

**Capitalizing RND –  
The Incremental Information Content of Accruals vs. Cash Flows for  
German Firms**

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**Abstract**

Numerous empirical studies provide evidence on the value relevance of capitalizing expenditures on intangibles such as research & development (Lev and Sougiannis 1996, Hand 2003). However, accounting standards in many countries, such as the U.S. or Germany, prohibit capitalizing these. In this paper, we analyze the role of the capitalization of RND in the process of providing value relevant information. Several studies show that accrual information has superior predictive ability compared to cash flows (Wilson 1986, Dechow 1994). Reporting RND on the balance sheet leads to an additional accrual component of earnings which in turn serves as a conveyor of additional information. Within the framework of Dechow (1994) we analyze a sample of the 152 largest German listed companies over a period of five years (2002-2006). Our results show an added value of the accrual information provided by capitalized RND, in accordance with the literature surrounding the idea that accrual information is superior to cash information.

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## **1. Introduction**

We analyze the question whether the capitalization of expenditures on Research and Development (RND) is value relevant from an accrual perspective. Several prior studies have provided empirical evidence to that end (Lev and Sougiannis 1996, Aboody and Lev 1998, Hand 2003). In this paper, we further investigate this question by asking where the additional value relevance comes from. We argue that it is the accrual component resulting from the process of RND capitalization which conveys additional information. In line with the literature on accruals vs. cash flows (Barth 2000), we argue that accrual information has superior predictive ability compared to cash flows (Wilson 1986, Dechow 1994). As the immediate expensing of RND investments is fundamentally equal to cash accounting, the question about the benefits of capitalizing RND can be regarded as a special case of the general question of the benefits of accrual accounting.

In our study, we apply an approach adapted from Dechow (1994). We analyze a sample of the 152 largest German public firms for the period 2002-2006. Our sample comprises firms preparing their financial statements according to IFRS, US-GAAP as well as German GAAP (HGB). While IFRS allows the selective capitalization of RND expenditures, US-GAAP and HGB prohibits this. All firms give information on their RND projects in the verbal part of their annual reports (Ruhwedel and Schultze 2003), however. We assume prices to reflect the market's expectations about the profitability of the RND investments undertaken. We therefore adjust the firms' accounts to either reflect full capitalization or full expensing. We receive two samples of identical size, consisting of identical firms only differing with respect to the treatment of RND. We then compare the explanatory power of these adjusted accounting figures for market values. Based on prior research, we expect capitalization (i.e. accrual accounting) to provide superior information compared to expensing (i.e. cash accounting).

Secondly, we expect the RND accrual to significantly add to the explanatory power of the regression. Our empirical results are consistent with both arguments.

We contribute to the literature on intangibles by providing evidence that the market prices the RND accrual established in the process of full RND capitalization. This does not allow us to infer that RND capitalization is a better form of accounting, but that it more closely reflects the capital markets judgment of firm value. Secondly, to our knowledge, we are the first to analyze the value relevance of RND capitalization in a German environment. The German environment is especially interesting for its relative importance of technology, RND and other intangible resources due to its lack of physical resources. On the other hand, German accounting is known for its conservative tradition and debtor orientation. During the period analyzed this is changing and many firms have adopted a more transparent and investor oriented reporting. While there are many empirical studies having analyzed the value relevance of capitalizing intangibles in general or RND in particular within anglo-saxon environments (e.g. Ahmed and Falk 2006), there are few within continental Europe (e.g. Markarian, Pozza, and Prencipe 2008). As the arguments in favour of immediate expensing of RND are largely based on conservatism, one would expect that in such an environment market participants are wary of RND capitalization (Chan, Faff, Gharghori, and Ho 2007; Davies and Waddington 1999; Healy and Wahlen 1999) and therefore RND should not be priced. Our evidence points to the contrary, however.

The remainder of the paper is organized as follows. Section 2 summarizes prior research of the two literature branches mentioned above and outlines our approach by linking these two. In section 3 we develop our hypotheses based on the linkage of intangibles and accruals according to the framework of Dechow (1994). Section 4 describes the sample selection and data, and section 5 presents the results. Section 6 summarizes and concludes the study.

## 2. Prior Research

### 2.1. Capital Market Relevance of Intangibles

Numerous empirical studies examine the capital market relevance of intangibles. Questions addressed include issues such as whether announcements on expenditures on intangibles influence investors' decisions (decision relevance), or whether the reporting on intangibles in different manners influences the quality of analysts' forecasts (forecast relevance), or whether accounting information is able to explain a company's market value (value relevance).<sup>1</sup>

Within a traditional event studies' methodology, Woolridge and Snow (1990) examine the effect of RND expenditure announcements and find overall statistically significant positive abnormal returns. Similar results were attained by Chan, Martin and Kensinger (1990) and Zantout and Tsetsekos (1994) by observing the effect of increased RND announcements.

Forecast relevance studies in the field of intangibles focus on aspects concerning the impact of accounting treatment of intangibles on forecasts as can be observed in earnings variability and forecast errors. In contrast to value relevance studies, forecast relevance studies do not regress on market value but on variables such as analysts' forecast errors, earnings change, the number of analysts following a firm in one year or the number of analysts covering a firm. Overall the findings show a positive relationship between total underlying intangibles and higher analyst following (Barron et al. 2002), a positive association between intangibles and analyst coverage (Barth, Kasznik and McNichols 2001) and a positive association between forecast errors and intangible intensity (Gu and Wang 2005). In an Australian GAAP environment Matolcsy and Wyatt 2006 provide evidence for the positive signaling effect of discretionary RND capitalization in terms of higher analyst following and lower absolute earnings forecast errors for firms with a stock of underlying intangibles.

Most studies on intangibles are value relevance studies and are designed as association studies on stock price or stock return. Information is termed value relevant if it has explanatory power on the market value of equity. These specific value relevance studies deal with the tradeoff between relevance and reliability related to expenditures on intangibles. In general, value

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<sup>1</sup> This classification refers to capital market relevance in general, as is used in Lo and Lys 2000. The appendix uses this classification for a classification of the literature on intangibles. For a classification of value relevance studies in general, distinguishing between short-window and long-window approaches, see Holthausen and Watts (2001).

relevance studies try to operationalize these two qualitative criteria of accounting, which determine decision useful information (Barth, Beaver and Landsman 2001). A vast branch of the literature examines the question as to whether intangibles like RND can be considered an asset and treated as such. Lev and Zarowin (1999) find a linkage between intangibles, business change and the loss of value relevance of financial information. They provide evidence for a declining explanatory power of accounting information due to the increasing importance of intangibles over time. As a remedy, they propose the capitalization of intangibles or the restatement of financial reports. As an Australian answer to Lev and Zarowin (1999), Ahmed and Goodwin (2006) find an increase in value relevance of earnings and book value for capitalizers but no significant improvement for non-capitalizers. The overall findings of value relevance studies show that, by focusing on relevant information, expensing RND does not provide value relevant information. However, by capitalizing and amortizing such assets, an increase in value relevance can be confirmed.

Especially Australia, but also France provide an interesting object of research, as, before the adoption of IFRS, the capitalization of RND was allowed and subject to the management's discretion. In such an environment, the impact of capitalization can directly be observed. As a result, Australian studies show that capitalizers present higher value relevance of earnings, whereas the expensing of intangibles decreases the usefulness of accounting information (Barth and Clinch 1998, Ahmed and Falk 2006, Ritter and Wells 2006).<sup>2</sup> Most studies are however conducted within the US-environment, where only software development costs may be capitalized. Lev and Sougiannis (1996) estimate amortization rates on RND for different industries and make adjustments on earnings and book values. They find that the capitalization and amortization of RND is value relevant while their expensing is not. This is consistent with the findings of Aboody and Lev (1998) for the software industry and Amir and Lev (1996) for the wireless communications industry.

The comparative approach of Zhao (2002) analyzing different countries finds that the relative value relevance of RND reporting is a function of both the reporting environments and the RND accounting standards. Therefore capitalizers (France, UK) provide more value relevant

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<sup>2</sup> In a French-GAAP environment Cazavan-Jeny and Jeanjean (2006) find that firms that capitalize are smaller, highly leveraged, less profitable and have less growth opportunities concluding that the capitalization choice might be a self selection issue. In contrast to Australian studies their results show a negative association between capitalization and stock return, i.e. the market considers capitalization as bad news not expecting future benefits. However, the authors stress that this might be a special case because France has a low legal enforcement and as such managers have a more opportunistic approach to the use of RND capitalization.

accounting information as opposed to expensers (Germany, USA). The same is true for code law countries (France, Germany) as opposed to common law countries (UK, USA). As a consequence it is established that the disclosure of such information on intangibles, as is the case in Germany and the USA, has a positive informative effect for the capital market, but not as strong as when capitalizing these costs.

