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Empirical Studies on the Economic Consequences of Financial Reporting Flexibility

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1. Introduction

The empirical studies included in this thesis address "the fundamental question of whether accounting matters" (FIELDS/LYS/VINCENT (2001), p. 256). Accounting matters if it has economic consequences. Accounting has economic consequences if it affects the real decisions made by managers and others, rather than simply mirroring the past. In the spirit of ZEFF (1978) and HOLTHAUSEN/LEFTWICH (1983), financial reporting can have economic consequences through its informational and contracting roles. First, accounting information may improve the information set about the timing, magnitude, and risk of future cash flows of (particularly less well-informed) parties. Second, accounting is often used as an instrument in (e.g., compensation and debt) contracts that aim at alleviating agency costs (WATTS/ZIMMERMAN (1986)). Hence, accounting influences the outcome of such contracts, which in turn influences decisions and, ultimately, firm values.

I define financial reporting flexibility as a feature of an accounting system, which has two dimensions: First, accounting choices between two or more ways of recognizing, measuring and/or presenting a firm within the system. Second, flexibility to portray more detailed information compared to other financial reporting systems. To the extent accounting choices or more detailed information affects the information set of parties or contractual outcomes, accounting flexibility has economic consequences.

FIELDS/LYS/VINCENT (2001) attest the absence of a comprehensive theory of financial reporting flexibility. I argue that this may turn into a potential benefit since examining research questions pertaining to the economic consequences of accounting flexibility may contribute at the intersection of the accounting literature and other fields.

This thesis examines the economic consequences of accounting flexibility inherent in International Financial Reporting Standards (IFRS). The IFRS comprise a system that is well-suited for an examination of the economic consequences of financial reporting flexibility for multiple reasons: First, the fundamental role of reporting under IFRS is to provide existing and potential investors, lenders and other creditors in making decisions with decision-useful information on a company's business activities (Framework.OB2), which addresses the informational role of accounting. The concept of decision-usefulness also encompasses the stewardship role of accounting and its influence on contractual outcomes (Framwork.BC1.24). The objective of presenting decision-useful information makes IFRS superior to other financial reporting systems with respect to the amount and detail of information mapped into the accounting system: Many jurisdictions have recently started to extend or converge their accounting systems to IFRS in order to have a competitive system and over 100 jurisdictions require or permit the application of IFRS for some or all firms in their economy (BARTH (2008)).

Second, several papers acknowledge that IFRS are principles-based (e.g., BALL (2006)) as opposed to rules-based, which has an important implication: Principles-based financial reporting systems create greater flexibility. Greater flexibility triggers discretion (HAIL/LEUZ/WYSOCKI (2010)): Discretion can enable managers to convey private information to the markets in a less costly fashion or create room for managerial opportunism.¹ These possible outcomes create variation in firms' application of IFRS, which likely yields several settings that can be exploited to document the economic consequences of accounting flexibility, that cannot be studied under different reporting systems.

This thesis investigates IFRS accounting flexibility within the European Union. Investigating accounting flexibility in the context of the European Union offers several advantages. First, the EU mandated publicly traded European firms to prepare consolidated financial statements using IFRS from 2005 onwards (EC No.1606/2002). Although the Fourth and Seventh Council Directive (78/660/EEC and 83/349/EEC respectively) harmonized accounting practices within the European Union to some extent, differences largely remained (e.g., JOOS/LANG (1994)). Hence, the introduction of IFRS aimed at "harmonising the financial information presented [...] in order to ensure a high degree of transparency and comparability of financial statements and hence an

¹ Therefore, professional judgment is a distinctive element of the accounting process in principles-based systems (SCHIPPER (2003)).

efficient functioning of the Community capital market and of the Internal Market." (Art. 1 IAS-Regulation 1606/2002).

Second, while several papers have tried to assess the economic consequences of voluntary (for a review, see SODERSTROM/SUN (2007)) and mandatory IFRS adoption (for a review, see BRÜGGEMANN/HITZ/SELLHORN (2011)), the available evidence points at the importance of institutional differences (e.g., enforcement mechanisms) and firm-level incentives that moderate adoption effects. Also, the study by KVAAL/NOBES (2010) indicates that pre-IFRS national practices continue where this is allowed under IFRS. Most likely, this heterogeneity across European IFRS-applying firms and countries provides a fruitful field to gather evidence on the economic effects of accounting flexibility.

On the basis of NOBES (2006), table 1 presents major overt options and table 2 presents major covert options available within IFRS. In many cases these options are only *de facto* exercised within specific industries² or of less importance to managers and others because they do not impact the financial statements materially. Therefore, I examine two options among firms from industries whose primary asset or investment is strongly influenced by financial reporting flexibility: First, the flexibility to capitalize development costs. I follow most prior studies examining the effects of capitalizing development costs and treat capitalization as a covert option, especially for those investments that arise between research and development in the life cycle of an innovation activity. However, the ability to capitalize development costs itself is a feature of IFRS that make IFRS more flexible compared to other accounting systems. I exploit this feature in two different ways: By benchmarking top-R&D-investing IFRS firms against matched US firms that must expense virtually all of their R&D investment to study whether accounting flexibility affected R&D investment during the recent financial crisis (chapter 2 of this thesis); and by examining the composition and potential value of firms' innovation activities revealed by capitalization to disentangle different effects of corporate control (chapter 3).

² For example, CHRISTENSEN/NIKOLAEV (2010) document that virtually no firms revalue their property, plant and equipment or intangibles according to IAS 16 and IAS 38. Also, the fair value model under IAS 40 is a mere phenomenon of the real estate industry.

IFRS		Description of option
IAS 2	Inventories	FIFO or weighted average for the determination of the cost of inventories (para. 25).
IAS 2	Inventories	Marking to market allowed for inventories of commodity broker-traders (para. 3).
IAS 16	Property, Plant and Equipment	Cost or fair value measurement basis for classes of property, plant and equipment (para. 29).
IAS 19	Employee Benefits	Actuarial gains and losses may be recognized in different ways with different impacts on profit or loss and/or comprehensive income (paras. 92-95)
IAS 20	Accounting for Government Grants and Disclosure of Government Assistance	Asset grants can be shown as a deduction from the asset or as deferred income (para. 24).
IAS 28	Investments in Associates	In investor statements, associates can be shown at cost or as available-for-sale investments (para. 38).
IAS 31	Interests in Joint Ventures	In group statements, a choice of proportional consolidation, or equity accounting for joint venture entities (para. 30).
IAS 38	Intangible Assets	Cost or fair value measurement for some types of intangible asset (para. 72).
IAS 39	Financial Instruments: Recognition and Measurement	Choice of cost basis or marking to market for some financial assets and liabilities (para. 9). (Other choices are also available within para. 9.)
IAS 40	Investment Property	Permission to classify a property held under an operating lease as an investment property (para. 6).
IAS 40	Investment Property	Entity-wide choice of cost or fair value as measurement basis for investment property (para. 30).
IFRS 3	Business Combinations	Choice of full goodwill method vs. revaluation method (para 19).

Table 1: Examples of Major Overt Options Pertaining to Recognition or

 Measurement in IFRS for Consolidated Financial Statements

IFRS		Description of option
IAS 8	Accounting Policies, Changes in Accounting Estimates and Errors	The determination of materiality for various purposes (para. 5).
IAS 11	Construction Contracts	Use of percentage of completion method only if the outcome of a contract can be estimated reliably (para. 22).
IAS 12	Income Taxes	Recognition of deferred tax asset for a loss carryforward only if future taxable profit is probable (para. 34).
IAS 17	Leases	Lease classification based on 'substantially all the risks and rewards' with no numerical criteria (para. 8).
IAS 19	Employee Benefits	Determination of actuarial assumptions (para. 72)
IAS 21	The Effects of Changes in Foreign Exchange Rates	Determination of functional currency based on a mixture of criteria (paras. 9-12).
IAS 23	Borrowing Costs	Capitalization of borrowing costs for qualified assets (paras. 10 and 12)
IAS 27	Consolidated and Separate Financial Statements	The identification of a subsidiary on the basis of 'power to control' (para. 4).
IAS 36	Impairment of Assets	Identification of an indication of impairment based on a mixture of criteria (paras. 12-14).
IAS 37	Provisions, Contingent Liabilities and Contingent Assets	Recognition of a provision based on probability of outfiow of resources (para. 14).
IAS 38	Intangible Assets	Capitalisation of development costs when all of various criteria are met (para. 57).
IAS 38	Intangible Assets	Amortisation of intangible assets only if useful life is assessed as finite (para. 88).
IAS 39	Financial Instruments: Recognition and Measurement	Estimation of hedge effectiveness as a condition for use of hedge accounting (para. 88).
IAS 40	Investment Property	Use of cost basis, despite entity-wide choice of fair value, for an investment property whose fair value cannot be measured reliably (para. 53).
IFRS 3	Business Combinations	Determination of fair values (para. 18) and impairment only approach including, testing for impairment at level of cash generating units (IAS 36.90)
E.g., IAS 39, IAS 40,	Fair Value Measurement	Several standard specify a hierarchy to determine fair values. While level 1 fair values are those from active markets, level 2 (comparable transactions) and level 3 fair values (model-based) include more discretion.

Table 2: Examples of Major Covert options Pertaining to Recognition or

 Measurement in IFRS for Consolidated Financial Statements

Second, I investigate the flexibility to choose between the cost and fair value models to account for investment properties under IFRS with a focus on the real estate industry since investment property is their primary asset. Under US GAAP, real estate investment trusts report property assets under the cost model and rarely report fair values. Interestingly, IFRS mandate fair value disclosures when firms apply the cost model for their investment property. Hence, this is the only asset class of tangible assets for which the flexibility towards the cost and the fair value model as well as the recognition or disclosure of fair values can be examined with respect to their economic consequences (chapter 4).

Accordingly, the thesis is composed of five chapters of which the following three represent papers that are intended for submission to peer-reviewed/refereed journals. Therefore, each chapter (including this introduction and the conclusion in chapter five) has a separate list of references and a separate appendix including tables and definitions. For all the papers, I gratefully acknowledge the financial contribution of the European Commission Research Training Network INTACCT (Contract MRTN-CT-2006-035850).

In the following, I briefly summarize each chapter and acknowledge helpful suggestions and assistance:

Chapter 2 "*Do Accounting Rules Affect R&D Investment?*" investigates whether international differences in financial reporting rules have the potential to affect important macroeconomic variables.³ We analyze two sets of top-R&D-investing firms which are subject to different standards for R&D accounting. While European IFRS applying firms capitalize parts of their R&D investments, US firms are required to expense their R&D investments. We expect and find that, when under earnings pressure, these two sets of firms engage in differential earnings management behavior: Whereas IFRS firms tend to increase R&D capitalization ratios in the financial crisis (accounting earnings management), matched US firms protect their earnings by cutting their R&D spending (real earnings management).

³ This chapter is based on Müller, Maximilian and Thorsten Sellhorn, 2011, "Do Accounting Rules Affect R&D Investment?", Working Paper, WHU – Otto Beisheim School of Management.

We document that by means of greater financial reporting flexibility, that is, increasing capitalization ratios, EU firms have a higher R&D growth compared to US firms. Also, results indicate that especially those EU firms with strong earnings management incentives increase capitalization ratios during the crisis. This finding could contribute to explaining a recent trend indicating substantial variation in aggregate R&D investment growth between EU and US firms. Hence, this finding addresses the literature on the economics of innovation by documenting a hitherto omitted determinant of R&D investment. Since cutting R&D spending potentially has negative long-term consequences, our paper could be of interest to standard setters interested in the real economic effects of internationally divergent accounting rules.

For this paper, we thank Igor Goncharov, Stefan Hahn, Martin Jacob, Laurence van Lent, Caspar David Peter, Wolfgang Schultze, Anne Wyatt, and workshop participants at the University of Augsburg, Frankfurt School of Finance seminar and the European Accounting Association congress in Rome 2011 for helpful comments and suggestions and Matthias Breuer, Philip Bulis, Dario Claus, Frederic Friedel, Maximilian Messing, Marcel Meuer, Leonard La Roche and Julian Scheffler for valuable research assistance.

Chapter 3 "Large Shareholders and the Value of Research and Development Projects" investigates the opposing effects of monitoring benefits vs. costs of expropriation from the existence of corporate control on the market value of innovation activities, separating the effects for research and development projects.⁴ In order to separate research and development projects, we analyze top-R&D-investing European firms that expense research project investments and capitalize development project investments under IFRS. While we find development projects to be valued higher than research projects, we expect and find that having a majority shareholder increases the valuation of research projects are valued higher than research projects. As development projects are valued higher than research projects, we attribute the differential valuation effect of corporate control to monitoring benefits

⁴ This chapter is based on Müller, Maximilian and Thorsten Sellhorn, 2011, "Large Shareholders and the Value of Research and Development Projects", Working Paper, WHU – Otto Beisheim School of Management.

overshadowing expropriation costs for research projects. Put differently, the potential for expropriation and any costs associated with it is higher for development projects. However, when development projects are surrounded by managerial opportunism, we also find some evidence of monitoring benefits that influence their value positively.

Our evidence emphasizes disentangling a firm's innovation activities for identification purposes: Financial reporting flexibility reveals relevant information that signals different expected returns to different innovation activities. This information may calibrate agency problems resulting from controlling shareholders. At least, it helps to document opposing effects of controlling shareholders on the value of a firm's innovation activities. Hence, these findings contribute to the corporate governance literature on agency problems that minority shareholders can be exposed to as well as to studies examining the market valuation of R&D.

