure level as a function of size, return, stock listing status, financial leverage, and audit firm size. However, Hail (2002) admits that this approach might lead to statistically unsound estimates, with a consistently lower explanatory value in terms of R^2 in comparison with an exogenously introduced disclosure level, a turned-insignificant size variable, and its delimitation to large samples. In our analysis, a self-selection bias would have only occurred when disclosure level would impact both COEC and sample selection procedures, which seems highly unlikely here. A second cause of endogeneity might lie in a company-specific heterogeneity (Nikolaev and Van Lent, 2005), where company-specific characteristics might be unobservable to the empiricist, such as managerial ability or employee skills, assumed to be approximately constant over time. Nikolaev and Van Lent (2005) suggest either panel data and fixed-effects regressions, or an instrumental variable technique. Panel data, however, is only available in a longitudinal study. The instrumental variable is rejected by Nikolaev and Van Lent (2005) for its high vulnerability to misleading results, since the unobservable disturbance term cannot be tested, and the required high correlation with the explanatory variable would be difficult to justify from practice. Nevertheless, the discussion above shows that the unexpected positive relationship might be due to unobserved omitted variables, again indicating that the results need to be taken with caution, and within all limitations.

Table VIII recapitulates the findings for *H1*.

Conclusion and outlook

This study extends the existing body of literature in three ways:

(1) a disclosure index has been applied on several sample countries;

(2) an approach to COEC providing explicit matching of input variables to a pre-specified estimation date is applied; and

(3) evidence on the importance of temporal context of voluntarily disclosed information and its different impact on COEC is observed and provided for the first time, thus emphasising the importance of context-specific voluntary disclosure research.

The findings show that the expected negative relationship between COEC and disclosure level might not be as straightforward as initially assumed. Whereas the expected significant relationship between forward-oriented disclosure and COEC was found, the results for historical information were significantly positive.

Hypothesis	Assumed relationship	Actual relationship	Hypotheses therefore …
H1a	Negative association between DRANK historical and COEC	Positive, significant relationship with COEC	Rejected
H1b	Negative association between DRANK forward-oriented and COEC	Negative, significant relationship with COEC	Confirmed

Table VIII.
Hypothesis testing

Thus we conclude that:

- an impact of voluntary disclosure on COEC estimates has been confirmed;
- COEC is negatively associated with forward-oriented disclosure and positively associated with historical voluntary disclosure;
- Kim and Verrecchia (1994) provide analytical evidence that disclosure focused on different temporal contexts might represent such a situation; and
- the results might be influenced by an endogeneity bias – a subsequent discussion has shown that there might be a mitigated self-selection bias, indicating the possibility of omitted unobservable variables.

These results need to be regarded with caution. Both implied COEC and disclosure level are constructs and are not directly observable; the relatively small sample size and the focus on one year define the need for further research in order to confirm the results. Future research might apply the different temporal settings of voluntarily disclosed information over several periods, where forward-oriented information in one year becomes historical in the following years, which also calls for dynamic analytical models. The explanations provided by Kim and Verrecchia (1994) hint at investors with different expectations and knowledge about a company. In the presence of institutional investors trading for liquidity and arbitrage, some shares might be more liquid than others. Different COEC estimation approaches might be applied in order to test for different outcomes depending on the approach selected; the disclosure index might also be tested on larger samples (cross-sectional as well as inter-temporal), or tailor-made for specific industries, allowing not only for specific indicators, but specific indicator combinations, as well as different scoring models. The contribution of this paper thus lies not only in showing a new setting within which voluntary disclosure should be investigated, but also in opening new venues for future research, and therefore taking the next step in voluntary disclosure research, especially with regards to intellectual capital.

References

Aboody, D. and Lev, B. (1998), "The value relevance of intangibles: the case of software capitalization", *Journal of Accounting Research*, Vol. 36, Supplement, pp. 161-91.

Andriessen, D. (2004), *Making Sense of Intellectual Capital*, Butterworth-Heinemann, Oxford.

Baiman, S. and Verrecchia, R. (1995), "Earnings and price-based compensation contracts in the presence of discretionary trading and incomplete contracting", *Journal of Accounting and Economics*, Vol. 20, pp. 93-121.

Barry, C. and Brown, S. (1985), "Differential information and security market equilibrium", *Journal of Financial and Quantitative Analysis*, December, pp. 407-22.

Beattie, V. and Thomson, S.J. (2005), "Lifting the lid on the use of content analysis to investigate intellectual capital disclosures in corporate annual reports", paper presented at the 1st Workshop on Visualising, Measuring, and Managing Intangibles and Intellectual Capital, Ferrara University, Ferrara, 18-20 October.