However, a strong argument against the capitalization of intangibles is held both by standard setters and the literature with regard to a presumed lack of reliability of such an accounting treatment (for a theoretical reflection see Barth, Clinch and Shibano 2003, Herrmann, Saudagaran and Thomas 2006). For intangibles, future cash flows are considered to be too uncertain to qualify as an asset.<sup>3</sup> Kothari, Laguerre and Leone (2002) provide evidence on higher earnings volatility of RND-expenditures compared to PPE and conclude that RND may not qualify as an asset due to the higher uncertainty of future benefits. Based on their results, Amir, Guan and Livne (2007) find increasing earnings volatility only in industries with high RND-intensity as compared to physical capital intensity. Their results support RND capitalization under certain circumstances, as in industries with rather low RND-intensity, such expenditures cannot be considered more risky resp. less reliable. In addition, Amir, Guan and Livne (2007) show that RND investments are, on average, recoverable in all industries, indicating that future economic benefits can be attributed to intangible expenditures in the majority of cases. Thus, higher earnings variability due to investments in intangibles does not justify a strict prohibition of capitalizing such expenditures. Wyatt (2008) evaluates the literature with respect to the relevance and reliability of financial and non-financial information on intangibles. Her investigation comprises a wide range of papers from different disciplines in order to make inferences on the reliability of intangibles which cannot be measured directly. She finds that it is not reliability on its own, that is important, but reliability relative to relevance. Consistent with Barth, Clinch and Shibano (2003), she concludes that despite the obvious problem of reliable measurement, the information on intangibles is value relevant.

From a theoretical point of view, the capitalization process is intended to yield a stream of income which is smoother than the associated stream of cash flows, via the accrual process. Consequently, capitalizing RND will result in less volatile earnings compared to the immediate

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<sup>3</sup> For instance in IAS 38 par. 21 six criteria for development costs as measures for future economic benefits need to be cumulatively fulfilled to qualify as an intangible asset. IAS 38 par. 57 defines these criteria as: technical feasibility, intention to complete, ability to use or sell, future economic benefits, adequate resources and ability to measure. In that respect, the recognition criteria for intangible assets are far more stringent than for tangible assets.

expensing. If the latter is considered a desirable virtue of earnings, the accrual process is a helpful means to this end. When comparing two samples of capitalizers and non-capitalizers, the earnings variability of the latter should consequently be higher. If one were to observe the contrary, a possible explanation for the higher earnings variability of a capitalizing sample could be the discretion involved in the capitalization process. Such a comparison may therefore be used to unravel earnings management.

Concerning intangible assets, managers' actions and their consequences are less observable than in the context of tangible assets. Information asymmetries and agency costs are higher when dealing with intangible assets due to the greater discretionary portion of accruals. The reason for this is that future cash flows are uncertain and hence, subject to management manipulation (Jones 1991). In this context, reliability takes on the meaning of faithful representation, not of earnings variability. This is also the view that is expressed in the current discussion of the FASB and IASB concerning the conceptual framework and reliability as a qualitative characteristic. Faithful representation is attained "when the substance of an economic phenomenon is depicted completely and neutrally"<sup>4</sup>, which rather refers to the issue of managerial manipulation. Interpreting high earnings variability as a sign for low reliability, as in Kothari, Laguerre and Leone (2002), may therefore be insufficient, as long as the capitalized intangibles faithfully represent the management's expectations about future economic benefits. Therefore higher earnings variability is not necessarily a reason for less reliable – in the sense of faithfully represented – financial information and can not call into question whether expenditures on intangibles should be capitalized. The issue is rather whether RND accruals as discretionary accruals might have impact on market value. In this context Subramanyam (1996) examines the pricing of discretionary accruals. He shows that managers use their discretion to improve the ability of earnings to reflect fundamental value. Such income smoothing even improves the value relevance of earnings.<sup>5</sup> Hence, the discretionary portion of the intangible accrual, which is generated when capitalizing such expenditures, cannot necessarily be interpreted as an opportunistic earnings manipulation. Such accounting choice may well improve the quality of the communication through reported earnings. Besides, the expensing of e.g. RND is subject to manipulation via real earnings management: if

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<sup>4</sup> See project update of the FASB stated July 10, 2007.

<sup>5</sup> For detailed research on the benefits of accounting policy within the principal-agent framework, the reader is referred to Demski (1998). He shows that by accounting policy provides management with means of communicating private information which might be useful for the principal.

managers wish to increase reported earnings, they can simply cut the actual RND expenditure, which might even be more damaging than the manipulation via capitalization (Deng and Lev 2006).

A further unresolved issue is whether capitalization of intangible expenditures provides any additional information. It may well be argued that the information needs of investors are just as well satisfied by voluntary disclosures. Analysts are supposed to make up for the deficiencies of accounting by closely analyzing such information. On the other hand, experimental studies indicate that analysts are unable to fully capture the dynamic effects of not capitalizing intangible investments. Even when they are familiar with the problem of expensing intangible investments, the errors in forecasts increase considerably under such an accounting treatment as compared to capitalizing (Luft and Shields 2001).

Our paper contributes to the above studies by linking these with the literature that provides strong evidence that the capitalization of investments contains better information than pure cash information. The immediate expensing of intangible expenditures can be regarded as cash accounting. We therefore relate the issue of the value relevance of RND capitalization to that on the value relevance of accruals vs. cash flows.

## *2.2. Accrual vs. Cash Accounting*

Fundamentally, there are two different accounting concepts: cash accounting and accrual accounting. Cash accounting is often regarded a more “primitive concept” (Bowen, Burgstahler and Daley 1987), only used by some very small companies, not differentiating between a short-term and a long-term view. Cash accounting focuses on inflows and outflows of cash effectively occurring during the considered period and neglects possible future effects. In contrast, GAAP are widely based on accrual accounting. In Statement of Financial Accounting Concepts No. 1 (1978) the FASB states that “...*Information about enterprise earnings and its components measured by accrual accounting generally provides a better indication of enterprise performance than does information about current cash receipts and payments*”. Hence, “accrual accounting is at the heart of earnings measurement and financial reporting” (Barth et al. 1999, p. 205).

Various empirical studies compare the value relevance of earnings relative to cash flows, in order to analyze which of the two is able to better explain a firm’s stock returns. Present

earnings are derived from present cash flows via the accrual process. As a consequence, the accrual process itself is often regarded a result of trading off relevance and reliability (Dechow 1994). The accrual process allows us to calculate the earnings of the period by matching expenses and revenues occurred in the same period.

The definition of accruals proposed by Healy (1985) has been widely used in the accounting literature. He defines accruals as the difference between reported earnings and cash flows from operations. Besides, he decomposes total accruals into discretionary and non discretionary accruals, explaining the association between managers' accrual- and accounting procedure-decisions and their bonus plans based on accounting earnings. Based on this definition ( $\text{Earnings} = \text{Accruals} + \text{Cash Flows}$ ), numerous studies investigate the question whether and under which circumstances earnings or cash flows better explain stock returns or better forecast future cash flows (see Dechow 1994, Lev and Zarowin 1999). Bowen, Burgstahler and Daley (1987) extend this approach by differentiating between cash flow from operations and cash flow after investment activities. By doing so, they expect to mitigate collinearity problems.

This discussion on the benefits of accrual accounting is really identical to the question whether capitalizing intangible investments is beneficial. Capitalizing and amortizing RND equals accrual accounting whereas immediately expensing RND equals cash accounting. We therefore use the methodology applied in the value relevance studies dealing with accruals vs. cash flows in order to provide evidence that RND expenditures contain incremental information which explain market value. We expect that the additional explanatory power is due to the accrual component arising from treating RND expenditures as assets.