For this paper, we thank Igor Goncharov, Stefan Hahn, Martin Jacob and Caspar David Peter for helpful comments and suggestions and Matthias Breuer for research assistance.

Chapter 4 "*Recognition vs. Disclosure of Fair Values*" investigates whether recognition and disclosure of fair values are equivalent in their informativeness in the unique setting of the European real estate industry where recognition and disclosure can be compared for the same item of information on these firms' primary asset: Fair values of investment properties that are recognized or disclosed under IFRS.⁵ We hypothesize and find earnings including investment property fair value information to have a higher informativeness than earnings determined under the alternative, the cost model. When we adjust these cost model earnings for the disclosed fair values from the footnotes, our results indicate that cost model firms' 'as if fair value' earnings continue to be less informative, which appears partially attributable to the lower reliability of disclosed fair values.

⁵ This chapter is based on Müller, Maximilian, Edward J. Riedl and Thorsten Sellhorn, 2011, "Recognition vs. Disclosure of Fair Values", Working Paper, WHU – Otto Beisheim School of

Management and Boston University.

These findings suggest that different outcomes of reporting flexibility over the same item of information do matter, that is, recognition and disclosure are not substitutes. Flexibility to report under the fair value model signals more informative earnings, i.e., changes the information set, and has pricing consequences to the extent more informative earnings have effects on information asymmetry. Taken together, our study offers evidence that addresses the IASB's reconsideration of requiring all real estate firms to report their investment property at fair value. This could potentially have profound consequences for future convergence efforts between IASB and FASB.

For this paper, we thank Joachim Gassen, Igor Goncharov, Stefan Hahn, Philip Joos, Wayne Landsman, Laurence van Lent, Caspar David Peter, Peter Pope and workshop participants at Humboldt-University Berlin, Gießen University and the INTACCT workshop in Varna for helpful comments and suggestions and Andreas Veller and Alexander Weckenbrock for excellent research assistance.

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2. Do Accounting Rules Affect R&D Investment?¹

2.1. Introduction

Levels of R&D investment and R&D intensity have been considerably higher in the United States (US) than in the European Union (EU) for many years. The main firm-level factors explaining this difference have been identified to include firm size (ORTEGA-ARGILÉS/BRANDSMA (2008)), lack of growth of new, technology-based firms (O'SULLIVAN (2007)) as well as a less entrepreneurial culture, a more costly investor protection rights regime, high taxation, more difficult access to finance and to adequate skills, costly social security regimes, and overregulation of labor and capital markets (MONCADA-PATERNÒ-CASTELLO ET AL. (2010); O'SULLIVAN (2007)). In 2008, the world economy entered into a strong financial and economic crisis. Recent data from the "EU Industrial R&D Investment Scoreboard" (EC (2010)) indicates that EU firms' R&D spending has grown significantly faster than that of US firms in 2008 and 2009 for the first time in at least the past decade.

In this paper, we analyze whether international differences in R&D accounting standards, a hitherto little explored factor, have contributed to this noteworthy shift in R&D investment growth. Prior literature shows that managers have incentive to achieve earnings targets. In times of crisis, the net benefit of engaging in earnings management to achieve these targets increases. In R&D-intensive firms, earnings targets may be achieved by increasing R&D capitalization ratios (accounting earnings management) or by reducing R&D spending, a discretionary expenditure ('real' earnings management). We argue that firms under earnings pressure trade off these earnings management approaches. Where the accounting regime prohibits R&D capitalization, we expect that firms will cut R&D spending to achieve their earnings targets, whereas elsewhere firms will be predisposed to increasing R&D capitalization in order to achieve the same earnings effect, leaving R&D spending unaffected. Such behavior would suggest that international differences in R&D accounting standards have a profound effect on a fundamental macroeconomic variable, R&D investment.

¹ This chapter is based on Müller, Maximilian and Thorsten Sellhorn, 2011, "Do Accounting Rules Affect R&D Investment?", Working Paper, WHU – Otto Beisheim School of Management.

We test our predictions using matched samples of R&D-intensive firms from the EU and the US. In the EU, firms have been reporting under International Financial Reporting Standards (IFRS) since 2005.² The applicable IFRS, IAS 38 Intangible Assets, requires firms to capitalize development costs when certain vague criteria are met. IAS 38 has been characterized as giving firms a highly discretionary covert option regarding the amount to capitalize development costs (NOBES (2006)). In contrast, US firms reporting under US GAAP have to expense virtually all R&D investments. While a one-dollar reduction in R&D expenditures is the only R&D-related way for US firms to generate a one-dollar profit, EU managers may instead implement a more aggressive R&D capitalization strategy instead. Thus, comparing these two economic areas and controlling for known determinants of R&D investment allows us to isolate the effect of differences in R&D accounting standards on R&D investment. We expect IFRS firms under earnings pressure to increase R&D capitalization while US firms under earnings pressure would tend to reduce R&D spending to achieve their earnings targets.

Our first set of tests assesses the influence of international differences in R&D accounting on the rate of change in R&D spending in the financial crisis, controlling for other factors that have been shown to influence R&D investment: First, we test whether, during the crisis, EU firms increase their development cost capitalization ratio, that is, the portion of capitalized development costs in total R&D investment. Second, we investigate whether, during the crisis, the change in R&D investment for EU firms is greater than the change in R&D investment for matched US firms and whether that difference can be explained by an increase in EU firms' development cost capitalization ratio. In combination, these tests provide evidence on whether IFRS firms and US firms make different R&D-related earnings management decisions during the financial crisis and whether those decisions have an impact on their levels of R&D investment. Finally, in order to provide further evidence that the effect is due to different earnings management strategies, we examine whether EU and US firms adjust R&D spending to meet earnings

² Several EU firms voluntarily adopted IFRS before this date; for a review of corresponding research see SODERSTROM/SUN (2007).

benchmarks. For EU firms, we further test whether they reduce R&D *expenses* to meet earnings benchmarks by increasing their capitalization ratio.

Our results are largely consistent with our predictions. First, we document an increase in EU firms' development cost capitalization ratios during the crisis. As the tests control for other factors driving the capitalized amounts, this indicates that EU firms use the accounting discretion inherent in the rules of IAS 38 to engage in accounting earnings management as they enter times of economic hardship. Second, controlling for other determinants of R&D investment, we find that there is an incrementally positive effect of an increase in the development cost capitalization ratio in the crisis on the change in R&D investment compared to US firms. This suggests that IFRS firms engage more strongly in accounting earnings management whereas US firms resort to 'real' earnings management to counteract the profit effects of the financial crisis. Finally in our test for earnings management to meet benchmarks, we find patterns consistent with prior literature. We find that, when the firm-level incentives for earnings management are strong, EU managers appear to view decreasing R&D investment more favorably than increasing the development cost capitalization ratio to manipulate their R&D expenses. However, most notably, when the incentives for earnings management arise at a macro-economic level, as is the case during a crisis, EU firms have a stronger preference to increase their development cost capitalization ratios. This result suggests that managers use accounting flexibility and resort to increasing their capitalization ratio to signal strength, e.g., compared to their R&D cutting competitors.

Overall, our findings suggest that the recent switch in R&D growth rates between the US and the EU during the financial crisis is in part explained by internationally divergent accounting rules. Apparently, accounting rules have the potential to ultimately affect firms' long-term competitiveness through their differential effects on R&D spending. Since the FASB and the IASB are currently working on a joint project aimed at harmonizing accounting for R&D, our evidence would be of interest to these standard setters as it documents potential economic repercussions of financial reporting standard setting. Our paper contributes to two distinct strands of literature. First, we add to the literature on the economics of innovation, that is, the determinants of a firm's R&D activity (for a detailed discussion, see BERGER (1993)). More closely related, several papers have documented a positive effect of R&D tax incentives on a firm's R&D activity (for a review, see HALL/VAN REENEN (2000)). To the extent that accounting flexibility provides benefits to R&D intensive firms via an increased ability to meet earnings benchmarks (which is rewarded by capital markets) and an increased ability to engage in positive NPV projects through capitalizing development costs, there is a reporting incentive to engage in accounting earnings management. We document that this reporting incentive exists and (indirectly) impacts a firm's R&D investment in times of economic hardship. Therefore, our findings also address a debate of whether a difference in accounting adversely affects investments in intangibles assets in the literature that studies their recognition and measurement (SKINNER (2008) and LEV (2008)).

Second, we contribute to the earnings management literature by investigating the extent to which R&D spending and R&D accounting are used to achieve earnings targets through the trade-off of real earnings management vs. accounting earnings management (ZANG (2007); WANG/D'SOUZA (2006); OSWALD/ZAROWIN (2007)). While previous studies have highlighted benefits and costs of capitalizing R&D (OSWALD (2008)), we exploit the crisis setting to document that firms that have the flexibility favor accounting earnings management over real earnings management in times of economic hardship, when signaling strength via relatively high R&D investment is potentially more important; hence, this complements the survey findings by GRAHAM/HARVEY/RAJGOPAL (2005) that managers, on average, favor real earnings management.

We note that our findings are subject to several limitations: First, while we document a positive effect of development cost capitalization ratio on EU firms' R&D investment, this is a test against firms with a lower development cost capitalization ratio. This group includes EU firms that decrease their capitalization ratio as well as all matched US firms. We conclude that this suggests that US firms have a comparative disadvantage as they are not allowed to capitalize R&D. Further analyses indicate that this effect also holds when we only compare firms with an increase in capitalization ratio vs. US firms.

Second, we document an explanation for the variation in R&D investment during the financial crisis, but do not test actual economic effects that a higher R&D investment for capitalizing EU firms may have. Considering a time lag of at least three years between R&D investments and their output/effects (LIN/CHEN (2005)), any ex post output measurement cannot be performed at this point; also due to these lagged output consequences, it is possible that managers simply delayed projects and will catch up with their competitors. Hence, any predictions of R&D intensive firms' contribution to differences in GDP growth between US and EU cannot be made reliably. Also, the available ex ante measurements (for a review, see HALL (2000)) rely on regressing market value on some form of a knowledge asset that is constructed from past R&D investments and only allow to assess the value, that is, the expected performance of the knowledge asset. As for the ex post measures, it is open how differences in growth would impact the absolute value of the knowledge stock.

Finally, we draw inferences on the trade-off between real and accounting earnings management for EU firms in times of economic hardship by comparing pre-crisis periods with crisis periods. We would expect capitalization rates to unravel in post-crisis observations. However, as pointed out above, these tests cannot yet be made.

2.2. Background and Hypothesis Development

2.2.1. Accounting for R&D

Under IFRS, IAS 38.8 defines "development" to be "the application of research findings or other knowledge to a plan or design for the production of new or substantially improved materials, devices, products, processes, systems or services before the start of commercial production or use." IAS 38.8 also defines "research" as "the original and planned investigation undertaken with the prospect of gaining new scientific or technical knowledge and understanding". Further, under IAS 38.57 "an intangible asset arising from

development (or from the development phase of an internal project) shall be recognized if [...] an entity can demonstrate all of the following:

- The technical feasibility of completing the intangible asset so that it will be available for use or sale;
- its intention to complete the intangible asset and use or sell it;
- its ability to use or sell the intangible asset;
- how the intangible asset will generate probable future economic benefits;
- [...] the availability of adequate technical, financial and other resources to complete the development and to use or sell the intangible asset;
- its ability to measure reliably the expenditure attributable to the intangible asset during its development."

It has been widely acknowledged that this requirement includes vague criteria that effectively make development cost capitalization a covert option that is highly discretionary (NOBES (2006)). In fact, the discretion in determining the amount to be capitalized was one of the reasons for the FASB to reject the selective capitalization method (GORNIK-TOMASZEWSKI/MILLAN (2005)).

Therefore, under US GAAP, all research and development costs³ are charged to expense when incurred (SFAS 2.12 [ASC 730-10-25-1]). Only under SFAS 86.5 (ASC 985-20-25-3), costs of producing product masters incurred subsequent to establishing technological feasibility shall be capitalized for software to be sold, leased, or marketed. Thus, the scope for capitalization of R&D related costs is much broader under IFRS than under US GAAP.

³ SFAS 2.8 (ASC 730-10-20) defines research as the "planned search or critical investigation aimed at discovery of new knowledge, with the hope that such knowledge will be useful in developing a new product or service, or a new process or technique, or in bringing about a significant improvement to an existing product or process" and development as the "translation of research findings or other knowledge into a plan or design for a new product or process, or for a significant improvement to an existing product or process, whether intended for sale or use."

2.2.2. The Capitalization Ratio

Anecdotal evidence suggests that the amount capitalized as well as the capitalization ratio (of R&D investment) are closely watched by analysts⁴ and other stakeholders due to the discretionary nature of development cost capitalization under IAS 38 and its inherent earnings management potential. A firm's current period R&D investment (RDI_{it}) can be split up into two parts: Research expenses and development expenses⁵ (RE_{it}) as well as capitalized development costs (CDC_{it}): $RDI_{it} = RE_{it} + CDC_{it}$. Accordingly, the development cost capitalization ratio (CR_{it}) is defined as the proportion of a period's R&D investment being capitalized: $CR_{it} = \frac{CDC_{it}}{RDI_{it}}$. From one period to the next, CR grows ($\Delta CR > 0$) if the growth in capitalized development costs, that is, the change in CDC (ΔCDC_{it}) divided by prior period's CDC, is greater than the growth in R&D investment, that is, the change in RDI_{it}

 (ΔRDI_{it}) divided by prior period's *RDI*: $\Delta CR_{it} > 0$ if $\frac{\Delta CDC_{it}}{CDC_{it-1}} > \frac{\Delta RDI_{it}}{RDI_{it-1}}$.