Beattie, V., McInnes, B. and Fearnley, S. (2002), *Through the Eyes of Management: A Study of Narrative Disclosures*, Institute of Chartered Accountants in England and Wales, London.

Bernardi, R.A. (1994), "Validating research results when Cronbach's alpha is below 0.70: a methodological procedure", *Educational and Psychological Measurement*, Vol. 54 No. 3, pp. 766-75.

Black, F. (1993), "Beta and return", *Journal of Portfolio Management*, Vol. 20, pp. 8-18.

Bontis, N. (2003), "Intellectual capital disclosures in Canadian corporations", *Journal of Human Resource Costing and Accounting*, Vol. 7 Nos 1/2, pp. 9-20.

Botosan, C. (1997), "Disclosure level and the COEC", *The Accounting Review*, Vol. 72 No. 3, pp. 323-49.

Botosan, C.A. and Plumlee, M.A. (2002), "A re-examination of disclosure level and the expected COEC", *Journal of Accounting Research*, Vol. 40 No. 1, pp. 21-40.

Brynjolfsson, E. and Yang, S. (1999), "The intangible costs and benefits of computer investments: evidence from the financial markets", working paper, MIT Sloan School/Stanford Graduate School of Business, Cambridge, MA/Stanford, CA.

Buzby, S.L. (1974), "Selected items of information and their disclosure in annual reports", *The Accounting Review*, Vol. 49 No. 3.

Buzby, S.L. (1975), "Company size, listed versus unlisted stocks, and the extent of financial disclosure", *Journal of Accounting Research*, Vol. 13 No. 1, pp. 16-37.

Cerf, A.R. (1961), *Corporate Reporting and Investment Decisions*, University of California Press, Berkeley, CA.

Chow, C.W. and Wong-Boren, A. (1987), "Voluntary financial disclosure by Mexican corporations", *The Accounting Review*, Vol. 62 No. 3, pp. 533-41.

Coles, J. and Loewenstein, U. (1988), "Equilibrium pricing and portfolio composition in the presence of uncertain parameters", *Journal of Financial Economics*, pp. 279-303.

Coles, J., Loewenstein, U. and Suay, J. (1995), "On equilibrium pricing under parameter uncertainty", *Journal of Financial and Quantitative Analysis*, September, pp. 347-64.

Cooke, T.E. (1989), "Voluntary corporate disclosure by Swedish companies", *Journal of International Financial Management and Accounting*, Vol. 1, pp. 171-95.

Danish Ministry of Science, Technology and Innovation (2003a), *Intellectual Capital Statements – The New Guideline*, Danish Ministry of Science, Technology and Innovation, Copenhagen.

Danish Ministry of Science, Technology and Innovation (2003b), *Analysing Intellectual Capital Statements*, Danish Ministry of Science, Technology and Innovation, Copenhagen.

Danish Ministry of Science, Technology and Innovation (2003c), *Intellectual Capital Statements in Practice – Inspiration and Good Advice*, Danish Ministry of Science, Technology and Innovation, Copenhagen.

Daske, H., Gebhardt, G. and Klein, S. (2006), "Estimating the expected COEC using analyst's consensus forecasts", *Schmalenbach Business Review*, Vol. 58, pp. 2-36.

Diamond, D. and Verrecchia, R. (1991), "Disclosure, liquidity and the COEC", *The Journal of Finance*, September, pp. 1325-60.

Edvinsson, L. and Malone, M.S. (1997), *Intellectual Capital: Realizing Your Company's True Value by Finding its Hidden Brainpower*, HarperCollins, New York, NY.

Faff, R. (2004), "A simple test of the Fama and French model using daily data: Australian evidence", *Applied Financial Economics*, Vol. 14, pp. 83-92.

Fama, E.F. and French, K.R. (1992), "The cross-section of expected stock returns", *Journal of Finance*, Vol. 47, pp. 427-65.

Feltham, G.A. and Ohlson, J.A. (1995), "Valuation and clean surplus accounting for operating and financial activities", *Contemporary Accounting Research*, Vol. 11 No. 2, pp. 689-731.

Firth, M. (1979), "The impact of size, stock market listing, and auditors on voluntary disclosure in the corporate annual reports", *Accounting and Business Research*, Autumn, pp. 273-80.

Fischer, A. (2003), *Shareholder Value Reporting mittels jahresabschlussergänzender Angaben: Untersuchung ökonomiker Wirkungsweisen der Investor Relations im Rahmen einet wertorientierten Unternehmungsführen*, Paul Haupt, Bern/Stuttgart/Wien.