### *2.3. Linking Accruals with the Capitalization of RND*

There is a large amount of research dealing with the subject whether earnings (including the accrual component) or solely cash flows are a better explanatory measure for market value. In her pioneering study, Dechow (1994) demonstrates a greater association of accounting earnings with firm value, compared to cash flows. Also, a strong negative relation between accruals and cash flows is established. Her results indicate that accruals improve the ability of earnings to measure firm performance and to forecast future cash flows. She demonstrates that, via the accrual process, present earnings are a better performance measure than present cash flows.

In her study, Dechow (1994) uses stock price performance against which she compares realized cash flows and earnings. In her analysis, she uses the following variables:

E	=	earnings (excluding extraordinary items and discontinued operations)
CFO	=	cash from operations
NCF	=	change in the balance of the cash account (net cash flow)

NCF fluctuates with cash inflows and cash outflows associated with the company's investment, financing and operating activities containing no accrual adjustments. In contrast CFO includes non-current accruals being the NCFs generated from the firm's operating activities. Finally earnings include total accruals, both current and non-current accruals. Dechow (1994) develops three simple regressions with these three performance measure variables and stock returns ( $R_{it}$ ) as the dependent variable:

$$R_{it} = \alpha_1 + \alpha_2 E_{it} + \varepsilon_{it}$$

$$R_{it} = \alpha_1 + \alpha_2 CFO_{it} + \varepsilon_{it}$$

$$R_{it} = \alpha_1 + \alpha_2 NCF_{it} + \varepsilon_{it}$$

Her results show that earnings are more strongly associated with stock returns than either cash flow measure over each measurement interval. She refers this to accruals which improve the association of earnings with contemporaneous stock returns by mitigating the timing and matching problems of cash flows. Based on her approach we assume that the accrual component created through the capitalization of RND likewise contains explanatory power for market value enhancing the value relevance of financial information.

Barth et al. (1999) also show that accruals are a value relevant component of earnings and help to explain the market value of equity. In contrast to prior research surrounding the valuation implications of the accrual and cash flow components of earnings (Rayburn 1986, Wilson 1986/87, Bowen, Burgstahler and Daley 1987, Bernard and Stober 1989, Dechow 1994), they utilize the framework of Ohlson (1999), which extends Ohlson (1995). They provide evidence that both the accrual and cash flow components of earnings have incremental information content in a valuation model including equity book value and abnormal earnings. In a following study, Barth, Cram and Nelson (2001) also disaggregate earnings into the accrual component and cash flow component. They extend this segmentation by decomposing total accruals into its major components: change in accounts receivable, change in accounts payable,

change in inventory, depreciation, amortization, and other accruals. Based on the framework of Dechow, Kothari and Watts (1998) they demonstrate that a combination of accrual and net cash flow is superior compared to the aggregated earnings in forecasting future cash flows. In contrast to prior studies, they show that all accrual components, including non-current accruals, aid in forecasting future cash flows. Accruals can be differentiated according to their time horizon, i.e. whether they refer to current or non-current assets. Dechow (1994) focuses on short term accruals to show higher explanatory power of earnings. Guay and Sidhu (2001) extend Dechow (1994) and also provide evidence that non-current accruals reduce timing and matching problems in cash flows as is the case for current accruals. They show that due to longer intervals, the economic and statistical properties vary between short and long term accruals. Thus, non-current accruals also improve the usefulness of earnings. In a following paper Barth et al. (2005) use this decomposition of earnings into its cash flow and different accrual components to establish a linear information system based on the Ohlson model. They provide evidence that higher decomposition results in lower mean prediction errors contained in the model.

We create a model which relates the findings of the literature on accruals vs. cash flows in order to support the demand of capitalizing RND. We extend the framework of Dechow (1994) by three aspects: Firstly, in accordance with to Barth, Cram and Nelson (2001) and Barth et al. (2005) we decompose total accruals into all its major components. We also include non-current accruals in our analysis in accordance with Richardson et al. (2005). Besides depreciation and amortization we also include investments as part of non-current accruals. Secondly, we introduce RNDACC as a special non-current accrual generated by RND capitalization. Thirdly, we build our analysis on the generalized version of the extended Ohlson model (1999) as applied in Barth et al. (1999). Following Dechow (1994) we also use stock price performance as a benchmark, but not on a per-share basis. Our dependent variable is represented by market capitalization defined as “stock price times number of shares”.

We base our model on Barth, Cram and Nelson (2001) who provide evidence that the decomposition of total accruals into its major components significantly improves the prediction of future cash flows, as each accrual reflects different information concerning future cash flows. Barth et al. (2005) develop three different linear information models (LIM) with different levels of earnings disaggregation. Their third, most complex LIM decomposes earnings into cash flows and the four major components of accruals: change in receivables,

change in inventory, change in payables and depreciation. They show that the highest decomposition results in the least mean prediction errors. We extend this decomposition by introducing RNDACC as a specific non-current accrual which is generated via the RND capitalization process including the amortization of total capitalized RND less RND capitalized in the reporting year. According to Barth, Cram and Nelson (2001) we show that each accrual implies different information for market capitalization.

We also extend Dechow (1994) by making explicit use of the Ohlson model. A central critique of the value relevance studies put forward by Holthausen and Watts (2001) is that many studies are lacking a theoretical underpinning of the relationship under investigation. We therefore derive our regression model directly from the relationship proposed by Ohlson (1995). According to the Ohlson model, the market value of a company is a function of a company's book value and the present value of the expected future abnormal earnings. In accordance with Barth et al. (1999), we use a generalized version of the extended framework in Ohlson (1999), which includes earnings components by splitting up comprehensive earnings into core earnings and transitory earnings. Barth et al. (1999) replace earnings and transitory earnings by total accruals and cash flows as earnings components. We extend this decomposition by disaggregating total accruals into their major accrual components and by including RNDACC.

In summarizing, we can conclude that, based on prior evidence, we expect that the market prices RND expenditures as assets. Furthermore, numerous studies show that accrual information is superior to cash flow information. Based on Dechow (1994) we can therefore expect that additional, value relevant information is created from the accrual process.

### **3. Model Description and Hypothesis Development**

Our model is based on Barth, Cram and Nelson (2001), who decompose earnings into cash flows and six accrual components: change in accounts receivable, change in accounts payable, change in inventory, depreciation, amortization and other accruals. They define accruals as the difference between operating cash flow and earnings, like change in accounts receivable. In addition, balance sheet accruals are the related balance sheet items, i.e. adjustments from cash to net worth, such as accounts receivable. We apply this idea to all important balance sheet items as is demonstrated in Figure 2.

Figure 1: Balance Sheet Accruals vs. Accruals

<b>Balance Sheet Accruals</b>	<b>Accruals</b>	
Accounts Receivable	Change in Accounts Receivable	} <i>Current Accruals</i>
Accounts Payable	Change in Accounts Payable	
Inventory	Change in Inventory	
Property, Plant and Equipment (PPE)	Change in PPE	} <i>Non Current Accruals</i>
Intangible Assets (INT)	Change in INT	
Other Assets	Other Accruals	

We use this definition of accruals and balance sheet accruals to generate the particular accrual obtained when capitalizing RND: The relevant balance sheet accrual is represented by the RND asset (RNDBSACC), which changes from period to period. The periodic change of RNDBSACC is represented by RNDACC, which is defined as RND amortization less new capitalized RND costs. By including the balance sheet accrual (RNDBSACC) and the accrual component of earnings (RNDACC), we provide evidence that RND expenditures contain incremental information content. However, the decomposition into the cash flow component and various accrual components is only possible if in a prior period the balance sheet accrual was created through capitalization.