2.2.3. Numerical Example

The following numerical example shall illustrate the trade-off between different earnings management strategies for IFRS firms and the corresponding strategies US GAAP firms may engage in:

Assume two identical firms, A (B) accounting under IFRS (US GAAP). Their earnings before R&D investment amount to 200 Currency Units (CU), they have a budgeted R&D investment of 150 CU and an earnings target (e.g., analysts' consensus forecast) of 100 CU. If both firms do not alter their R&D investment and firm A does not capitalize any development costs, both firms miss their target by 50 CU. Both firms may engage in real earnings management, that is, cutting down R&D investment by 50 in order to meet the earnings target. However, firm A could also capitalize a third of the budgeted R&D investment (CR=33.33%) assuming it could be argued that this proportion qualified for capitalization. While a one-dollar reduction in R&D

⁴ CHIANG/MENSAH (2004) finds that UK analysts favor expensing R&D. Also, the Association for Investment Management and Research argues for expensing (POPE/REES (1992)).

⁵ If an investment meets the definition of development (IAS 38.8) but does not qualify for development cost capitalization it will be expensed.

expenditures is the only R&D-related way for US firms to generate a onedollar profit, EU managers may instead implement a more aggressive R&D capitalization strategy instead. As a consequence, firm A's R&D investment would be as budgeted and higher than firm B's.

2.2.4. Related Literature

Various studies document an underinvestment problem due to mandatory expensing of R&D, e.g., research on the adoption of a standard that implements mandatory expensing (e.g., SFAS 2) finds a negative effect of expensing on R&D investment (DUKES/DYCKMAN/ELLIOTT (1980); HORWITZ/KOLODNY (1980); ELLIOTT/GORDON/DYCKMAN/ROLAND (1984); SHEHATA (1991); WASLEY/LINSMEIER (1992)).

In line with an increasing body of evidence that supports the view that managers manipulate earnings to achieve earnings targets, e.g., through discretionary accruals (BARTOV/GIVOLY/HAYN (2002); GORE/POPE/SINGH (2007)) or classification strategies (MCVAY (2006)), studies that investigate more specific reporting incentives find that managers decrease a firm's in R&D investment to meet earnings benchmarks: BABER/FAIRFIELD/HAGGARD (1991), partition their sample into three categories based on whether a firm will miss an earnings goal regardless of its R&D investment, exceed an earnings goal regardless of its R&D investment or meet an earnings goal by reducing its R&D investment. Firms in the latter group are documented to be most likely to cut R&D. This finding is supported by similar studies by PERRY/GRINAKER (1994), BANGE/DE BONDT (1998) as well as BUSHEE (1998) who documents that the effect is moderated by transient vs. long-term institutional ownership. The finding by COOPER/SELTO (1991) that managers are less willing to invest in profitable R&D projects when costs are expensed is supported by the notion that there is a time lag of at least three years between R&D investments and their output/effects (LIN/CHEN (2005)) and, thus, managers trade-off a boost of current period earnings and future, uncertain earnings (from a current period R&D investment). DECHOW/SLOAN (1991) find that the growth in R&D investment is reduced over CEOs' final years of tenure but mitigated through CEO stock ownership. Finally, ROYCHOWDHURY (2006) finds that firms that report small profits have unusually low discretionary expenses (e.g., R&D expenses). In fact, these studies provide evidence in line with GRAHAM/HARVEY/RAJGOPAL (2005) that show that firms prefer to meet benchmarks by cutting or delaying positive NPV projects (e.g., R&D) over altering accounting estimates by means of a survey of over 401 financial executives.

While altering accounting is summarized as accounting earnings management, altering the investment structure is referred to as 'real' earnings management: Within a theoretical framework, DEMSKI (2004) as well as EWERT/WAGENHOFER (2005) show that tighter accounting standards (e.g., mandatory expensing of R&D) reduce accounting earnings management and diminish the disutility of engaging in real earnings management, i.e., changing the timing of operations, allocation of resources, or decisions to undertake investment projects.

Empirical papers support this notion for certain settings: E.g., BARTON (2001) finds that financial derivatives are used as a substitute for accounting earnings management. Also, BLACK/SELLERS/MANLY (1998) find that the use of asset sales to smooth income is less pronounced in countries that allow certain revaluations. For R&D investment settings, various studies show that firms trade off R&D investment reduction and accruals manipulation as earnings management tools (GUNNY (2009); ZANG (2007); WANG/D'SOUZA (2006)). While GUNNY (2009) documents that real earnings management has an economically significant impact on future performance, WANG/D'SOUZA (2006) find that managers are more likely to cut R&D when accounting flexibility is low, and that managers prefer the use of accrual to real earnings management given ample accounting flexibility. Additionally, ZANG (2007) documents that managers use real and accrual manipulations as substitutes and determine real manipulation before accrual manipulation. Most closely related, OSWALD/ZAROWIN (2007) show that UK firms that expense R&D cut their investment to meet earnings targets, while those that capitalize manipulate the current period R&D expense without changing investment levels, i.e., R&D capitalization mitigates the tendency to cut R&D investment. Even though these papers advocate R&D capitalization, recent experimental evidence on reputation-driven real earnings management indicates that managers

responsible for initiating an R&D project are more likely to overinvest when R&D is capitalized in order to protect it from impairment (SEYBERT (2010)). Therefore, the debate whether a difference in accounting adversely affects investments, especially for intangibles (SKINNER (2008) and LEV (2008)), is ongoing and, to our knowledge, there is no evidence on this issue in an IFRS vs. US GAAP setting.

2.2.5. Hypothesis Development

As noted in the literature, e.g. by SCHIPPER (2003), tighter accounting standards may lead to a substitution effect in that the reduction of accounting earnings management is met with increased real earnings management. This notion has been documented within theoretical frameworks by DEMSKI (2004) as well as EWERT/WAGENHOFER (2005). DEMSKI (2004) assumes tighter accounting standards lower the disutility of engaging in real earnings management and, thus, reduce (increase) accounting (real) earnings management. EWERT/WAGENHOFER (2005) consider two strategic players, a risk-neutral manager of a firm and a competitive, risk-neutral capital market, and document that there is an endogenous substitution between accounting and real earnings management that is solely market-driven. However, when they extend their model to assume that managers want to meet or beat an earnings target, there is an interaction between accounting and earnings management: Tightening standards and, thus, decreasing the effectiveness of accounting earnings management, changes the optimum and leads to a substitution effect. Applying these results to a one R&D intensive EU firm vs. one equal US firm setting, we conjecture that the EU firm with ample accounting flexibility, i.e., capitalizing development costs is possible, rather engages in accounting earnings management (increases its development cost capitalization ratio) while a comparable US firm, that follows tight accounting standards for R&D (i.e., mandatory expensing of R&D) rather engages in real earnings management.

As a first, general step based on the observation from the "EU Industrial R&D Investment Scoreboard" (EC (2010)) that the recent financial crisis induced (yet unexplained and abnormal) variation in EU firms' R&D investment growth compared to US firms' R&D investment growth, we

hypothesize that the recent financial crisis induced an exogenous, sectoral shock that, on average, changed (and most likely increased) a firm's incentive for earnings management. With the notable exception of COHEN/ZAROWIN (2007), there is little evidence on the association between economic conditions and the tendency for firms to engage in earnings management. In their study of earnings management over the business cycle, COHEN/ZAROWIN (2007) document that the percentage of firms that meet or beat earnings benchmarks in a given quarter is positively correlated with the aggregate level of the market that quarter. However, this result only indicates that earnings management activity is positively associated with aggregate market conditions *if* benchmark beating is due to earnings management. In our investigation, we take a closer look at one specific accrual of R&D intensive firms, capitalized development costs, and argue that the benefits of engaging in accounting earnings management outweigh the benefits from engaging in real earnings management. This trade-off becomes more important in crisis times, since a cut in R&D investment is potentially more costly in crisis times as a company can signal strength if it can maintain a high level (or even higher level compared to competitors without the flexibility to capitalize) of innovation activities. As a consequence, we expect EU firms to react differently from US firms to the change in earnings management incentives: Hence, EU firms are more likely to increase their development cost capitalization ratio⁶ as opposed to a cut in R&D investment that US firms are more likely to engage in. Therefore, we expect that

H1a: *EU firms increase their development cost capitalization ratio during the financial crisis.*

As a second step, we hypothesize that, during the financial crisis, mandatory expensing adversely affects US firms' R&D investment compared to that of EU firms. That is, US firms reduce their R&D investment growth

⁶ Note that increasing the development cost capitalization rate creates a positive, one-time profit effect and, in the long run, is only beneficial in a growth scenario; that is, increasing today's development cost capitalization rate, increases future amortizations (decreases future profit), which will only be compensated if future R&D investment grows. Therefore, we have to assume that managers have a limited horizon or believe in constant growth. While Dechow and Sloan (1991) document the limited horizon problem in specific cases, the "EU Industrial R&D Investment Scoreboard" indicates positive R&D growth in the past six years.

more strongly than comparable EU firms, in part, because the latter increase their development cost capitalization ratio. Therefore, we expect that

H1b: there is an incremental positive effect of an increase of capitalization ratio growth in the crisis on the growth in R&D investment for EU firms compared to US firms.

Note that we have an expectation for the influence of an increase in the development cost capitalization ratio during the crisis only. This is based on the evidence from OSWALD/ZAROWIN (2007) that, when the incentives for earnings management are low, the accounting for development costs should only play a minor role in EU managers' R&D investment decision rationale, i.e., in no-crisis times. Also, we focus on R&D investment growth as this is an unexplained phenomenon from the "EU Industrial R&D Investment Scoreboard" that we intend to partly explain.

Another point that is important to keep in mind is the fact that, based on the criteria in IAS 38, one would expect that during the financial crisis it should be harder for EU firms to document a market for their product (their ability to sell the intangible asset) as well as the availability of adequate financial resources to complete the development and to sell the intangible asset. As this runs against our hypothesis, finding a positive, significant incremental effect would be strong evidence for development cost capitalization being a covert option that is highly discretionary.

As our argument mainly relies on an increase in earnings management incentives and for our first hypotheses we assume this increase to be constant for each firm in the sample, using a more specific variable that proxies for the incentive for earnings management at the firm level, allows for a more detailed investigation of a potential difference in R&D investment growth cuts. Apart from an earnings management explanation, the findings by, e.g., CONLON/GARLAND (1993), that degree of project completion is a dominating effect present in resource allocation decisions, suggest that when resources get more scarce (e.g., during a crisis) managers are more likely to allocate funds to projects that have a higher degree of project completion. Based on the definitions of research as well as development in IAS 38, projects in the development phase have a higher degree of completion. This suggests that an increase in the development cost capitalization ratio need not necessarily be driven by earnings management incentives. That is, it may be a mere effect of a reduction in investment in research as well as more money allocated towards development projects. Although profitability considerations have been shown to influence innovation portfolio management (COOPER (1999)), it is an open question whether profitability in the sense of a one-time profit effect from development cost capitalization is part of managers' rationale. In order to discriminate between these alternative explanations, we try to identify firms with strong earnings management incentives and observe their crisis-related behavior when trading off accounting and real earnings management.

In order to do so, we assume the incentive for earnings management to be an increasing function of a firm's incentive and capacity to meet earnings benchmarks via R&D manipulations. These earnings benchmarks may be endogenous, i.e., management aspires to maintain a steady and predictable rate of earnings growth, that is, management engages in intertemporal "income smoothing" (GAGNON (1967); ZUCCA/CAMPBELL (1992)). Benchmarks may also be extrinsic, i.e., management attempts to meet or exceed certain oneperiod thresholds regarding reported income numbers (HAYN (1995); BURGSTAHLER/DICHEV (1997); DURTSCHI/EASTON (2005)). There may be different targets: First, forecasted numbers (analysts' consensus forecasts or management's forecasts). Second, prior-period numbers and, finally, absolute numbers, i.e., zero or "round" numbers as well as other heuristics.

In line with prior literature, BABER/FAIRFIELD/HAGGARD (1991), BUSHEE (1998), and, most notably, OSWALD/ZAROWIN (2007) we consider extrinsic earnings targets for three groups of firms. The first group of firms performs so poorly that they cannot meet the benchmark even before considering their R&D investment (group 1). The second group would not meet the benchmark if they maintained R&D investment at last year's level (group 2). Finally, the third group of firms is successful enough that they would meet the benchmark even if current year R&D investment maintained at last year's level (group 3). We expect group 2 firms to have more incentive to manipulate their R&D investment than group 1 and group 3 firms. However as the evidence by OSWALD/ZAROWIN (2007) indicates, we must have different expectations about group 2 firms depending on their ability to use development cost capitalization as an accounting earnings management tool. Therefore during the crisis, we expect that US firms in group 2 most likely engage in real earnings management, that is, to cut R&D *investment*, while we expect that EU firms in group 2 most likely engage in accounting earnings management, i.e., manipulating R&D *expenses* by increasing their development cost capitalization ratio. Therefore, we expect that

- H2a: during the crisis, US firms in group 2 are more likely to cut their R&D investment than US firms in group 1 or 3;
- H2b: during the crisis, EU firms in group 2 are more likely to increase their development cost capitalization ratio than EU firms in group 1 or 3.