Fischer, T.M. (2002), "ZP-Stichwort: value reporting", *Zeitschrift für Planung*, Vol. 13, pp. 211-16.

Gebhardt, W.R., Lee, C.M.C. and Swaminathan, B. (2001), "Toward an implied cost of capital", *Journal of Accounting Research*, Vol. 39 No. 1, pp. 135-76.

Hail, L. (2002), "The impact of voluntary corporate disclosures on the *ex-ante* cost of capital for Swiss firms", *The European Accounting Review*, Vol. 11 No. 4, pp. 741-73.

Healy, P. and Palepu, K. (2001), "Information asymmetry, corporate disclosure, and capital markets: a review of empirical disclosure literature", *Journal of Accounting and Economics*, Vol. 31 Nos 1-3, pp. 405-40.

Kaplan, R.S. and Norton, D.P. (1996), *The Balanced Scorecard*, Harvard Business School Press, Boston, MA.

Kim, O. and Verrecchia, R.E. (1994), "Market liquidity and volume around earnings announcements", *Journal of Accounting and Economics*, Vol. 17 Nos 1/2, pp. 41-67.

Krippendorff, K. (2004), *Content Analysis. An Introduction to its Methodology*, Sage Publications, Thousand Oaks, CA.

Lang, M. and Lundholm, R. (1993), "Cross-sectional determinants of analyst ratings of corporate disclosures", *Journal of Accounting Research*, Vol. 31, pp. 246-71.

Leadbetter, C. (2000), *New Measures for the New Economy*, Institute of Chartered Accountants in England and Wales, London.

Leitner, K.H. (2005), "Managing and reporting intangible assets in research technology organisations", *R&D Management*, Vol. 35 No. 2, pp. 125-36.

Leuz, C. and Verrecchia, R. (2000), "The economic consequences of increased disclosure", *Journal of Accounting Research*, Vol. 38 No. 3, pp. 91-124.

Marston, C.L. and Shrives, P.J. (1991), "The use of disclosure indices in accounting research: a review article", *British Accounting Review*, Vol. 23, pp. 195-210.

Merton, R. (1987), "A simple model of capital market equilibrium with incomplete information", *The Journal of Finance*, Vol. 42 No. 3, pp. 483-510.

Müller, M. (1998), "Shareholder Value Reporting – ein Konzept wertorientierter Kapitalmarktinformation", in Müller, M. and Leven, F.J. (Eds), *Shareholder Value Reporting*, Ueberreuter Wirtschaft, Vienna, pp. 123-44.

Nikolaev, V. and Van Lent, L. (2005), "The endogeneity bias in the relation between cost-of-debt capital and corporate disclosure policy", *European Accounting Review*, Vol. 14 No. 4, pp. 677-724.

Ohlson, J. (1995), "Earnings, book value, and dividends in security valuation", *Contemporary Accounting Research*, Spring, pp. 661-87.

Reese, R. (2005), "Alternative Modelle zur Schätzung der erwarteten Eigenkapitalkosten – Eine empirische Untersuchung für den deutschen Aktienmarkt", *Münchner Betriebswirtschaftliche Beiträge*, No. 6.

Riegler, C. and Kristandl, G. (2004), "Value Reporting in österreichischen Unternehmen – Beobachtung des Berichtverhaltens von ATX und ATX-Prime Unternehmen", in Seicht, G. (Ed.), *Jahrbuch für Controlling und Rechnungswesen 2004*, LexisNexis Verlag, Wien, pp. 245-67.

Roos, G., Pike, S. and Fernström, L. (2004), "Intellectual capital management, measurement and disclosure", in Horváth, P. and Möller, K. (Eds), *Intangibles in der Unternehmenssteuerung*, Vahlen, München, pp. 127-58.

Ruhwedel, F. and Schultze, W. (2002), "Value Reporting: Theoretische Konzeption und Umsetzung bei den DAX 100 – Unternehmen", *Zeitschrift für betriebswirtschaftliche Forschung*, Vol. 54, pp. 602-32.

Schmalenbach Gesellschaft Work Group on Accounting and Reporting of Intangible Assets (2003), "'Freiwillige externe Berichterstattung über immaterielle Werte'", *Der Betrieb*, Vol. 23, pp. 1233-7.

Schmalenbach Gesellschaft Work Group on Financial Accounting (2002), "Grundsätze für das Value Reporting", *Der Betrieb*, Vol. 45, pp. 2337-40.