In accordance with Barth, Cram and Nelson (2001) and Barth et al. (2005) we create a complex linear information model by decomposing earnings into cash flows and accruals. Accruals can be further decomposed into different accrual components: on the one hand change in working capital, which is a summary variable of change in accounts receivable, change in inventory and change in accounts payable. We also include change in non-current balance sheet accruals, which are depreciation, amortization and new investments in PPE and INT. In this case INT excludes RND. Traditional accrual vs. cash flow studies only consider depreciation and amortization as non-current accruals. We extend this definition firstly by including positive changes of PPE and INT and secondly by RNDACC, which represents the net effect of the annual RND capitalization and amortization. Note that the accrual component can easily be derived from the balance sheet accrual component, based on the following relationship, if changes in working capital, depreciation, amortization and new investments are known:

$$\text{Accrual}_{t,i} = \text{Balance Sheet Accrual}_{t,i} - \text{Balance Sheet Accrual}_{t-1,i}$$

t = Current Period

i = (Balance Sheet) Accrual Component i

Based on the framework of Dechow (1994) we argue that the value relevance of capitalizing RND is attributed to the accrual component of earnings. We expect that the RND capitalization leads to earnings that are more strongly associated with market capitalization than earnings obtained by expensing these expenditures resp. by the cash outflow due to the generated RNDACC. We expect that accruals extend the information content of cash flows, as a more primitive concept, to obtain earnings that are more useful over finite intervals. Our approach is consistent with Abrahams and Sidhu (1998), who also investigate the role of RND capitalization in firm valuation and performance measurement using an Australian sample. They show that “RND accruals (particularly the initial capitalization) improve accounting earnings as a measure of performance [...]“ (p. 169). However, their regression is not based on a theoretical construct, like the Ohlson model as is in our case.<sup>6</sup>

Thus our first hypothesis assumes that aggregated earnings, in which the capitalization of RND is considered, have higher explanatory power than aggregated earnings obtained by expensing RND.

**Hypothesis 1:** Capitalizing RND leads to financial information with superior market value explanatory power.

According to Dechow (1994) and Barth et al. (2005) we demonstrate that accruals as an earnings component contain incremental information. Additionally we hypothesize that this is also the case for RNDACC obtained through RND capitalization.

**Hypothesis 2:** Disaggregating earnings into cash flow and different accrual components results in superior market value explanatory power.

The different regressions are as follows, with LIM 1 representing the Dechow (1994) model, extended to include book value according to Ohlson (1995):

**LIM 1 (exp):**

$$MV_{it} = \alpha_0 + \alpha_1 E_{it}^{exp} + \alpha_2 BV_{it}^{exp} + \varepsilon_{it}$$

With:

$$MV = \text{Markt Value represented by Market Capitalization}$$

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<sup>6</sup> For a critical evaluation on the relevance of the value relevance literature for standard setters see Holthausen and Watts (2001).

$E^{\text{exp}}$	=	Earnings (expensing sample)
$BV^{\text{exp}}$	=	Book Value (expensing sample)
$\varepsilon_{it}$	=	disturbance term

LIM 2 and LIM 3 disaggregate earnings into its major cash flow and accrual components. In order to decompose earnings, the following equations are applied for the expensing sample:

$$\begin{aligned} \text{FCF} &= \text{OCF}^{\text{exp}} + \text{ICF}^{\text{exp}} \\ \text{OCF}^{\text{exp}} &= E^{\text{exp}} + \text{DEP} + \text{AMORT} + \text{WCACC} \\ \text{ICF}^{\text{exp}} &= \text{PPE\_INV} + \text{INT\_INV}^7 \end{aligned}$$

The capitalizing sample requires adjustments for the calculation of E, BV, OCF and ICF:

$$\begin{aligned} E^{\text{cap}} &= E^{\text{exp}} - \text{RND\_INV} - \text{RND\_AMORT} = E^{\text{exp}} - \text{RNDACC} \\ BV^{\text{cap}} &= BV^{\text{exp}} + \text{RNDBSACC} \\ \text{OCF}^{\text{cap}} &= E^{\text{cap}} + \text{DEP} + \text{AMORT} + \text{RND\_AMORT} + \text{WCACC} \\ &= E^{\text{exp}} - \text{RND\_INV} - \text{RND\_AMORT} + \text{DEP} + \text{AMORT} + \text{RND\_AMORT} + \text{WCACC} \\ &= E^{\text{exp}} - \text{RND\_INV} + \text{DEP} + \text{AMORT} + \text{WCACC} \\ \text{ICF}^{\text{cap}} &= \text{PPE\_INV} + \text{INT\_INV} + \text{RND\_INV} \end{aligned}$$

Therefore we derive LIM 1 for the capitalizing sample with the adjusted data:

**LIM 1 (cap):**

$$MV_{it} = \alpha_0 + \alpha_1 E_{it}^{\text{cap}} + \alpha_2 BV_{it}^{\text{cap}} + \varepsilon_{it}$$

The likewise adjustments in OCF and ICF do not affect FCF, which is equal both in the expensing and the capitalizing sample:

$$\text{FCF} = \text{OCF}^{\text{exp}} + \text{ICF}^{\text{exp}} = \text{OCF}^{\text{cap}} + \text{ICF}^{\text{cap}}$$

We define:

$$\begin{aligned} \text{LTACC}^{\text{exp}} &= \text{DEP} + \text{AMORT} + \text{PPE\_INV} + \text{INT\_INV} \\ \text{LTACC}^{\text{cap}} &= \text{DEP} + \text{AMORT} + \text{RND\_AMORT} + \text{PPE\_INV} + \text{INT\_INV} + \text{RND\_INV} \\ \text{RNDACC} &= \text{RND\_AMORT} + \text{RND\_INV} \end{aligned}$$

By using these equations, FCF can also be calculated as follows:

$$\begin{aligned} \text{FCF} &= \text{OCF}^{\text{cap}} + \text{ICF}^{\text{cap}} \\ &= E^{\text{cap}} + \text{DEP} + \text{AMORT} + \text{RND\_AMORT} + \text{WCACC} + \text{PPE\_INV} + \text{INT\_INV} + \text{RND\_INV} \end{aligned}$$

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<sup>7</sup> Note that all variables concerning investing activities such as PPE\_INV, INT\_INV, RND\_INV and ICF are Cash Outflows and carry a negative sign.

$$\begin{aligned}
&= E^{\text{cap}} + (\text{DEP} + \text{AMORT} + \text{RND\_AMORT} + \text{PPE\_INV} + \text{INT\_INV} + \text{RND\_INV}) + \text{WCACC} \\
&= E^{\text{cap}} + \text{LTACC}^{\text{cap}} + \text{WCACC} \\
&= E^{\text{cap}} + \text{DEP} + \text{AMORT} + \text{ICF} + \text{RNDACC} + \text{WCACC}
\end{aligned}$$

with:

FCF	=	Free Cash Flow
OCF	=	Operating Cash Flow
ICF	=	Investing Cash Flow
DEP	=	Depreciation
AMORT	=	Amortization
RND_AMORT	=	RND Amortization
WCACC	=	Working Capital Accrual (Change in Accounts Receivable + Change in Inventory - Change in Accounts Payable)
PPE_INV	=	Investments in PPE
INT_INV	=	Investments in Intangibles (other than RND)
RND_INV	=	Investments in RND
LTACC	=	Long Term Accrual
RNDACC	=	RND Accrual
RNDBSACC	=	RND Balance Sheet Accrual

Decomposing earnings into its major components leads to LIM 2 for the expensing sample:

**LIM 2 (exp):**

$$MV_{it} = \alpha_0 + \alpha_1 FCF_{it} + \alpha_2 LTACC^{\text{exp}}_{it} + \alpha_3 WCACC_{it} + \alpha_4 BV^{\text{exp}}_{it} + \varepsilon_{it}$$

For the capitalizing sample we derive LIM 2 (cap) as follows:

**LIM 2 (cap):**

$$MV_{it} = \alpha_0 + \alpha_1 FCF_{it} + \alpha_2 LTACC^{\text{cap}}_{it} + \alpha_3 WCACC_{it} + \alpha_4 BV^{\text{cap}}_{it} + \varepsilon_{it}$$

Further disaggregation of  $LTACC^{\text{exp}}$  resp.  $LTACC^{\text{cap}}$  leads to LIM 3:<sup>8</sup>

**LIM 3 (exp):**

$$MV_{it} = \alpha_0 + \alpha_1 FCF_{it} + \alpha_2 ICF^{\text{exp}}_{it} + \alpha_3 \text{DEPAMORT}_{it} + \alpha_4 WCACC_{it} + \alpha_5 BV^{\text{exp}}_{it} + \varepsilon_{it},$$

**LIM 3 (cap):**

$$MV_{it} = \alpha_0 + \alpha_1 FCF_{it} + \alpha_2 ICF^{\text{cap}}_{it} + \alpha_3 \text{DEPAMORT}_{it} + \alpha_4 \text{RNDACC}_{it} + \alpha_5 WCACC_{it} + \alpha_6 BV^{\text{cap}}_{it} + \varepsilon_{it},$$

In order not to reject hypothesis 1 we assume the financial information based on the capitalized data to contain higher value relevance for both LIM 1 and LIM 3 than based on the expensed data. Thus, the market value explanatory power of the analysed LIM's are supposed to show the following relationships:

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<sup>8</sup> According to ICF we summarize depreciation on PPE and amortization on INT in DEPAMORT.

$$\text{LIM 1 (exp)} < \text{LIM 1 (cap)} \quad \text{and} \quad \text{LIM 3 (exp)} < \text{LIM 3 (cap)}.$$

Further we presume LIM 3 to provide superior explanatory power compared to LIM 1 in both samples due to the higher disaggregation of earnings in order not to reject hypothesis 2:

$$\text{LIM 1 (exp)} < \text{LIM 3 (exp)} \quad \text{and} \quad \text{LIM 1 (cap)} < \text{LIM 3 (cap)}.$$

Our third hypothesis is the logical consequence of hypothesis 1 and 2 as we assume that the higher market value explanatory power is due to the RNDACC component.