When our benchmarks are based on profitability, the comparison between group 1 and group 2 firms is of great importance as R&D investment/expenses increase with profitability: As a corollary, one would expect that group 2 firms are more likely to cut their R&D investment/expenses compared to group 3 firms. However, if group 2 firms are more likely to cut R&D investment/expenses compared to group 1, this could not be explained by profitability as group 2 firms are more profitable than group 1 firms and, thus, would be evidence of earnings management. Also, this argument gets even stronger considering the available evidence that group 1 firms' managers may likely under-report earnings by a large amount for sufficiently bad earnings news, a behavior known as "taking a big bath" (e.g., HEALY (1985)).

2.3. Research Design

To test H1a, we estimate the following fractional logit⁷ regression model for EU firms:

(1) $CR_{it} = \alpha + \beta_1 C_{it} + CONTROLS_{it} + \varepsilon_{it}$

⁷ Since our dependent variable is a fraction and bound between 0 and 1, OLS results may be biased (PAPKE/WOOLDRIDGE (1996)). The fractional logit model does not suffer from this bias.

 CR_{it} is firm i's development cost capitalization ratio in period t and equals the fraction of a firm's R&D investment that gets capitalized in period t:

(2)
$$CR_{it} = \frac{CDC_{it}}{RDI_{it}}$$

C is an indicator variable that equals one in the years 2008 and 2009, that is, the years affected by the financial crisis as documented by abnormal variation in R&D investment growth as well as sales and GDP growth in the Investment Scoreboard".⁸ "EU Industrial R&D Consistent with LEV/SARATH/SOUGIANNIS (2005), and BEAVER/RYAN (2000), who show that the effect of capitalization on measured profitability is related to the firm's life cycle stage, we include as controls determinants of the decision to expense vs. capitalize assuming that these variables likely also drive the decision to increase the capitalization ratio. Therefore, we include earnings variability, profitability, size, R&D intensity, risk, and the market to book ratio.⁹ For the sake of illustration, these controls are captured in the vector CONTROLS_{it}. In line with Hypothesis 1a, we expect a positive coefficient on β_1 .

To test H1b, we estimate the following regression¹⁰:

(3)
$$RDG_{it} = \alpha + \beta_1 CRG_{it} + \beta_2 C_{it} + \beta_3 C_{it} * CRG_{it} + CONTROLS_{it} + \varepsilon_{it}$$

RDG is defined as firm i's change in R&D investment from period t-1 to t, scaled by its R&D Investment in period t-1. *CRG* is defined as firm i's change in capitalization rate from period t-1 to t, scaled by its capitalization rate in period t-1. Since *CRG* is only greater than zero for EU firms, β_2 captures the effect of the crisis for US firms on the growth in R&D investment. In addition to the arguments above based on the descriptive evidence from the "EU Industrial R&D Investment Scoreboard", we expect a negative sign for

⁸ We also checked the sensitivity of our results towards different fiscal year ends with unchanged inferences, e.g., we ran the regressions for all firms with December 31 as fiscal year end.

⁹ Oswald and Zarowin (2007) suggest that it is more appropriate to use control variables that are designed to explain R&D investment in an earnings management setting since they might explain more general earnings management via R&D: Results for β_1 remain the same.

¹⁰ Our results are not sensitive towards an OLS regression or a fixed effects regression (we present results for OLS regressions with firm-clustered, robust standard errors); also, results are not qualitatively affected by the chosen outlier (winsorizing vs. truncating) treatment of our major variables of interest.

this coefficient. β_1 captures the effect of an increase in the development cost capitalization ratio on the growth in R&D investment before the crisis. As outlined above, we conjecture no effect of an increase in the development cost capitalization ratio when the incentives for accounting earnings management are low (i.e., in the years prior to the crisis). β_3 , the coefficient on the interacted term, picks up the incremental effect of *CRG* during the crisis. We expect a positive sign on the coefficient β_3 . Note that an increase in *CRG* is not mechanically associated with an increase in R&D growth due to the fact that *CRG* can increase when the overall R&D investment decreases.¹¹ This can be illustrated by reformulating *CRG*_{it} in terms of *RDG*_{it}:

(4)
$$CRG_{it} = \frac{CDC_{it}}{CDC_{it-1}} \times \left(1 - \frac{RDG_{it}}{1 + RDG_{it-1}}\right) - 1$$

The first derivative, $\frac{\partial CRG_t}{\partial RDG_t} = -\frac{CDC_t}{CDC_{t-1} \times (1 + RDG)^2} < 0$, shows that

CRG is decreasing in *RDG*, i.e., the interrelation between *CRG* and *RDG* induces a negative bias on the coefficient β_3 .¹² This bias works against our prediction for β_3 .

In line with prior research (BUSHEE (1998); OSWALD/ZAROWIN (2007)) that has identified firm characteristics that are likely to influence the R&D investment decision, we include capital expenditures as well as sales to control for funds available to invest in R&D projects. Also, we include the prior change in R&D investment, measured as one-year lagged R&D investment minus two-year lagged R&D investment, all divided by current period sales, as a proxy for changes in the firm's R&D opportunity set over time. To proxy for the amount of available cash flow we include cash flow from operations. Tobin's Q is included to control for the marginal benefits/costs firms face when altering their R&D investment. Firm size is included as an information

¹² As demonstrated by the second derivative $\left(\frac{\partial^2 CRG_t}{\partial RDG_t^2} = \frac{2 \times CDC_t}{CDC_{t-1} \times (1 + RDG)^3} > 0\right)$, the

decrease of CRG_t is decreasing for increasing values of RDG_t.

¹¹ However, if *RDG* and growth in capitalized amounts ($CDC_{it} < CRG_{it-1}$) are negative with *RDG* being greater, one would also expect a positive coefficient (*RDG* and *CRG* decrease at the same time). We will discuss this in further detail in section 5.

environment as well as cash availability proxy. For all the latter controls, we assume a positive association with R&D investment and respectively negative association with the likelihood to engage in earnings management (either to cut R&D investment or expenses or to increase development cost capitalization ratio). Finally, leverage is included to proxy for a firm's proximity to debt covenants and we hypothesize that firms with higher leverage may be more likely to engage in earnings management.

For our tests of earnings management to meet a benchmark, we use three benchmarks in line with prior literature, e.g., BURGSTAHLER/DICHEV (1997) and DEGEORGE/PATEL/ZECKHAUSER (1999). We assume that firms manage earnings to avoid losses (zero earnings level) and earnings decreases (zero earnings change), and to meet analysts' expectations (median consensus analyst forecast three months before fiscal year end). Therefore, to test H2a and H2b, we group firms based on their level of pre-tax earnings before R&D investment in the current year (*EBRD*_t), or change vs. the previous year ($\Delta EBRD_t$), or median analysts' forecast for the current year (*AF*_t; *AFBRD*_t being the difference between *EBRD*_t and *AF*_t, all compared to their R&D investment in the previous year (*RDI*_{t-1})).

This leads to the following groups:

For the zero earnings level benchmark, we identify a firm as belonging to group 1 if $EBRD_t < 0$, group 2 if $0 < EBRD_t < RDI_{t-1}$, and group 3 if $RDI_{t-1} < EBRD_t$. For the zero earnings change benchmark, we identify a firm as belonging to group 1 if $\Delta EBRD_t < -RDI_{t-1}$, group 2 if $-RDI_{t-1} < \Delta EBRD_t < 0$, and group 3 if $0 < \Delta EBRD_t$. For the analysts' forecast benchmark, we identify a firm as belonging to group 1 if $AFBRD_t < 0$, group 2 if $0 < AFBRD_t < RDI_{t-1}$, and group 3 if $RDI_{t-1} < AFBRD_t$.

To illustrate for the zero earnings level benchmark, group 1 (3) firms show losses (profits) even before potentially manipulating their R&D investment or development cost capitalization ratio (in the case of EU firms). Group 2 firms would show losses if they maintained R&D investment at last year's level, but can show profits by manipulating their R&D investment: While US firms in group 2 can only cut their R&D investment, EU firms in group 2 can alternatively or additionally increase their development cost capitalization ratio.

We employ the following basic logistic regression model to compare each group's probability to cut their R&D investment for US firms:

(5)
$$R \& D - Cut_{ii} = \alpha + \beta_1 G 2_{ii} + \beta_2 G 3_{ii} + \beta_3 * C_{ii} + \beta_4 * G 2_{ii} * C + \beta_5 * G 3_{ii} * C + CONTROLS_{ii} + \varepsilon_{ii}$$

*R&D-Cut*_{it} is an indicator variable that equals one if an US firm cuts its R&D investment in period t, compared to t-1, and zero otherwise. Also $G2_{it}$ ($G3_{it}$) is an indicator variable that equals one if a firm is in group 2 (3) in year t, and zero otherwise. The intercept, α (β_3) captures the (incremental) probability of an R&D cut for group 1 before (during) the crisis. β_1 and β_2 capture the incremental probabilities for groups 2 and 3, compared to group 1, while β_3 and β_4 capture the incremental probabilities relating to β_1 and β_2 during the crisis. As hypothesized in H2a, we expect $\beta_4 > \beta_3 > \beta_5$. In line with OSWALD/ZAROWIN (2007), we use the same controls as in equation 3.

As managing R&D expenses for EU firms may be achieved either (a) by cutting R&D investment or (b) by increasing the R&D investment's portion that gets capitalized, we further test how EU firms manage their R&D expenses. To test (a), we use the same specification as for US firms. To test (b), we use a dummy variable, $Inc-CR_t$, that equals one if a firm increased its development cost capitalization ratio in period t. To specifically address our question whether EU firms with a strong incentive for earnings management increase their development cost capitalization ratio during the crisis, we estimate the following model (where G2, G3 and C are all as defined before):

(6)
$$Inc - CR_{it} = \alpha + \beta_1 G2_{it} + \beta_2 G3_{it} + \beta_3 * C_{it} + \beta_4 * G2_{it} * C + \beta_5 * G3_{it} * C + CONTROLS_{it} + \varepsilon_{it}$$

In line with H2b, we expect $\beta_4 > \beta_3 > \beta_5$.

In order to make a valid comparison of US and EU firms, we match the firms based on size and industry, that is, the natural logarithm of total assets and first digit SIC code. Although the choice to capitalize development costs is an endogenous EU firm decision, for the purposes of our tests it is exogenous, since it is predetermined at the time of the earnings management decision as we exclude all EU firms that do not capitalize or switch to capitalization in the investigation period. That is, we model the capitalization of EU firms to be based on stable firm characteristics that are taken account of by our fixed effects or OLS regressions with firm clustered, robust standard errors. Also for our tests of earnings management, the membership in a group is transitory and changes from year to year. Thus, the accounting choice is not correlated with the grouping.

2.4. Data and Sample

Our initial sample consists of all publicly listed companies in the 2009 "EU Industrial R&D Investment Scoreboard" (779 EU and 505 US firms). The yearly published "EU Industrial R&D Investment Scoreboard" presents information on the top 1000 EU companies and 1000 non-EU companies investing in R&D. The Scoreboard includes data on R&D investment along with other economic and financial data from the last four financial years. The Scoreboard has been prepared from companies' annual reports and accounts received by an independent data provider. To prepare the Scoreboard, a database of 8,437 EU and 2,398 non-EU companies' accounts was screened. The R&D investment included in the Scoreboard is the cash investment which is funded by the companies themselves. Where part or all of R&D costs have been capitalized, the additions to the appropriate intangible assets are included to calculate the cash investment and any amortization is eliminated. We use this sample as it is, to our knowledge, the only source providing data on R&D investment for both US and EU firms for our sample period from 2005-2009. We start in 2005 as this is the year of mandatory IFRS adoption within the EU. The data on development cost capitalization has been hand-collected from firms' annual reports.¹³ The data for all control variables has been obtained

¹³ For example, the Volkswagen group as the most R&D intensive EU firm discloses on p. 243 of their annual report that "of the total research and development costs incurred in 2009, 1,947 million [...] met the criteria for capitalization under IFRS". From the recognized research and (prior and non-capitalized) development costs in the income statement of 5,429m in 2009, 1,586m relate to the amortization or impairment of development costs. Therefore, the R&D cash investment equals (1,947m + [5,429m - 1,586]=) 5,790m, which

from Worldscope. Data on analyst forecasts has been obtained from the Institutional Brokers Estimate System database (I/B/E/S).

Table 1 presents the sample selection. All publicly listed firms within the "EU Industrial R&D Investment Scoreboard" lead to a possible sample of 779 EU and 505 US firms. This provides 6,420 potential firm-years. We exclude EU firms with no development costs capitalized as well as firms that switch to capitalization in the investigation period. We then exclude firm-years in which the data source lacks sufficient data for the analyses, leading to the final sample of 3,116 firm-year observations. Since we work with growth variables, we lose some observations in our multivariate tests.