Schultze, W. (2004), "Value-relevant disclosures (value reporting): conceptual framework and current practice of the German DAX100 firms", paper presented at the 27th Annual Congress of the European Accounting Association, Prague, April.

Singhvi, S. and Desai, H.B. (1971), "An empirical analysis of the quality of corporate financial disclosure", *Accounting Review*, No. 1, pp. 129-38.

Streiner, D.L. (2003), "Being inconsistent about consistency: when coefficient alpha does and doesn't matter", *Journal of Personality Assessment*, Vol. 80 No. 3, pp. 217-22.

Stromann, H. (2003), *Wertrelevanz deutscher und US-amerikanischer Rechnungslegungsinformationen – Theoretische und empirische Analyse des Feltham-Ohlson-Modells*, Hilke, Wiesbaden.

Sveiby, K.E. (1998), *Wissenskapital: das unentdeckte Vermögen*, MI Verlag, Landsberg am Lech.

Welker, M. (1995), "Disclosure policy, information asymmetry and liquidity in equity markets", *Contemporary Accounting Research*, Vol. 11 No. 2, pp. 801-27.

Further reading

Alreck, P.L. and Settle, R.B. (1995), *The Survey Research Handbook*, McGraw-Hill, Boston, MA.

Bozzolan, S., Favotto, F. and Ricceri, F. (2003), "Italian annual intellectual capital disclosure: an empirical analysis", *Journal of Intellectual Capital*, Vol. 4 No. 4, p. 543.

Brennan, N. (2001), "Reporting intellectual capital in annual reports: evidence from Ireland", *Accounting, Auditing & Accountability Journal*, Vol. 14 No. 4, pp. 423-36.

Chui, A. and Wei, K.C.J. (1998), "Book-to-market, firm size, and the turn-of-the-year effect: evidence from the Pacific-Basin emerging markets", *Pacific-Basin Finance Journal*, Vol. 6, pp. 275-93.

Cooke, T.E. (1989), "Disclosure in the corporate annual reports of Swedish companies", *Accounting and Business Research*, Vol. 19 No. 74, pp. 113-24.

Cooke, T.E. (1991), "An assessment of voluntary disclosure in the annual reports of Japanese corporations", *International Journal of Accounting*, Vol. 26 No. 3, pp. 174-89.

Cooke, T.E. (1992), "The impact of size, stock market listing and industry type on disclosure in the annual reports of Japanese listed corporations", *Accounting and Business Research*, Vol. 22, pp. 229-37.

Fama, E.F. and French, K.R. (1996), "The CAPM is wanted, dead or alive", *The Journal of Finance*, Vol. 51 No. 5, pp. 1947-58.

Fama, E.F. and French, K.R. (1997), "Industry costs of equity", *Journal of Financial Economics*, Vol. 43, pp. 153-93.

Fama, E.F. and French, K.R. (2004), "The capital asset pricing model: theory and evidence", *Journal of Economic Perspectives*, Vol. 18 No. 3, pp. 25-46.

Frost, G. and Wilmshurst, T. (2000), "The adoption of environment related management accounting: an analysis of corporate environment sensitivity", *Accounting Forum*, Vol. 24 No. 4.

Guthrie, J. and Petty, R. (2000), "Intellectual capital: Australian annual reporting practices", *Journal of Intellectual Capital*, Vol. 1 No. 3, pp. 241-51.

Guthrie, J., Petty, R., Ferrier, F. and Wells, R. (1999), "There is no accounting for intellectual capital in Australia: a review of annual reporting practices and the internal measurement of intangibles within Australian organisations", OECD Conference Report, Amsterdam, June.

Guthrie, J., Petty, R., Yongvanich, K. and Ricceri, F. (2004), "Using content analysis as a research method to inquire into intellectual capital reporting", *Journal of Intellectual Capital*, Vol. 5 No. 2, pp. 282-93.

Loewenstein, L. (1991), *Sense and Nonsense in Corporate Finance*, Addison-Wesley, Reading, MA.

Neuendorf, K.A. (2002), *The Content Analysis Guidebook*, Sage Publications, Thousand Oaks, CA.

Nichols, N.A. (1993), "Efficient? Chaotic? What's the new finance?", *Harvard Business Review*, March/April, pp. 50-60.

Olsson, B. (2001), "Annual reporting practices: information about human resources in corporate annual reports in major Swedish companies", *Journal of Human Resource Costing and Accounting*, Vol. 6 No. 1, pp. 39-52.

Wagenhofer, A. (2005), *Internationale Rechnungslegungsstandards – IAS/IFRS*, Redline Wirtschaftsverlag, Frankfurt.

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