**Hypothesis 3:** The accrual component obtained through RND capitalization is value relevant.

Focusing on LIM 3 of the capitalizing sample, we expect a significant regression coefficient for the independent variable RNDACC in order not to reject hypothesis 3.

#### **4. Sample Selection and Descriptive Statistics**

Our sample consists of the 152 largest German public firms listed in the H-DAX for the years 2002 through 2006 also comprising companies of the former DAX 100, nowadays represented by the Prime Standard. We obtained share price data from datastream and other information from the annual reports. Our sample contains companies reporting according to German GAAP, where the capitalization of RND is prohibited, as well as companies reporting in IFRS with partial capitalization of development costs (IAS 38), and also companies according to US-GAAP with partial capitalization of software development costs (FAS 86). This required us to make adjustments to the original data in order to conduct our study. Based on the data basis, we created two different samples. The expensing sample consists of data presuming full expensing of RND for which we converted all companies under IFRS and US-GAAP with capitalized development costs in order to obtain a sample to fully expensed RND. The second sample was modeled to allow for full capitalization of all RND costs. Because our aim is to show a significant difference between full expensing and full capitalization, we do not allow for partial capitalization. For the amortization adjustments we presume a constant amortization rate of 20% per year for capitalized RND based on other studies such as Lev, Sarath and Sougiannis (2005), who determine five years as the expected useful life for RND. We further assume a basis of the RND assets capitalized in prior periods as the mean of all RND costs over the period 2002-2006 multiplied by 1/amortization rate of 20%. This allows us to assume that, on average, investment and amortization of RND occur steadily.

Differences in the variables of the two samples are as follows:

Figure 2: Differences between the Expensing and the Capitalizing Sample

Variable	Expensing Sample	Capitalizing Sample
Earnings	$E^{\text{exp}}$	$E^{\text{cap}} = E^{\text{exp}} - \text{RNDACC}$
OCF	$\text{OCF}^{\text{exp}} = E^{\text{exp}} + \text{DEP} + \text{AMORT} + \text{WCACC}$	$\text{OCF}^{\text{cap}} = E^{\text{cap}} - \text{RND\_INV} + \text{DEP} + \text{AMORT} + \text{WCACC}$
ICF	$\text{ICF}^{\text{exp}}$	$\text{ICF}^{\text{cap}} = \text{ICF}^{\text{exp}} + \text{RNDINV}$
FCF	FCF	FCF
WCACC	WCACC	WCACC
DEPAMORT	DEPAMORT	DEPAMORT
LTACC	$\text{LTACC}^{\text{exp}}$	$\text{LTACC}^{\text{cap}} = \text{LTACC}^{\text{exp}} + \text{RNDACC}$
RNDACC	0	RNDACC
BV	$\text{BV}^{\text{exp}}$	$\text{BV}^{\text{cap}} = \text{BV}^{\text{exp}} + \text{RNDBSACC}$

According to our theoretical arguments in section 2, the RND capitalization refers to the accrual process affecting earnings and book value, but not FCF. The effects on OCF and ICF by RNDACC cancel out and the value of FCF remains after the capitalization of RND. Only E and LTACC are affected by RNDACC and BV by RNDBSACC.

For both the expensing and capitalizing sample we use panel data referring to the 152 firms observed at 5 different time periods ( $5 \times 152 = 760$  observations). Panel data allow us to use a method for controlling for some types of omitted variables that cannot be measured or observed. We use OLS regression with entity (firm) fixed effects to eliminate omitted variable bias generated by variables such as reporting behaviour or managerial discretion, which may be correlated with various accruals. Such effects might determine the market value for each observed firm differently, but do not change over time within the firm resp. only change slowly and thus could be considered to be constant between 2002 and 2006. According to prior research (e.g. Dechow and Ge 2006, Barth et al. 2005 and Barth, Cram and Nelson 2001) we use the balance sheet approach to determine the accrual components of earnings. This is consistent with our definition of accruals described in section 3 represented by the change in balance sheet accruals.<sup>9</sup>

<sup>9</sup> Note that the balance sheet approach might lead to measurement errors in accrual estimates if mergers and acquisitions, discontinued operations, foreign currency translations and divestitures occur as examined in Hribar and Collins (2002). They find that this is particularly the case if the aim is to analyse earnings management, to estimate discretionary and nondiscretionary accruals and to detect accruals anomaly. However, Fairfield, Whisenant and Yohn (2003) find no difference in their results when eliminating appr. 12.000 firm-years affected by these transactions. Due to our small sample size and to avoid survivorship bias we include these firm-years.

Table 1 and 2 present descriptive statistics for the variables used in the estimation equations. All variables are scaled by total assets at the beginning of fiscal year.

Table 1: Distributional Statistics (deflated by total assets at the beginning of fiscal year)

*Panel A: Expensing sample*

<b>Variable</b>	<b>Mean</b>	<b>Median</b>	<b>Std. Dev.</b>
MV	1.078	0.578	1.509
E <sup>exp</sup>	0.044	0.038	0.117
FCF	0.046	0.045	0.390
ICF <sup>exp</sup>	-0.075	-0.044	0.132
WCACC	-0.012	-0.001	0.128
DEPAMORT	0.063	0.034	0.323
BV <sup>exp</sup>	0.502	0.435	0.500

*Panel B: Capitalizing sample*

<b>Variable</b>	<b>Mean</b>	<b>Median</b>	<b>Std. Dev.</b>
MV	1.078	0.578	1.509
E <sup>cap</sup>	0.063	0.055	0.108
FCF	0.046	0.045	0.390
ICF <sup>cap</sup>	-0.110	-0.076	0.155
WCACC	-0.012	-0.001	0.128
DEPAMORT	0.063	0.034	0.323
RNDACC	-0.019	-0.009	0.040
RNDAMORT	0.015	0.007	0.023
BV <sup>cap</sup>	0.564	0.480	0.521

The results of the distributional statistics are essentially consistent with prior research (Richardson et al. 2005, Barth et al. 2005) revealing that the means and medians of market value, book value, earnings, depreciation and amortization are positive. Comparing the expensing and capitalizing sample we find overall higher amounts for earnings, book value and ICF using the capitalized data, which is due to the RNDACC resp. RNDBSACC as presented in Figure 3. The results also reveal that, on average, the market values of equity exceeds book values, indicating that book value is insufficient to explain market value. By allowing full capitalization of RND, the gap between mean market value and book value diminishes. Additionally our findings are consistent with Guay and Sidhu (2001) as the standard deviation of earnings is smaller than the standard deviation of cash flows in both samples. This signals that accruals might reduce the volatility of cash flows as shown by Dechow (1994). Further, as expected in section 2, our results show that the earnings volatility, measured by standard deviation, of the capitalizing sample is considerably lower than that of the expensing sample. This is consistent with our prior argument that the accrual process results in smoother earnings and therefore less earnings variability.

In order to control for multicollinearity, we analyzed the pair-wise correlation-coefficients of the two samples for LIM 3. The results presented in Table 2 only show a significantly high relationship between WCACC and FCF for both samples and for the capitalizing sample between BVCAP and WCACC. The analysis of VIFs shows no indication of multicollinearity problems.