Table 1: Sample Selection

	Less	Remaining
Firms included in the "EU R&D Investment Scoreboard" 2009		2,000
Less firms		
Not US or EU	469	1,531
Not publicly listed	247	1,284
Potential firm-year observations (1284 firms times 5 fiscal years)		6,420
Less		
firm-years of firms not capitalizing throughout the sample		
period and collection insufficient	2,586	3,834
firm-years with insufficient data for analyses	718	3,116

2.5. Empirical Results

In this section, we present the empirical results for our analyses. First, we test H1 by investigating whether EU firms increase their development cost capitalization ratio during the recent financial crisis and whether there is an incremental positive effect of an increase in the level of development cost capitalization ratio in the crisis on the growth in R&D investment for EU firms compared to US firms. Second, we test H2 by more specifically examining EU and US firms' incentive to manipulate their R&D investment/expenses by examining tests of earnings management to meet benchmarks.

is the amount given for the Volkswagen group in the "EU Industrial R&D Investment Scoreboard" for 2010 p. 73.

2.5.1 The Effect of an Increase in Development Cost Capitalization Ratio

Table 2 presents descriptive evidence for the regression variables. The table reveals that the median development cost capitalization ratio has increased from 0.16 to 0.20 during the crisis. While our EU sample firms¹⁴ have a higher mean and median R&D growth than US firms before the crisis, they only have a higher mean R&D growth after the crisis. EU firms' R&D mean growth decreases by -62.2%, while their mean growth in capitalization ratio only decreases by -28.0% which suggests that capitalized development costs did not decrease as much as R&D investment, i.e., EU firms capitalized more aggressively.

Table 3 presents the multivariate results from estimating equation (1) for EU firms: Although most controls attain the predicted signs, most coefficients on the controls but earnings sign, beta as well as R&D intensity are insignificant. More importantly, we document a positive effect on the indicator variable crisis. This suggests that EU firms increase their development cost capitalization ratio during the financial crisis, which amplifies managers' incentive to make more use of the accounting flexibility provided under IAS 38; and thus, supporting H1a.

To further investigate the effect of capitalization ratio growth during the crisis on EU firms' R&D investment growth rate compared to US firms' growth rate, we estimate equation (3) and present the corresponding results in table 4. The association between growth in the development cost capitalization ratio and growth in R&D investment before the crisis (β_1) is negatively significant. As outlined above, this can be mainly due to the negative bias induced by R&D growth when measuring growth in the capitalization ratio. Additionally, the negative coefficient could also be explained by a loss of momentum in research-intensity (as opposed to development-intensity) when a firm enters the development stage of a major R&D project in its business cycle.

Since *CRG* is only different from zero for EU firms, β_2 captures the effect of the crisis for US firms on the growth in R&D investment. We

¹⁴ In the Scoreboard, EU firms had a lower R&D growth than EU firms. The difference compared to the Scoreboard is likely due to the employed sample selection criteria.
	EU					US							
	Variable	Ν	mean	p50	sd	p5	p95	Ν	mean	p50	sd	p5	p95
Crisis=0	CR	1,133	0.292	0.167	0.327	0	1						
	R&D-Growth	522	0.243	0.166	0.331	-0.243	1.009	741	0.177	0.129	0.253	-0.172	0.694
	CR-Growth	522	0.182	0.000	0.913	-0.873	2.390						
	CapEx	522	0.167	0.171	0.546	-0.621	0.909	741	0.123	0.127	0.550	-0.715	0.949
	Size	522	14.143	13.971	1.870	11.363	17.384	741	14.630	14.497	1.552	12.359	17.478
	Prior Change R&D	522	0.000	0.000	0.000	0.000	0.000	741	0.012	0.000	0.353	0.000	0.000
	Sales	522	0.174	0.158	0.247	-0.085	0.518	741	0.144	0.119	0.430	-0.147	0.540
	Free Cash Flow	522	0.128	0.090	0.289	-0.174	0.609	741	0.095	0.140	0.340	-0.371	0.416
	Tobin's Q	522	1.538	1.222	1.196	0.556	3.392	741	2.191	1.775	1.503	0.781	5.165
	Leverage	522	0.214	0.210	0.155	0.000	0.492	741	0.206	0.156	0.259	0.000	0.595
Crisis=1	CR	755	0.307	0.201	0.312	0	0.995						
	R&D-Growth	615	0.092	0.023	0.311	-0.280	0.895	612	0.080	0.040	0.244	-0.260	0.581
	CR-Growth	615	0.131	0.000	0.771	-0.893	1.700						
	CapEx	615	-0.098	-0.082	0.608	-1.140	0.775	612	-0.105	-0.071	0.639	-1.041	0.727
	Size	615	13.593	13.464	1.990	10.456	17.130	612	14.356	14.265	1.698	11.659	17.291
	Prior Change R&D	615	0.000	0.000	0.000	0.000	0.000	612	0.006	0.000	0.132	0.000	0.000
	Sales	615	-0.014	0.007	0.269	-0.449	0.307	612	0.035	0.042	0.415	-0.459	0.432
	Free Cash Flow	615	0.103	0.092	0.338	-0.249	0.543	612	0.086	0.142	0.440	-0.441	0.445
	Tobin's Q	615	0.997	0.799	0.743	0.361	2.330	612	1.641	1.322	1.173	0.533	3.932
	Leverage	615	0.235	0.230	0.157	0.000	0.493	612	0.216	0.163	0.253	0.000	0.613

Table 2: Descriptive Statistics

		EU				US							
	Variable	Ν	mean	p50	sd	p5	p95	Ν	mean	p50	sd	p5	p95
Total	CR	1,888	0.2982	0.179	0.321	0	1						
	R&D-Growth	1,137	0.161	0.091	0.329	-0.280	1.009	1353	0.133	0.090	0.253	-0.221	0.628
	CR-Growth	1,137	0.155	0.000	0.839	-0.891	1.953						
	CapEx	1,137	0.024	0.065	0.594	-0.920	0.851	1353	0.020	0.039	0.602	-0.899	0.845
	Size	1,137	13.845	13.756	1.954	10.819	17.300	1353	14.506	14.396	1.625	12.156	17.388
	Prior Change R&D	1,137	0.000	0.000	0.000	0.000	0.000	1353	0.010	0.000	0.276	0.000	0.000
	Sales	1,137	0.072	0.092	0.275	-0.344	0.439	1353	0.095	0.089	0.427	-0.318	0.497
	Free Cash Flow	1,137	0.114	0.091	0.317	-0.232	0.553	1353	0.091	0.141	0.388	-0.421	0.426
	Tobin's Q	1,137	1.245	0.970	1.014	0.408	2.922	1353	1.942	1.573	1.391	0.611	4.734
	Leverage	1,137	0.225	0.218	0.156	0.000	0.493	1353	0.210	0.159	0.256	0.000	0.597

All variables as defined in the appendix.

VARIABLES	Pred. sign	CR
Crisis	+	0.130**
Earn_Sign	-	(0.059) 0.091 (0.057)
Earn_Var	+	(0.057) -0.026* (0.014)
Size	-	-169.400** (82.730)
Beta	-	0.147
R&D Intensity	+	0.037
Tobin's Q	+	0.002
Constant		(0.033) 1.290*** (0.177)
Observations		1,774

Table 3: The Increase of the Development Cost Capitalization Ratio During the Financial Crisis for EU firms (H1a)

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 3 presents multivariate results from a firm-clustered, robust standard errors pooled fractional logit regression with the development cost capitalization ratio as the dependent variable in order to analyze whether EU firms increased their development cost capitalization ratio during the financial crisis (H1a). All variables as defined in the appendix.

Table 4: The Incremental Positive Effect of an Increase of Capitalization Ratio Growth during the Crisis on the Growth in R&D Investment for EU firms compared to US firms (H1b)

_____I

VARIABLES	Pred. sign	R&D-Growth			
CR-Growth	-	-0.156***			
		(0.038)			
Crisis	-	-0.065***			
		(0.012)			
Crisis*CR-Growth	+	0.131***			
		(0.048)			
Change CapEx	+	0.115***			
		(0.014)			
Size	-	-0.009***			
		(0.003)			
Prior Change R&D	+	0.022*			
C		(0.013)			
Change Sales	+	0.145***			
U		(0.045)			
Free Cash Flow	+	0.002			
		(0.019)			
Tobin's O	+	0.016***			
τ.		(0.006)			
Leverage	_	-0.069***			
		(0.027)			
Constant		0.288***			
		(0.047)			
Observations		2,490			
R-squared		0.170			
Robust standard errors in parentheses					

*** p<0.01, ** p<0.05, * p<0.1

Table 4 presents multivariate results from a firm-clustered, robust standard errors pooled OLS regression with R&D growth as the dependent variable in order to analyze whether there is an incremental positive effect of the growth in the development cost capitalization ratio on the growth in R&D investment for EU firms compared to US firms during the crisis (H1b). All variables as defined in the appendix.

document a significantly negative coefficient which confirms the descriptive evidence from table 2 in a multivariate setting. Most interestingly β_3 , the coefficient on the interacted term, picking up the incremental effect of growth in the capitalization ratio on R&D growth during the crisis, is significantly positive. That is, *on average*, EU firms exhibit an incremental increase in R&D growth compared to firms with a lower capitalization ratio growth, such as our sample of matched US firms with capitalization growth of zero; and thus, supporting H1b. Most controls attain the predicted signs and are significant.

In order to further analyze the relationship between *RDG* and *CRG*, we split all our EU observations based on our reformulation of *CRG* in terms of RDG^{15} into six distinct cases as illustrated in table 5 and predict the coefficient sign of *CRG* based on assumptions about the relation of $\frac{RDI_t}{RDI_{t-1}}$ to $\frac{CDC_t}{CDC_{t-1}}$ that cause a certain co- or countermovement of *RDG* and *CRG* in our regression for H1b (eq. (3)) for each of the cases:

|--|

Case	$\frac{RDI_{t}}{RDI_{t-1}}$	$\frac{CDC_{t}}{CDC_{t-1}}$	$\frac{RDI_{t}}{RDI_{t-1}} > \text{ or } < \frac{CDC_{t}}{CDC_{t-1}}$	RDG _t	CRG_t	Hypothesized association
1	>1	<1	>	>0	<0	<0
2	<1	>1	<	<0	>0	<0
3	<1	<1	<	<0	>0	<0
4	<1	<1	>	<0	<0	>0
5	>1	>1	>	>0	<0	<0
6	>1	>1	<	>0	>0	>0

Next, in table 6 we benchmark each case against all US firm observations in our regression for H1b and present our results from table 4 as a reference in the last column. The coefficients on *CRG* attain their predicted sign throughout cases one to six: The association between *CRG* and *RDG* is only positive for case four and case six.

In H1b we test against firms with a lower development cost capitalization ratio. This group includes EU firms that decrease their

¹⁵ See equation 4 in section 3.

	(case 1)	(case 2)	(case 3)	(case 4)	(case 5)	(case 6)	(all)
VARIABLES	R&D-Growth						
CR-Growth	-0.292***	-0.484***	-0.814***	0.720***	-1.850***	0.139***	-0.156***
	(0.068)	(0.037)	(0.226)	(0.079)	(0.091)	(0.046)	(0.0382)
Crisis	-0.048***	-0.053***	-0.053***	-0.054***	-0.048***	-0.052***	-0.065***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.016)
Crisis*CR-Growth	-0.002	0.153***	-0.304	-0.310***	-0.146	0.225***	0.131***
	(0.086)	(0.046)	(0.281)	(0.085)	(0.154)	(0.070)	(0.048)
Change CapEx	0.107***	0.101***	0.111***	0.105***	0.098***	0.116***	0.115***
	(0.013)	(0.013)	(0.014)	(0.014)	(0.014)	(0.014)	(0.013)
Size	-0.008**	-0.006	-0.005	-0.005	-0.008*	-0.009**	-0.009***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)
Prior Change R&D	0.015	0.019*	0.016	0.016	0.019*	0.016	0.022*
	(0.009)	(0.009)	(0.011)	(0.011)	(0.011)	(0.011)	(0.013)
Change Sales	0.076**	0.075**	0.076**	0.078**	0.082**	0.090**	0.145***
	(0.036)	(0.036)	(0.037)	(0.037)	(0.037)	(0.039)	(0.045)
Free Cash Flow	0.002	0.010	0.005	0.000	0.012	0.007	0.002
	(0.018)	(0.017)	(0.019)	(0.019)	(0.019)	(0.02)	(0.019)
Tobin's Q	0.028***	0.026***	0.027***	0.028***	0.025***	0.019***	0.016***
	(0.007)	(0.006)	(0.006)	(0.007)	(0.006)	(0.006)	(0.006)
Leverage	-0.094***	-0.095***	-0.098***	-0.109***	-0.098***	-0.072***	-0.069***
	(0.026)	(0.025)	(0.026)	(0.025)	(0.026)	(0.027)	(0.027)
Constant	0.226***	0.198***	0.186***	0.186***	0.235***	0.256***	0.288***
	(0.055)	(0.057)	(0.060)	(0.055)	(0.062)	(0.060)	(0.047)
CR-Growth+	-0.293***	-0.332***	-1.179***	0.410***	-1.996***	0.364***	0.025
Crisis*CR-Growth	(0.065)	(0.035)	(0.167)	(0.041)	(0.127)	(0.059)	(0.035)
Observations	1,570	1,486	1,409	1,525	1,506	1,713	2,490
R-squared	0.186	0.234	0.213	0.246	0.321	0.189	0.170

Table 6: Results for H1b split into six distinct Cases that describe the Relationship between RDG and CRG

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 6 presents multivariate results from a firm-clustered, robust standard errors OLS regression for six distinct cases in order to further analyze the incrementally positive effect of the growth in the development cost capitalization ratio on the growth in R&D investment for EU firms compared to US firms during the crisis (table 4). All variables as defined in the appendix.

capitalization ratio as well as all matched US firms. Hence, in the following analysis we focus on only those firms that have positive capitalization ratio growth: The cases that are in line with our hypothesis that EU firms employ a more aggressive capitalization strategy (capitalization growth is positive), that is, cases two, three, and six, and as a consequence have a higher R&D investment growth compared to US firms during the crisis, cases two and six attain a positive sign for the interaction of *Crisis* and *CRG*. Potentially, the insignificant coefficient for the interacted term in case three results from too few observations identified. Cases two, three, and six exclude observations with negative capitalization growth. Hence, these findings indicate that US firms have a comparative disadvantage during the financial crisis as they are not allowed to capitalize any of their R&D spending.