Table 2: Pearson correlation matrix between independent variables of LIM 3

*Panel A: Expensing sample*

	FCF	ICF <sup>exp</sup>	WCACC	DEPAMORT	BV <sup>exp</sup>
FCF	1				
ICF <sup>exp</sup>	0.511 (**)	1			
WCACC	0.918 (**)	0.338 (**)	1		
DEPAMORT	0.192 (**)	0.233 (**)	0.078	1	
BV <sup>exp</sup>	0.016	0.248 (**)	-0.085 (*)	0.110 (**)	1

\* Correlation is significant at the 0.05 level (2-tailed)

\*\* Correlation is significant at the 0.01 level (2-tailed)

*Panel B: Capitalizing sample*

	FCF	ICF <sup>cap</sup>	WCACC	DEPAMORT	RNDACC	BV <sup>cap</sup>
FCF	1					
ICF <sup>cap</sup>	0.512 (**)	1				
WCACC	0.918 (**)	0.338 (**)	1			
DEPAMORT	0.192 (**)	0.234 (**)	0.078	1		
RNDACC	0.069	0.364 (**)	0.032	-0.013	1	
BV <sup>cap</sup>	0.423 (**)	0.445 (**)	0.869 (**)	-0.022	-0.106 (*)	1

\* Correlation is significant at the 0.05 level (2-tailed)

\*\* Correlation is significant at the 0.01 level (2-tailed)

## 5. Empirical results

In order to consider firm fixed effects as explained in section 4, we modify the above regression equations to include the variable  $\alpha_i^{10}$  which captures firm fixed effects and leads to firm specific intercepts. This yields the following modified regression equations, representing an entity fixed effects model as a variation of the common multiple regression model.

### LIM 1 (exp):

$$MV_{it} = \alpha_0 + \alpha_1 E_{it}^{exp} + \alpha_2 BV_{it}^{exp} + \alpha_i + \varepsilon_{it}$$

### LIM 1 (cap):

$$MV_{it} = \alpha_0 + \alpha_1 E_{it}^{cap} + \alpha_2 BV_{it}^{cap} + \alpha_i + \varepsilon_{it}$$

### LIM 3 (exp):

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<sup>10</sup> with  $\alpha_i = \beta_0 + \beta_1 Z_i$  (holding constant the unobserved firm characteristics Z).

$$MV_{it} = \alpha_0 + \alpha_1 FCF_{it} + \alpha_2 ICF_{it}^{exp} + \alpha_3 DEPAMORT_{it} + \alpha_4 WCACC_{it} + \alpha_5 BV_{it}^{exp} + \alpha_i + \varepsilon_{it}$$

**LIM 3 (cap):**

$$MV_{it} = \alpha_0 + \alpha_1 FCF_{it} + \alpha_2 ICF_{it}^{cap} + \alpha_3 DEPAMORT_{it} + \alpha_4 RNDACC_{it} + \alpha_5 WCACC_{it} + \alpha_6 BV_{it}^{cap} + \alpha_i + \varepsilon_{it}$$

We use the Hausman specification test to justify the fixed effects model and reject the random effects model: Random effects result in better p-values as they are a more efficient estimator. They occur when some omitted variables are constant over time but vary between firms while others are fixed between firms but vary over time. Thus, the Hausman test compares a more efficient model (random effects model) against a less efficient but consistent model (fixed effects model) to validate that the more efficient model gives consistent results. The underlying null hypothesis implies that the estimators of both the fixed and the random effects model do not differ substantially. Therefore it is only safe to use the random fixed effects model if the null hypothesis is not rejected.

Table 3: Hausman Specification Test

	<i>Chi<sup>2</sup></i>	<i>P-Value</i>
LIM 1 <sup>exp</sup>	71.53	0.000
LIM 1 <sup>cap</sup>	27.34	0.000
LIM 3 <sup>exp</sup>	28.66	0.000
LIM 3 <sup>cap</sup>	246.63	0.000

The results of the Hausman test show significant p-values for both the expensing and capitalizing sample. The results indicate that the random effects model is not appropriate and we should use the fixed effects model including firm fixed effects.<sup>11</sup>

We use a dummy variable to control for cross listings as this might influence market value and exclude all companies that are listed on more than one stock exchange. We also eliminate all observations from our sample with missing values in the variables. Thus, our final sample only consists of companies for which data was fully available for the considered period. All variables are scaled by total assets at the beginning of fiscal year to reduce problems of heteroscedasticity. The analysis of residuals justifies the use of an OLS linear regression model. The histogram of residuals shows a normal distribution and the scatterplot of residuals over the standardised residuals shows no signs of heteroscedasticity. The Durbin-Watson-

<sup>11</sup> For a detailed discussion on the Hausman specification test, see Baltagi, B. H. (2005), pp. 66-74.

statistics of 2.112 (LIM 1) and 2.076 (LIM 3) for the expensing sample and 2.109 (LIM 1) and 2.065 (LIM 3) for the capitalizing sample show no sign of autocorrelation.

Table 4: Regression Results for LIM 1

*Panel A: Expensing sample*

<i>Regression Results</i>	
R <sup>2</sup> within	0.226
Akaike info criterion	662.588
Schwarz info criterion	673.690
Standard error	0.842
Observations	299
F-value	32.46
Durbin-Watson	2.112

  

	<i>coefficients</i>	<i>standard error</i>	<i>t-statistics</i>	<i>p-value</i>
E <sup>exp</sup>	3.463	0.610	5.68	0.000
BV <sup>exp</sup>	0.612	0.127	4.83	0.000
const.	0.620	0.081	7.61	0.000

*Panel B: Capitalizing sample*

<i>Regression Results</i>	
R <sup>2</sup> within	0.253
Akaike info criterion	652.051
Schwarz info criterion	663.152
Standard error	0.827
Observations	299
F-value	37.60
Durbin-Watson	2.109

  

	<i>coefficients</i>	<i>standard error</i>	<i>t-statistics</i>	<i>p-value</i>
E <sup>cap</sup>	4.349	0.710	6.12	0.000
BV <sup>cap</sup>	0.616	0.124	4.98	0.000
const.	0.457	0.090	5.08	0.000

We see from the high F-Value that the models are highly significant. Likewise the determination coefficients are high, indicating strong explanatory power of the models. The results allow us not to reject hypothesis 1. Hence, capitalizing RND leads to earnings with superior market value explanatory power. The higher “R<sup>2</sup> within” of LIM 1 for the capitalizing sample (0.253) compared to the expensing sample (0.226) shows higher market value explanatory power of earnings when capitalizing RND. “R<sup>2</sup> within” is used in fixed effects models. We also conduct the Vuong (1989) likelihood ratio test for model selection without

presuming under the null hypothesis that either model is “true” (Dechow 1994, p. 23). The Vuong Z-Statistic identifies the financial information (earnings and book value including capitalized RND vs. including expensed RND) which is closer to explaining market value. Both models have explanatory power, but the test statistic provides direction concerning which model is closer to the “true data generating process”.<sup>12</sup> A negative Z-statistic indicates that the residuals produced by LIM 1 from the expensing sample ( $R^2$  within: 0.226) are larger than those produced by LIM 1 from the capitalizing sample ( $R^2$  within: 0.253). The results presented in Table 5 show a negative and significant Z-statistic identifying LIM 1 including financial information based on capitalized RND data as the model of choice.

Table 5: Vuong Likelihood Ratio Test (LIM 1)

Model Selection: LIM 1 (expensing) vs. LIM 1 (capitalizing)	
Vuong’s Z-statistic	Probability
- 2.58	0.010

The Akaike (AIC) and Schwarz information criterion (SIC) are further model selection criteria, which consider the idea of penalization when adding regressors.<sup>13</sup> In comparing the two models, the model with the lower value of AIC resp. SIC is preferred. The results of these model selection criteria are consistent with those obtained by analyzing “ $R^2$  within”. Both AIC and SIC are lower for the model using the capitalizing sample compared to using the expensing sample (AIC: 652.051 < 662.588 and SIC: 663.152 < 673.690). All model selection criteria show that by capitalizing RND adjusted aggregate earnings have stronger explanatory power than when such expenditures are immediately expensed.

<sup>12</sup> The Vuong Z-Statistic is defined as  $Z = \frac{1}{\sqrt{n}} \frac{LR}{\hat{\omega}}$ , with simplified  $LR_i$  for each observation i:

$$LR_i = \frac{1}{2} \log \left[ \frac{RSS_{cap}}{RSS_{exp}} \right] + \frac{n}{2} \left[ \frac{(e_{cap_i})^2}{RSS_{cap}} - \frac{(e_{exp_i})^2}{RSS_{exp}} \right]$$

and the standard deviation of LR:  $\hat{\omega}$ ; for a detailed

discussion on the Vuong Test, see Dechow (1994), Appendix 2, pp. 37-40.

<sup>13</sup> According to  $R^2$  both information criteria are defined based on RSS with  $\ln AIC = \left( \frac{2k}{n} \right) + \ln \left( \frac{RSS}{n} \right)$  and

$$\ln SIC = \frac{k}{n} \ln n + \ln \left( \frac{RSS}{n} \right),$$

with n observations and k regressors. SIC imposes even greater penalty when adding

regressors compared to AIC see Gujarati, D. N. (2003), pp. 536.

These results remain valid when decomposing earnings into its components, as is done in LIM 3. The results for LIM 3 using disaggregated earnings are presented in Table 6.

Table 6: Regression Results for LIM 3

*Panel A: Expensing sample*

<i>Regression Results</i>	
R <sup>2</sup> within	0.514
Akaike info criterion	529.082
Schwarz info criterion	551.265
Standard error	0.672
Observations	298
F-value	46.24
Durbin-Watson	2.076

  

	<i>coefficients</i>	<i>standard error</i>	<i>t-statistics</i>	<i>p-value</i>
FCF	3.082	0.447	6.90	0.000
ICF <sup>exp</sup>	-5.525	0.586	-9.43	0.000
WCACC	-5.814	0.563	-10.32	0.000
DEPAMORT	-3.159	0.465	-6.79	0.000
BV <sup>exp</sup>	0.259	0.106	2.44	0.015
const.	0.521	0.070	7.41	0.000

*Panel B: Capitalizing sample*

<i>Regression Results</i>	
R <sup>2</sup> within	0.525
Akaike info criterion	524.126
Schwarz info criterion	550.006
Standard error	0.666
Observations	298
F-value	40.12
Durbin-Watson	2.065

  

	<i>coefficients</i>	<i>standard error</i>	<i>t-statistics</i>	<i>p-value</i>
FCF	3.192	0.546	5.85	0.000
ICF <sup>cap</sup>	-5.598	0.622	-8.99	0.000
WCACC	-5.777	0.601	-9.61	0.000
DEPAMORT	-3.241	0.560	-5.79	0.000
RNDACC	5.247	1.668	3.15	0.002
BV <sup>cap</sup>	0.263	0.105	2.51	0.013
const.	0.404	0.092	4.40	0.000

The results again show a higher “R<sup>2</sup> within” and a lower AIC and SIC for the capitalizing sample. The decomposition of earnings therefore does not diminish the higher value relevance

of the capitalizing sample. We also conduct a Vuong likelihood ratio test, presented in Table 7, to identify the model of choice. Again, the results show a significant negative Z-statistic, revealing that the regression based on the capitalized sample is the model of choice. This allows us again not to reject hypothesis 1.

Table 7: Vuong Likelihood Ratio Test (LIM 3)  
 Model Selection: LIM 3 (expensing) vs. LIM 3 (capitalizing)

<b>Vuong's Z-statistic</b>	<b>Probability</b>
- 2.50	0.013

In the following, we test our hypothesis 2. We compare the coefficient of determination for LIM 1 with its disaggregated counterpart, LIM 3.

Table 6 shows that for both the expensing and the capitalizing sample, disaggregating earnings into cash flow and accrual components in LIM 3 leads to higher market value explanatory power relative to LIM 1, presented in Table 4 (0.514 vs. 0.226 for the “R<sup>2</sup>’s within” of the expensing sample and 0.525 vs. 0.226 for those of the capitalizing sample). This allows us not to reject hypothesis 2. Thus, disaggregating earnings into cash flow and different accrual components enhances the value relevance of financial information. All regressors show highly significant regression coefficients. This is consistent with prior research like Barth, Cram and Nelson (2001) and Guay and Sidhu (2001), the long term accruals showing significant results for explanatory power

Finally, our findings provide evidence that the higher market value explanatory power is due to both the capitalization and the amortization of RND. Our definition RNDACC contains both increases (the capitalization) and decreases (the amortization) of RND assets. Focusing on LIM 3 of the capitalizing sample, the regression coefficient of RNDACC is highly significant with a positive regression coefficient of 5.247 and a t-statistic of 3.15. Therefore the accrual component that is created through RND capitalization contains incremental explanatory power for market value and thus is value relevant. This allows us not to reject hypothesis 3.

The overall results confirm that the higher explanatory power of aggregate earnings in the capitalizing sample can be traced back to the creation of RNDACC. Thus the value relevance of capitalizing RND can be explained by the generated accrual component of earnings, which contains incremental information anticipated by the market. Our models provide higher

explanatory power compared to Dechow (1994). Her models show adjusted  $R^2$  from 0.01% to 40.26%. From a theoretical perspective this might be due to the integration of book value according to the Ohlson (1995) model, and empirically it may be attributed to the use of a price instead of a return model and the consideration of fixed effects.

## **6. Conclusion**

The objective of this paper was to contribute to the ongoing debate whether RND expenditures should be immediately expensed or capitalized. In order to address this question, we combined two different strands of the accounting literature, i.e. the value relevance of RND capitalization and the discussion on accruals vs. cash flows. Our study hypothesizes that capitalizing RND is value relevant due to the accrual component that is created by capitalizing. Both our theoretical approach and our empirical investigation using multivariate regressions are consistent with this prediction. Firstly, by disaggregating earnings into cash flows and its major accrual components, we demonstrate higher market value explanatory power. This is consistent with Barth et al. (2005). Further we base our analysis on existing models of Dechow (1994), extending it by different aspects such as considering non-current accruals, introducing RNDACC as a specific non-current accrual obtained through the capitalization of RND expenditures, and including book value according to the Ohlson model. We use data from a German sample to form an expensing sample and a capitalizing sample. The capitalizing sample provides earnings that better explain market value than the expensing sample due to RNDACC, the accrual component that changes earnings and RNDBSACC, the balance sheet accrual component that changes book value.

The contribution made by this paper is to document benefits of accrual accounting as shown by Dechow (1994) in the context of intangibles, notably RND. Her findings suggest that accruals play an important role in improving the ability of earnings to reflect firm performance. Our extension of her model and empirical results allow us to relax her findings, which predominantly are referred to working capital accruals, by concluding that RND accruals are value relevant. Consequently the full capitalization of RND expenditures results in higher explanatory power than their expensing.

Our study opens several avenues for future research. The results presented here suggest that RNDACC obtained by creating a capitalizing sample is value relevant. Future research can investigate why and how investors value the additional earnings component. Further we

recommend an application of our methodology to observable data such as Australian GAAP, where the capitalization and amortization of RND is allowed. The use of observable data concerning the capitalization of RND might improve our findings.

## Appendix:

### Classification of literature on intangibles according to capital market relevance

Author	Sample	Description	Results	Classification
Aboody/ Lev (1998)	1987-1995 Compustat	Pooled Sample and 9 separate year regressions => mean coefficient; over time the credibility of the amounts of capitalized software development costs increased  3 approaches to examine the value relevance of software capitalization	Capitalized software development costs are positively associated with stock returns and the cumulative software asset reported on the balance sheet is associated with stock prices.  Capitalization change is associated with subsequent earnings changes.  Software capitalization does not reduce earnings quality.	Value Relevance
Abraham s/ Sidhu (1998)	1994-1995 Australian Stock Exchange	Pooled time series; for robustness: year-by-year estimation	RND capitalization assists in improving the usefulness of accounting based performance measures; stepwise removal of accruals leads to performance measures that are statistically inferior to NPAT; largest shift in explanatory power when the accrual RND capitalization is removed	Value Relevance
Ahmed/ Falk 2006	1992-1999 Australian Stock Exchange	Richer regression model than other Australian studies, e.g. Abrahams/ Sidhu (1998) and Goodwin (2002)  pooled data: whole, extractive and industrial regressions	Allowing managers to credibly signal their superior information by either capitalizing successful RND investment or expensing unsuccessful RND investments reduces information asymmetry.	Value Relevance
Amir/ Guan/ Livne (2007)	1972-2002 Compustat	cross-sectional annual regressions => mean and standard deviation of the coefficients; association of RND and CAPEX with subsequent earnings variability (=firm's underlying business risk); following Kothari et al. (2002)	RND contributes to variability of subsequent operating income more than physical assets => only in RND intensive industries;  There are fundamental differences between investment information about RND and CAPEX; Support for RND capitalization in certain circumstances (according to IFRS)	Value Relevance (Reliability)
Amir/ Lev (1996)	1984-1993 Compustat	panel data; focus on wireless communications industry => value relevance of nonfinancial information (more contributable to prices than earnings, book values, CF) => complementarity between financial and nonfinancial data	Current financial reporting of wireless communications companies is inadequate => due to full expensing of significant enhancing investments  Investors rely primarily on nonfinancial information => undo GAAP procedures, which is quite costly as the reports do not provide sufficient information	Value Relevance (non financial information)
Barron/ Byard/ Kile/Riedl (2002)	1986-1998 Compustat	analysts focus on core earnings vs. current earnings; matching problems associated with intangibles rather effect current earnings than core earnings	Usefulness of current earnings for predicting future earnings varies with the degree to which a firm is comprised of intangibles; Expensed intangibles are associated with more analyst uncertainty; Benefit of aggregating individual analysts forecasts is higher for high-intangible firms	Forecast Relevance