The coefficient on the interacted term for case four observations is negative. This indicates that our results for the interacted term with all observations are not driven by case four observations, that is, we do *not* observe a positive coefficient on the interacted term in the regression with all observations due to the fact that the positive relationship between negative *CRG* and *RDG* got stronger (which would not be in line with our reasoning for H1b).

In order to address concerns that our crisis-related results are solely driven by a shift in R&D investment growth between EU firms and US firms, that results from our (simplified) use of crisis as a time dummy, we replace *CRG* as well as the interacted effect in equation 1 with an EU dummy and show our results in table 7. The coefficient on *Crisis*, capturing the effect of the crisis for US firms on the growth in R&D investment, is significantly negative which confirms the descriptive evidence from table 2 as well as our multivariate evidence from table 4. The association between R&D investment growth and the EU dummy prior to the crisis is significantly positive; thus, also in line with the descriptive evidence from table 2: On average, EU firms exhibited positive R&D growth prior to the crisis. The coefficient on the interacted term, *Crisis*EU*, is marginally significant and *negative*. Opposed to our results for H1b with *CRG*, we fail to document an incremental positive association between R&D growth and EU firms compared to US firms during

		(1)
VARIABLES	Pred. sign	R&D-Growth
EU	+	0.066***
		(0.017)
Crisis	-	-0.047***
		(0.013)
EU*Crisis	?	-0.041*
		(0.021)
Change CapEx	+	0.113***
		(0.013)
Size	-	-0.008**
		(0.003)
Prior Change R&D	+	0.028**
		(0.012)
Change Sales	+	0.143***
		(0.045)
Free Cash Flow	+	0.010
		(0.020)
Tobin's Q	+	0.020***
		(0.006)
Leverage	-	-0.059***
		(0.017)
Constant		0.215***
		(0.050)
Observations		2,490
R-squared		0.166

Table 7: Results for H1b with EU Dummy instead of CRG

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 7 presents multivariate results from a firm-clustered, robust standard errors pooled OLS regression with R&D growth as the dependent variable in order to analyze whether there is an incrementally positive effect for EU firms on the growth in R&D compared to US firms during the crisis. All variables as defined in the appendix.

the crisis; hence, validating our results for H1b using *CRG*: EU firms exhibit an incremental increase in R&D growth compared to US firms during the crisis that is associated with growth in the capitalization ratio.

This, *ceteris paribus*, suggests that IFRS firms, on average, engage more strongly in accounting earnings management whereas US firms resort to (potentially more costly) real earnings management to counteract the profit effects of the financial crisis. That is, EU firms have an incrementally higher R&D growth (change in investment level) compared to US firms during the crisis, in part because of internationally divergent accounting rules. Contributing to recent experimental research that documents an overinvestment effect when R&D is capitalized and concludes that mandating R&D capitalization may not reduce real earnings management (SEYBERT (2010)), we find that the flexibility to capitalize development costs under IFRS, at least on average, reduces EU firms' change in R&D investment level less than mandatory expensing under US GAAP does.

2.5.2. Capitalization of R&D and Earnings Management

As our argument mainly relies on an increase in earnings management incentives and for our first hypotheses we assume this increase to be constant for each firm in the sample, using a more specific variable that proxies for the incentive to engage in accounting earnings management allows for a more detailed investigation of the difference in R&D investment growth cuts: Hence, we analyze the incentive to meet earnings benchmarks.

Therefore, we turn to multivariate, logistic regression results in table 8, 8 and 9 to further test the observed patterns. In table 8 for the zero earnings level and analyst forecast specification, we find a significantly positive incremental probability for US firms in group 2, which is the group that includes firms with the strongest earnings management incentives, to cut R&D investment prior to the crisis compared to group 1 and group 3 which is in line with prior literature, e.g., OSWALD/ZAROWIN (2007). The coefficients on the incremental effect of being in a specific group during the crisis do not give us a clear picture of whether there is a specific crisis-related effect. Only an incrementally stronger incentive for profitable US firms to manipulate (cut) their R&D investment to meet analysts' forecasts or the zero earnings threshold

	Benchmark				
	Zero	Changes	Analyst		
VARIABLES					
Constant	-1.533**	-0.812	-1.425**		
	(0.628)	(0.514)	(0.628)		
Group 2	1.125***	1.483***	1.246***		
	(0.270)	(0.337)	(0.274)		
Group 3	-2.667***	0.223	-2.475***		
-	(0.251)	(0.297)	(0.256)		
Crisis	-0.816***	-0.207	-0.644**		
	(0.288)	(0.325)	(0.300)		
Group 2 * Crisis	-0.615	0.757*	-0.721*		
I.	(0.388)	(0.396)	(0.416)		
Group 3 * Crisis	1.465***	-0.719**	1.228***		
	(0.325)	(0.344)	(0.342)		
Controls	Included	Included	Included		
Observations	1,837	1,837	1,837		
Rob	ust standard errors	in parentheses			
*** p<0.01, ** p<0.05, * p<0.1					

Table 8: Logit Regression of an Indicator for a Cut in R&D Investment for US

 Firms considering the Crisis

Table 8 presents multivariate results from a logistic regression with Cut-RDI as the dependent variable in order to analyze whether, during the crisis, US firms in group 2 are more likely to cut their R&D investment than EU firms in group 1 or 3 (H2a). Definition of group membership can be found in section 3. All other variables as defined in the appendix.

is documented. To conclude, we do not find support for the hypothesis that the incentive for US firms in group 2 to cut R&D investment got stronger during the crisis, that is, it remains stable; an additional decrease in R&D growth seems to be driven by profitable firms that use the discretionary nature of R&D investments to meet market pressure in the form of analysts' forecasts.

Motivated by our results for H1a and H1b, we further investigate the different means EU firms have to manage their R&D expenses: They trade off an R&D investment reduction as well as an increase in their development cost capitalization ratio. Table 9 presents the multivariate logistic regression results with the cut in R&D investment as the dependent variable. The results for precrisis periods indicate that firms in group 2 have the highest incentive and probability to cut R&D investments. Importantly, the β_4 coefficients in the changes and analyst groupings on the interacted term that capture the incremental effect on group 2 firms' incremental probability to cut R&D investment compared to groups 1 and 3 during the crisis are significantly negative. This indicates that the incentive for EU firms in group 2 to manipulate their R&D expenses by cutting their R&D investment has weakened during the crisis. Instead, table 10 that presents the multivariate logistic regression results with the increase in development cost capitalization ratio as the dependent variable, indicates that the β_4 coefficients on the interacted term that capture the incremental effect on group 2 firms' incremental probability to increase their development cost capitalization ratio compared to groups 1 and 3 during the crisis and to group 2 prior to the crisis are significantly positive across all groupings. In summary, our results suggest that, while reducing R&D investment seems more favorable than increasing the development cost capitalization ratio for firms with strong earnings management incentives in no crisis times, these firms have a strong preference for increasing the development cost capitalization ratio when the incentives for earnings management are strong on the firm level, and on a macroeconomic level, i.e., during crisis times.

2.6. Conclusion

This paper examines the effects of international differences in accounting for firms' R&D investment on R&D growth. We investigate this

Benchmark					
Zero	Changes	Analyst			
-0.347	-1.185	-0.547			
(0.502)	(0.745)	(0.515)			
1.828***	2.630***	2.280***			
(0.346)	(0.866)	(0.394)			
-1.548***	1.255*	-1.636***			
(0.295)	(0.682)	(0.318)			
-0.308	1.176	-0.296			
(0.377)	(0.744)	(0.397)			
-0.308	-2.470***	-2.654***			
(0.459)	(0.951)	(0.497)			
0.273	-2.250***	0.243			
(0.394)	(0.747)	(0.415)			
Included	Included	Included			
1,977	1,977	1,977			
standard errors in p	oarentheses				
*** p<0.01, ** p<0.05, * p<0.1					
	Zero -0.347 (0.502) 1.828*** (0.346) -1.548*** (0.295) -0.308 (0.377) -0.308 (0.377) -0.308 (0.459) 0.273 (0.394) Included 1,977 standard errors in p p<0.01, ** $p<0.05$,	ZeroBenchmark Changes -0.347 -1.185 (0.502) (0.745) $1.828***$ $2.630***$ (0.346) (0.866) $-1.548***$ $1.255*$ (0.295) (0.682) -0.308 1.176 (0.377) (0.744) -0.308 $-2.470***$ (0.459) (0.951) 0.273 $-2.250***$ (0.394) (0.747) Included 1.977 1.977 standard errors in parentheses $p<0.01, ** p<0.05, * p<0.1$			

Table 9: Logit Regression of an Indicator for a Cut in R&D Investment for EU

 Firms considering the Crisis

Table 9 presents multivariate results from a logistic regression with Cut-RDI as the dependent variable in order to analyze whether, during the crisis, EU firms in group 2 are more likely to cut their R&D investment than EU firms in group 1 or 3 (H2b). Definition of group membership can be found in section 3. All other variables as defined in the appendix.

	Benchmark				
	Zero	Changes	Analyst		
VARIABLES					
Constant	-1.209***	0.399	-1.249***		
	(0.344)	(0.537)	(0.367)		
Group 2	-1.415***	-2.585***	-1.776***		
	(0.406)	(0.666)	(0.456)		
Group 3	0.526	-1.782***	0.709*		
	(0.355)	(0.543)	(0.365)		
Crisis	0.675**	-0.952*	0.699*		
	(0.340)	(0.556)	(0.374)		
Group 2 * Crisis	1.668***	2.804***	2.249***		
	(0.452)	(0.766)	(0.496)		
Group 3 * Crisis	-0.322	1.912***	-0.378		
-	(0.365)	(0.566)	(0.396)		
Controls	Included	Included	Included		
Observations	1,794	1,794	1,794		
R	obust standard errors in	parentheses			
*** p<0.01, ** p<0.05, * p<0.1					

Table 10: Logit Regression of an Indicator for an Increase of the Capitalization

 Ratio (Inc-CR) for EU Firms considering the Crisis

Table 10 presents multivariate results from a logistic regression with Inc-CR as the dependent variable in order to analyze whether, during the crisis, EU firms in group 2 are more likely increase their development cost capitalization ratio than EU firms in group 1 or 3 (H2b). Definition of group membership can be found in section 3. All other variables as defined in the appendix.

issue using a sample of US and EU firms, which have been included in the "EU Industrial R&D Investment Scoreboard" 2009 as it is, to our knowledge, the only source providing data on R&D *investment* for both US and EU firms.

While IFRS firms capitalize parts of their R&D investments, US firms are required to expense their R&D investments. Recent data from the "EU Industrial R&D Investment Scoreboard" (EC (2010)) indicates that EU firms' R&D investment has grown significantly faster than that of US firms in 2008 and 2009, i.e. during the crisis, for the first time in at least the past decade. We aim to partly explain this change by different earnings management approaches: While R&D-intensive firms from the EU and US may achieve earnings targets by reducing R&D spending ('real' earnings management), only EU firms may do so by increasing R&D capitalization ratios (accounting earnings management) and, thus, trade-off these two approaches. Employing an accounting earnings management strategy may be less costly for EU firms as it reduces the deviation from their optimal R&D investment. Thus, we hypothesize they do so with the consequence that they have a higher R&D investment growth compared to US firms.

Accordingly, we examine whether EU firms increase the portion of capitalized development costs in total R&D investment during the crisis and whether an increase in capitalization ratio growth during the crisis has a positive effect on the growth in R&D investment for EU firms compared to US firms. Additionally, we examine whether EU and US firms adjust R&D spending to meet earnings benchmarks prior to and during the crisis. For EU firms, we further test whether they reduce R&D *expenses* to meet earnings benchmarks by increasing their capitalization ratio.

Empirical results reveal that EU firms increase their capitalization ratio during the crisis and, more importantly, that this increase is associated with a higher R&D growth for EU firms compared to a matched sample of US firms. Moreover in our tests of earnings management to meet benchmarks, we find that EU firms with the strongest incentive to manage their R&D *expenses* prefer manipulating their R&D investment prior to the crisis, that is, cut R&D investment. However most notably, when the incentives for earnings management are strong on the firm level, and on a macroeconomic level, as is the case during a crisis, EU firms have a stronger preference to increase their development cost capitalization ratios.

Overall, our results suggest that the switch in R&D growth rates between the US and the EU during the crisis can in part be explained by internationally divergent accounting rules. That is, international differences in the accounting for R&D spending adversely affect US firms' R&D investment compared to EU firms' investment in times of economic hardship. These findings are pertinent to the broader question of whether mandatory expensing of long-term investments leads to underinvestment because of reporting incentives. They suggest that, in crisis times, firms with strong incentives to manage earnings engage in accounting earnings management when they can and in real earnings management when they cannot. Given the convergence efforts between the FASB and IASB to eliminate differences between US and international accounting standards, as well as SEC considerations to allow US firms to report under IFRS, our results are likely of interest to standard setters and regulators in their continuing deliberations.