Barth/ Clinch (1998)	1991-1995 Australian Stock Exchange (100 largest and 250 random sample MVE > A\$ 10 Mio)	pooled cross-sectionally and intertemporal; extent to which different types of revalued assets are associated with share prices and non- market based estimates of firm value (=> based on the present value of analysts' forecasts of future earnings)	Revalued financial, tangible and intangible assets are value relevant => both upward and downward revaluations are value relevant though asset write-ups are discretionary and might affect the earnings value relevance	Value Relevance
Barth/ Kaszniak/ McNichols (2001)	1983-1994 Compustat	association between intangibles and analyst coverage	Positive association between intangibles and analyst coverage	Forecast Relevance
Bryant (2000 Working Paper and 2003 RAST)	1994-1996 Oil and Gas Firms	economic similarities between RND and E&D of oil/gas industry but different accounting treatment => inconsistency	Full Cost > Successful Efforts > Full Expense => consistent with accrual accounting being more value-relevant than a cash- basis accounting => due to earnings smoothing  policy of full capitalization of expenditures with uncertain future economic benefits > partial capitalization	Value Relevance
Cazavan- Jeny/ Jeanjean (2006)	1993-2002 French listed firms	firms that capitalize are smaller, highly leveraged, less profitable and have less growth opportunities  capitalization choice might be self selection issue	negative association between capitalization and stock return => might be due to earnings manipulation different results from prior research: France has a low legal enforcement => managers have a more opportunistic approach to the use of RND capitalization	Value Relevance
Deng/ Lev (2006)	1986-2000 Compustat firms incl. IPRD data	value relevance of in- process RND	Significant association between the values of in-process RND and acquiring firms' cash flows during 3 years subsequent to acquisition => IPRD is an asset with 3 years of life  => IPRD should be capitalized; reliability/objectivity not worse than CAPEX => average findings, not specific cases => individual impairment test needed	Value Relevance
Goodwin/ Ahmed (2006)	1975-1999 Australian Stock Exchange	Australian answer to Lev/ Zarowin (1999)	Value relevance of earnings and book value has increased for capitalizers; no significant improvement for non- capitalizers; capitalizers that amortize generally have the highest earnings value relevance	Value Relevance
Gu/ Wang (2005)	1981-1998 Compustat	information complexity of intangibles => idiosyncratic assets with high uncertainty in value, low tradability, transaction-specific, little value in their next best use	Positive association between analysts' forecast error and firm's intangible intensity; Forecast errors greater for firms with diverse/ innovative technologies	Forecast Relevance

Hand (2003)	1980-2000 Compustat	dynamic approach; net present value profitability	1. NPV of expenditures on RND, ADV, PERS have been consistently positive 2. Profitability of RND increased more than threefold; ADV and PERS remained unchanged 3. NPV profitability of RND and ADV increases as the scale of the expenditures made on those intangibles increases 4. Increasing profitability returns-to-scale of expenditures on both RND and ADV have become more pronounced over time	Value Relevance
Kothari/ Laguerre/ Leone (2002)	1972-1997 Compustat	Contribution to trade-off of relevance and reliability; Standard deviation of 5 annual earnings observations as a proxy for uncertainty of future earnings	RND investments generate future benefits that are far more uncertain than benefits from PPE investments => no support of either expensing or capitalizing	Value Relevance (Reliability)
Lev/ Nissim/ Thomas (2005)	1983-2000 Compustat	cross-sectional regressions => mean of annual results RND: 1- 8 years lifetime, depending on industry	increased association of adjusted earnings and BV with current stock price and future pre RND earnings (=intrinsic value) and future returns => need for standard setters to review current rules	Value Relevance
Lev/ Sarath/ Sougiannis (2005)	1972-2003 Compustat	key drivers of reporting biases: RND growth, RoE, earnings growth	high RND growth firms => report conservatively low RND growth firms => report aggressively systematic evidence of mispricing:	Value Relevance
Lev/ Sougiannis (1996)	1976-1991 NYSE, AMEX, OTC	annual cross-sectional regressions => mean values Estimate Amortization Rate, Adjust Earnings and Book Value	Capitalization and amortization of RND is value relevant	Value Relevance
Lev/ Sougiannis (1999)	1972-1989 CRSP, Compustat	cross-sectional regressions abnormal earnings due to innovation => RND explains the gap; association: large RND capital => low B/M	RND capital is significantly associated with subsequent returns; RND intensive firms: RND capital subsumes B/M effect; not result of survivorship bias; association between RND capital and subsequent returns due to a risk factor associated with RND rather than mispricing	Value Relevance
Lev/ Zarowin (1999)	1977-1996 Compustat	annual cross-section regressions decline of financial information (E, CF, BV) to explain market value	linkage: intangibles - business change - loss of value relevance of financial information 2 proposals: capitalization of intangibles, restated financial reports	Value Relevance
Matolcsy/ Wyatt (2006)	1990-1997 Barclays Australasia Consensus Earnings Profile	MVAD = MVE-(BVE-INT); market value added as a proxy for underlying intangible investments 2 stage least square estimates for: Analyst following Analyst forecast dispersion Analyst forecast error	Capitalization of intangibles is associated with higher analyst following and lower absolute earnings forecast errors => prove for benefits for analysts when managers have the option to capitalize intangibles => IAS 38 and AASB 138 reduce the usefulness of financial statements	Forecast Relevance

Ritter/ Wells (2006)	1979-1997 Australian Stock Exchange	AASB 138 more restrictive => recognition of identified intangible assets will diminish; BUT: disclosure of identified intangible assets is value relevant!  Goodwill is less likely to be reflected in future returns than identified intangible assets	Positive association between stock prices and voluntarily recognised and disclosed identifiable intangible assets; positive association between identifiable intangible assets and realized future period income	Value Relevance
Shi (2002)		SFAS 86 => negative impact on forecast errors pre-adopting and post-adopting period	capitalizing software developments costs leads to higher earnings variability which is positively correlated with forecast errors	Forecast Relevance
Sougiannis (1994)	1975-1985 Compustat	RND investment has impact on earnings and market value	long-run impact of RND on market value consists of an indirect and direct effect => RND variables are valued conditional on earnings  different from prior research: RND tax shields are found to be valued as earnings	Value Relevance
Wyatt (2005)	1993-1997 Australian Stock Exchange	Management's choice to record intangibles is associated with the strength of the firm technology, the length of the technology cycle time, and property-rights-related factors	=> managerial discretion provides benefits for investors and firm => concern of manipulation is overstated => limiting manager's choice reduces quality of balance sheet information	Value Relevance
Zantout/ Tsetsekos (1994)	1979-1990 Compustat	event study: effects of RND announcements on announcing and rival firms	voluntary disclosure of RND: - positive abnormal return for announcing firm - negative abnormal return for rival firm	Decision Relevance
Zhao (2002)	1990-1999 international comparison : F, G, UK, USA	pooled sample => by country => by group (code vs. common) initial attempt to empirically test the effect of RND accounting standard in an international context	RND reporting increases value relevance; allocation of RND costs between capitalizing and expensing provides incremental information  mixed results of previous comparative earnings studies due to different RND reporting standards and reporting environment	Value Relevance

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