We note that our results are subject to several limitations. First, due to the time lag of at least three years between R&D investments and their output effects, we cannot assess the consequences that higher R&D investment growth for our sample firms compared to US firms will have. Also, available ex ante measures do not allow to directly draw inferences from differences in R&D growth on the value of knowledge capital. However, future studies may yield interesting results towards the question whether adversely affected investments adversely affect output measures, on a firm- and macro-economic level. Also, we would have to observe whether the aggressive accounting earnings management behavior of EU firms 'cools off' in post-crisis years to ascertain that the documented effect is crisis-related.

Second, we investigate top-R&D investing firms. Our results may not generalize to less R&D intensive firms, e.g., because other accruals are manipulated for earnings management purposes or other discretionary expenditures are cut. However, given the costs to document that criteria for capitalization have been met are high compared to the expected benefits for low R&D intensive firms, we do not expect these firms to capitalize large amounts if any. Another way of testing our hypotheses would have been to compare capitalizers to firms that expense their R&D throughout the sample period. As discussed by OSWALD (2008)): One explanation is that these firms are primarily engaged in research and have to expense their R&D (mandatory expensers). On the other hand, it is possible that these firms have development expenditures which do not meet the criteria for capitalization¹⁶. We follow the assumption made by OSWALD (2008) that this latter explanation "is not that common based on the assumption that mangers who engage in R&D activities only undertake projects with a positive NPV, which suggests the development expenditures should meet the [...] conditions for capitalization." Also, we support this notion by multivariate results in chapter three of this thesis: permanent expensers' R&D payoffs have greater uncertainty. By means of a Heckman two-stage procedure we could have assessed the hypothesized effect during the crisis. However, as we want to contribute to the explanation of the variation in aggregate R&D growth between top-R&D investing EU and US firms, we did not follow this path, which is left open to future research.

¹⁶ Anecdotal evidence suggests that this argument is valid for some firms within the pharmaceutical industry. However, our data shows that some pharmaceutical firms do capitalize some of their R&D investment (although the scope may be less broad).

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2.8. Appendix

Definition of Variables

Table 3		
Beta	Percentile ranking of firm's beta within each firm's industry-year.	
Earn_Sign	=1 if earnings >0	
Earn_Var	Percentile ranking of firm i's earnings variance within each firm's industry, over 2005-2009	
M/B	Percentile ranking of firm i's market-to-book within each firm's industry-year.	
R&D Intensity	R&D investment divided by total assets at fiscal year end	
Size Percentile ranking of firm i's market value (measured a year end) within each firm's industry-year.		
Table 4-9		
CapEx Change	$ln(CAPEX_t) - ln(CAPEX_{t-1})$	
CDCt	Capitalized development costs in period t	
CR	CDC_t / RD_t	
CR-Growth	$(CR_{t}-CR_{t-1}) / CR_{t-1}$	
C=Crisis	=1 in years 2008 and 2009	
EU	=1 if firm is located in the European Union	
Free Cash Flow	CFO _t -((CAPEX _{t-1} +CAPEX _{t-2})/2) / Current Assets _t	
Leverage	Total Debt _t / Total Assets _t	
Prior Change R&D	$(RD_{t-1} - RD_{t-2}) / Sales_t$	
R&D-Growth	$(RD_t - RD_{t-1}) / RD_{t-1}$	
RD _t	R&D investment in period t	
Sales Change	$ln(Sales_t)-ln(Sales_{t-1})$	
Size	ln(MV-Equity _t)	
Tobin's q	$(MV-Equity_t + Preferred Stock_t + Total Debt_t) / Total Assets_t$	

3. Large Shareholders and the Value of Research and Development Projects¹

3.1. Introduction

We study the opposing effects of monitoring benefits vs. costs of expropriation from the existence of corporate control on the market valuation of innovation activities, separating the effects for research and development projects. While the evidence on the net effect of corporate control on firm value is scant and partially inconclusive (VILLALONGA/AMIT (2006)), the effect on the market value of R&D is only starting to mount: For some firms from civil law countries, HALL/ORIANI (2006) find that R&D is essentially not valued at all in firms with a controlling shareholder and attribute their finding to an accrued risk of expropriation by the major shareholder. We argue that expropriation is more likely to occur when explorations are being exploited (development projects) than for mere explorations (research projects) supposedly due to a lower market uncertainty and a higher NPV of development projects. Additionally, we conjecture that the potential for benefits from monitoring activities is higher for exploration due to higher agency costs from the owner-manager conflict for research projects. Hence, we expect that corporate control impacts the pricing of research and development projects differently.

Investigating this question in the context of the top-R&D investing European firms offers us several advantages. First, previous research has shown that in continental European countries several traded firms have a main shareholder holding a stake of more than 50% (LA PORTA/LOPEZ-DE-SILANES/SHLEIFER (1999), FACCIO/LANG (2002)). Second, because of their heterogeneity and non-tradability, R&D investments create higher information asymmetries (HALL (2002); ABOODY/LEV (2000)). Third, as EU firms have mandatorily been applying International Financial Reporting Standards (IFRS) since 2005, we are able to hand-collect information on development projects that are capitalized. This is a potentially important distinction prior studies have not taken account of. Finally, we make use of the yearly published "EU

¹ This chapter is based on Müller, Maximilian and Thorsten Sellhorn, 2011, "Large Shareholders and the Value of Research and Development Projects", Working Paper, WHU – Otto Beisheim School of Management.

Industrial R&D Investment Scoreboard", which presents information on the top 1,000 EU companies investing in R&D. Compared to other studies, our sample firms' relatively high mean R&D intensity of 7.5%, defined as R&D investment over assets, indicates that R&D investment is a primary investment for these firms. Taken together, this allows us to disentangle the effects of corporate control on the market value of exploration and exploitation² activities.

To examine the effects of controlling shareholders on the pricing of firms' innovation activities, we use market value as an indicator of firms' expected returns from R&D investments. Following hedonic pricing theory and a large body of studies (first, GRILICHES (1981)), this construct allows us to assess perceived differences in the value of research and development projects when a controlling shareholder is present. Comparing research and development projects' market value, we find a significantly higher value of development projects and that the existence of a majority shareholder increases the value of research projects and reduces the value of development projects. This evidence is consistent with the main opposing effects of corporate control: monitoring benefits vs. expropriation costs (SHLEIFER/VISHNY (1997)). Supposedly, monitoring benefits overshadow the cost of expropriation for research projects. The risk of expropriation seems to dominate for development projects, which is consistent with their higher market valuation. Even though the main effect of a controlling shareholder on the market value of development projects is negative, we also find some evidence of incremental monitoring benefits from controlling shareholders that influence development projects' value positively when they are potentially surrounded by managerial opportunism. This is consistent with controlling shareholders curtailing myopic or opportunistic behavior (e.g., BUSHEE (1998)).

Since some firms in our sample do not capitalize development project investments during the sample period, we assumed that these firms are primarily engaged in research activities. We test the robustness of our results

 $^{^2}$ Some may argue exploitation does not start before production/marketing commences, however, there is no clear definition of when exploitation starts. We label development activities as exploitation of exploration activities. That is, exploration activities are research activities.

towards a potential selection bias and estimate a Probit model for the probability of capitalizing. This analysis indicates that firms with a smaller variability in earnings, positive earnings, bigger firms in terms of total assets, firms with a smaller market to book ratio, more R&D intensive firms, those with a higher beta, and those that are more successful with their R&D programs are more likely to capitalize development costs. Consistent with selection bias, the endogeneity control is significant in all our estimations. However, our results and inferences are largely supported.

Taken together, these findings complement and extend the literature on the economics of innovation and the corporate governance literature on their intersection. First, our findings extend studies investigating the market value of R&D (for a review, see HALL (2000)). Whereas these studies provide evidence regarding variation in the market value of R&D over time, across industries or countries, our study provides evidence on different types of innovation activities, in the spirit of MARCH (1991) exploration and exploitation, as we split R&D into research and development projects and document a significantly higher value of development projects. As recommended by prior studies (HALL/ORIANI (2006)), we use R&D disclosures to disentangle mixed up effects. Given the growing body of papers that argue that firms' R&D investments create a portfolio of options and applies real options logic (MCGRATH (1997)), our results can play a catalytic role in beginning work on the moderating role of the composition of the R&D activity in the uncertaintyvalue relationship (ORIANI/SOBRERO (2008)).

Second, our findings extend studies of the benefits and costs of large shareholders (for a review, see SHLEIFER/VISHNY (1997)). Specifically, our study provides evidence that in R&D intensive firms – implying a higher level of information asymmetry - the presence of controlling shareholders has opposing valuation effects depending on the type of innovation activity. While the risk of expropriation overshadows monitoring benefits for assets from exploitation activities (development), the value of exploration (research) activities benefits more from monitoring. As the evidence on the net effect of shareholders firm value is limited large on (e.g., CLAESSENS/SIMEON/FAN/LANG (2002)),our evidence emphasizes

disentangling a firm's (innovation) activities for identification purposes, a dimension not considered by prior literature.

Finally, we add to the accounting literature on intangible assets (for a review, see WYATT (2008)). We document a significant valuation discount when managers have high incentives to engage in R&D related earnings management and increase the capitalized proportion of R&D investment, which (at least) yields a one-time beneficial effect on net income. Also, in such situations, large shareholders can serve a mitigating role. Therefore, we conclude that studies investigating the value relevance of intangibles (e.g., expensed vs. capitalized amounts) need to control for corporate governance mechanisms – at the firm-level.

Our results are subject to several limitations. First, other studies investigating the relationship of corporate governance mechanisms and (innovation) activities refine corporate governance variables, e.g., type of ownership (MUNARI/ORIANI/SOBRERO (2010))and manager (VILLALONGA/AMIT (2006)). Instead, we do not distinguish between different forms of corporate control (e.g., family owner and manager) but focus on refining firms' innovation activities to document an effect of corporate control on average. Therefore, we cannot rule out the possibility that distinct characteristics of concentrated ownership influence our findings significantly. However, we control for different levels of external institutional contexts and industry effects and are able to document an average effect of controlling shareholders across a wide variety of European countries and industries. Therefore, we argue that the characteristics of concentrated ownership are rather an interesting avenue for future research than a limitation.

Second, we concentrate on listed firms in order to assess the market value of firms' R&D activity. Therefore, our findings may not generalize to private firms. Nonetheless, only around 20% of Europe's top R&D investors are private firms as illustrated by the "EU Industrial R&D Investment Scoreboard". While raising capital in public markets creates strong incentives to provide information that is useful in evaluating and monitoring the firm, private firms are usually characterized as having relatively concentrated ownership structures and communicating information efficiently among shareholders via private channels (e.g., BURGSTAHLER/HAIL/LEUZ (2006)). As we specifically focus on public firms with concentrated ownership, we believe that our results may to some extent generalize to private firms. However, future research could adopt alternative output measures. These include among others new product introductions (KOCHHAR/DAVID (1996)), counting patents or citation-weighted patents (LEE (2005)), or corporate entrepreneurship (ZAHRA (1996)).

3.2. Related Literature and Hypothesis Development

3.2.1. Related Literature

Mainly two streams of the academic literature investigate the value of R&D investments. While the economics literature applies hedonic pricing theory and studies shadow values of a constructed knowledge stock, the accounting literature assesses the value relevance of R&D investments, typically within the OHLSON (1995) model. These studies' results point in the same direction: The economics literature (GRILICHES (1981); GRILICHES (1998); HALL (2000); HALL/MAIRESSE/MOHNEN (2009)) as well as the accounting literature (GREEN/STARK/THOMAS (1996); ABOODY/LEV (1998); BARTH/CLINCH (1998); OSWALD/ZAROWIN (2007); SOUGIANNIS (1994); LEV/SOUGIANNIS (1996)) attest a prima facie evidence (GRILICHES (1986)) in support of positively valued R&D investments.

However, several studies have documented considerable variation in the market value of R&D over time (LUSTGARTEN/THOMADAKIS (1987); HALL (1993)), across industries (JAFFE (1986); COCKBURN/GRILICHES (1988)) or countries (HALL/ORIANI (2006)).³ More precisely, HALL/ORIANI (2006) report rather low coefficients for the knowledge stock in firms from continental European countries (France, Germany, and Italy; e.g., in Italy, R&D capital is not valued at all). Therefore, they partition their sample on corporate control and find that both French and Italian firms have high R&D valuations when no single shareholder holds more than one third of the firm, but that R&D is essentially not valued at all in the remaining firms. They base their argument on a higher risk of expropriation when corporate control is present, which may

³ This is why we include a full set of year, country and industry dummies in our regression analyses.

be exacerbated by a weaker legal protection of minority shareholders in these civil law countries (e.g., LA PORTA/LOPEZ-DE-SILANES/SHLEIFER/VISHNY (1998)). JOHNSON/LA PORTA/LOPEZ-DE-SILANES/SHLEIFER (2000) discuss European legal cases from France, Belgium, and Italy to illustrate how and why the law accommodates expropriation in civil law countries. Additionally, in their survey of corporate governance, SHLEIFER/VISHNY (1997) report several studies that find evidence for the problem of expropriation by large investors and related detrimental wealth effects. Although not addressing the value of R&D capital, other papers highlight the importance of large shareholders to ensure the principals' effective monitoring over managers, especially when R&D investments are involved (HILL/SNELL (1989); BAYSINGER/KOSNIK/TURK (1991); FRANCIS/SMITH (1995)).

As MUNARI/ORIANI/SOBRERO (2010) note, "several works rooted in institutional theory (e.g., O'SULLIVAN (2000)) have underlined the limitations of agency theory analysis of the relation between corporate governance and innovation, emphasizing how this perspective does not incorporate a systematic analysis of the innovative enterprise." While these papers follow the path to investigate more closely economic, organizational and institutional conditions of an innovative enterprise, i.e., refine corporate governance variables, there are no studies investigating the role of corporate control depending on the type of the innovation project (e.g., research vs. development).

An increasing body of papers argues that firms' R&D investments create a portfolio of options (MCGRATH/NERKAR (2004)) and, thus, real options theory can help complement existing theories to account for two different sources of uncertainty: market and technological uncertainty: If investors use real options valuation, the market value of R&D should reflect both the NPV and the value of real options created through R&D investments (ORIANI/SOBRERO (2008)). While market uncertainty mainly affects the existence of future growth opportunities (HUCHZERMEIER/LOCH (2001)), the risk of a firm's survival in light of technological change is captured by technological uncertainty (TUSHMAN/ROSENKOPF (1992)): ORIANI/SOBRERO (2008) document situational opposing, non linear effects for both forms of uncertainty on the value of R&D and point at the importance of, yet

unexplored, firm-specific factors that could potentially influence the effect of uncertainty on the value of R&D. Specifically, "in the spirit of the seminal work by MARCH (1991), the effect of technological uncertainty on the value of R&D capital might be considerably affected by the composition of the R&D activity in terms of exploration and exploitation" (ORIANI/SOBRERO (2008), p. 359). Although we do not model the effect of technological uncertainty on the value of R&D, we split knowledge capital into a research knowledge stock as well as a development knowledge stock. Since research projects relate more closely to exploration activities and development projects more closely to exploitation, our investigations pertain to value differences of exploration and exploitation activities.

Finally, some papers have investigated whether managers use the differential accounting treatment of development project investments, which creates a one-time beneficial effect for net income, opportunistically to meet or beat earnings benchmarks. OSWALD/ZAROWIN (2007) and CAZAVAN-JENY/JEANJEAN/JOOS (2011) document that firms increase the proportion of R&D investment capitalized as development projects when the firm-level incentives for earnings management are high. However, survey results from GRAHAM/HARVEY/RAJGOPAL (2005) indicate that managers prefer to engage in real earnings management (cutting R&D investment) as compared to accounting based earnings management (increasing the proportion of R&D investment capitalized). Proponents of the capitalization of development project investments highlight the benefit of signaling successful projects and, thus, information about future performance. In line with this argument, a large body of evidence documents their value relevance. ABOODY/LEV (1998), for example, show that capitalized software development costs are positively associated with stock returns and improve predictions of future income.

3.2.2. Hypothesis Development

Large investors have both the interest in returns and the power to demand it, which turns into their incentive to collect information and monitor the management, thereby curtailing the owner-manager-conflict (JENSEN/MECKLING (1976); agency problem I^4) and avoiding the traditionally prevalent free rider problem (SHLEIFER/VISHNY (1997)). But there may be costs as well: Large investors represent their own interests, which need not coincide with the interests of other investors in the firm, and are able to extract benefits to the detriment of other shareholders without restraint (VILLALONGA/AMIT (2006); agency problem II^5).

Ownership structure is particularly important for the market valuation of R&D investments, since, as demonstrated by ABOODY/LEV (2000), these investments create higher information asymmetries: Many R&D projects are unique to the firm (i.e., little can be learned from observing competitors) and there are no organized markets for R&D (that is, no asset prices to derive The information from). results by LA PORTA/LOPEZ-DE-SILANES/SHLEIFER/VISHNY (2002) suggest that the presence of traded firms controlled by large shareholders, joint with a legal system offering weak protection to external investors, can generate underpricing phenomena related to expropriation. Other studies, however, document monitoring benefits (e.g., YAFEH/YOSHA (2003)). As in HALL/ORIANI (2006), due to higher information asymmetries associated with R&D investments, we assume that any pricing phenomenon should be related to R&D investments more strongly than to other corporate investments. Since the evidence on the question which of the two agency problems is more detrimental to firm value or the value of R&D investments is scant and inconclusive, we effectively test that the

H1: incremental effect of a controlling shareholder on the value of *R&D* investments is zero.

The differential accounting treatment of research and development projects under IFRS, however, bears information that can be utilized to discriminate between different levels of R&D related information asymmetries and uncertainties: Development costs identify more successful and mature projects, which implies a higher NPV, if only due to the time value of money;

⁴ This numbering follows VILLALONGA/AMIT (2006).

⁵ Agency problem II is related to agency problem I if controlling shareholders are treated as insiders.

several conditions must be met for their capitalization. A firm must demonstrate

- "the technical feasibility of completing the project so that it will be available for use or sale;
- its intention to complete the intangible asset and use or sell it;
- its ability to use or sell the intangible asset;
- how the intangible asset will generate probable future economic benefits;
- [...] the availability of adequate technical, financial and other resources to complete the development and to use or sell the intangible asset;
- its ability to measure reliably the expenditure attributable to the intangible asset during its development." (IAS 38.57⁶)

Development projects that meet these criteria likely create lower information asymmetries in the owner-manager conflict, e.g., due to their "visibility", and have a reduced market uncertainty compared to research projects in the real options logic, which suggest a higher valuation impact. As previously discussed, market uncertainty's effect on the value of R&D is Ushaped. However, ORIANI/SOBRERO (2008) only find a positive effect of market uncertainty on R&D capital for very high levels of uncertainty; also, for low levels of growth, the relationship between market uncertainty and R&D value is monotonically decreasing. As the effect of technological uncertainty is ambiguous and the criteria of IAS 38 do not address firm survival in face of technological change, it is hard to predict whether technological uncertainty is different for research projects compared to development projects ipso facto. Taken together, a higher NPV and a positive impact of reduced market uncertainty, however, suggest a higher valuation of development projects. Therefore, we conjecture

⁶ Under IFRS, IAS 38.8 defines "development" to be "the application of research findings or other knowledge to a plan or design for the production of new or substantially improved materials, devices, products, processes, systems or services before the start of commercial production or use." IAS 38.8 also defines "research" as "the original and planned investigation undertaken with the prospect of gaining new scientific or technical knowledge and understanding".

H2: *development projects have a higher valuation compared to research projects.*

Monitoring benefits from controlling shareholders reduce information asymmetries resulting from the owner-manager conflict, which are (at least in R&D intensive firms) closely associated with the information asymmetries from R&D investments. Hence within a firm, assuming higher information asymmetries for research projects, the potential for monitoring benefits from controlling shareholders should be higher for research projects.

As outlined by JOHNSON/LA PORTA/LOPEZ-DE-SILANES/SHLEIFER (2000) assets, profits, and/or corporate opportunities may be subject to the "diversion of corporate resources from the corporation (or its minority shareholders) to the controlling shareholder" (i.e., expropriation or tunneling). However, since we conjecture a higher value of development projects, a controlling shareholder's marginal utility of engaging in expropriation activities should be higher for development projects due to higher certainty towards their outcome and the diverted resources. That is, the potential costs of expropriation imposed by controlling shareholders should be higher for development projects from the owner-manager conflict for development projects suggest a lower potential for monitoring benefits.

Therefore, we differentiate between research and development projects and conjecture that the risk of expropriation (and likewise any underpricing resulting from it) is higher for development projects, while the positive valuation impact of controlling shareholders' monitoring benefits is more pronounced for research projects. Hence, we expect

H3a: a positive impact of the existence of a controlling shareholder on the market value of research projects as the monitoring benefits overshadow the expropriation costs for research projects.

⁷ We also label as expropriation cost the potentially arising lower credibility of capitalized development cost amounts as a consequence of a (planned) engagement in tunneling, which likely results in a valuation discount.

H3b: a negative impact of the existence of a controlling shareholder on the market value of development projects as the expropriation costs likely overshadow the monitoring benefits for development projects.

Allowing capitalization of development projects can facilitate the reduction of information asymmetries between management and investors particularly in industries with high proprietary costs of disclosure, such as those with high levels of R&D (HORWITZ/KOLODNY (1981); CLINCH (1991)). Mitigating against the credibility of the development projects' value are other features of the financial reporting environment that give rise to managerial opportunism (e.g., HEALY/PALEPU (1995)). These include debt- and equityrelated incentives to manipulate accounting numbers. To the extent that the policy choice is influenced by incentives to manipulate the reported accounting numbers, the ability of capitalized development projects to convey information may be reduced; that is, information asymmetries increase. In particular, capitalizing investments as development projects may be used opportunistically by managers for earnings management purposes, i.e., to meet or beat earnings targets for two reasons: First, by capitalizing an investment (as opposed to expensing) managers achieve a one-time net income increasing effect; second, capitalization criteria have been characterized as giving firms some flexibility over the capitalized amounts (NOBES (2006)). Therefore, we expect

H4a: a negative impact of increases in the capitalized proportion of a firm's total R&D investment on the market value of development projects if these increases are likely driven by earnings management incentives.

Earnings management related managerial opportunism amplifies the owner-manager conflict (agency problem I). Large shareholders may serve a monitoring role in reducing expenditures on activities with high potential for managerial moral hazard (such as R&D) (YAFEH/YOSHA (2003)) and in effectively curtailing R&D related myopic investment behavior by managers with strong earnings management incentives (BUSHEE (1998)). Therefore, we conjecture that large shareholders help mitigate earnings management related credibility concerns (H4a) over increases in the capitalized proportion of a firm's total R&D investment, which should result in a positive pricing impact. Hence, we expect

H4b: a positive impact of the existence of a controlling shareholder on the market value of development projects if earnings management related increases in the capitalized proportion of a firm's total R&D investment are likely.

3.3. Research Design

Prior research employs two methods to measure the returns to R&D. First, a Cobb-Douglas revenue production function approach that includes labor input, tangible capital, and knowledge capital, which is an asset constructed from real R&D investments using a conventional declining balance formula; the measure of output is usually the firm-level price multiplied by the quantity sold (i.e., *realized* returns).⁸ Second, a forward-looking approach, which uses the market value as an indicator of the firm's *expected* economic results from current and past R&D investments. We employ the latter approach since using R&D input as a measure of R&D output has several shortcomings: Risk in R&D programs leads to considerable dispersion in the value of its output ex post; as additional components of risk, the behavior of competitors in the product market and changes in input prices will influence the realized value. Using market value allows incorporating all the information currently available about expected success of past and present R&D investments in generating future profits for the firm (HALL/MAIRESSE/MOHNEN (2009)).

Following recent studies, we employ the second approach, which is grounded in the theory of hedonic prices (GRILICHES (1981)). The approach regards a product, i.e., a firm, as a set of diverse characteristics with varying qualities (ROSEN (1974)). The price of the unique set of characteristics is determined by valuing the single characteristics and their respective quality by the means of the respective utilities provided (ADELMAN/GRILICHES (1961)). The resulting firm value is interpreted as the sum of the utilities attributed to its distinct constituting components (HALL/ORIANI (2006)). Based on the early

⁸ In their survey of studies investigating the relationship between R&D and productivity at the firm level, MAIRESSE/SASSENOU (1991) highlight the problems involved in modeling the effects of R&D on productivity and in measuring the appropriate variables.

works of GRILICHES (1979) a firm's productivity is determined by the input factors of labor, capital, and knowledge. In defining the key characteristics of a firm, HALL (2000) picks up the notion of a knowledge stock and complements it with tangible assets and remaining intangible assets as a whole. Accordingly, it is possible to represent the market value of firm i at time t as a function of its assets:

(1) $V_{it} = V(A_{it}, K_{it}, I_{it})$

Firm value is the result of a function of tangible assets (A), the knowledge stock (K), and the remaining intangible assets (I) (e.g. goodwill, etc.). The knowledge stock represents a theoretical construct of the replacement value of accumulated and depreciated R&D based knowledge. Following GRILICHES/MAIRESSE (1984), we compute the R&D capital as a perpetual inventory of the past and present annual R&D investments with a constant depreciation rate:

(2) $K_{it} = (1 - \delta)K_{it-1} + RDI_{it}$

 K_t denotes the current year knowledge stock, K_{t-1} is the previous year stock, which is depreciated by a rate δ , an approximation of the proceeding obsolescence of the asset generated by R&D investments, and RDI_t is the R&D investment in period *t*. In order to employ *K* empirically, two issues remain. First, as the starting knowledge stock cannot be observed, we assume a constant annual R&D growth rate of *g*. Following Hall (2006), we calculate the initial knowledge stock as follows:

(3)
$$K_{it} \approx \frac{RDI_{it}}{\left(\delta + g\right)}$$

Second, we need to assume parameter values for δ and g. For the depreciation rate, GRILICHES/MAIRESSE (1984) early on settled on 0.15 as an appropriate rate and supported this number by testing the robustness of their results using deviating approximations. Since they did not find significant variations by employing alternative values for δ this initial 0.15 estimate diffused in related publications and has become standard in the economics literature (GRILICHES/HAUSMAN (1986); GRILICHES (1986); HALL (2000); HALL/ORIANI (2006)).⁹ Following previous studies, we assume a growth rate of 0.08. In order to check the validity of this assumption, HALL/ORIANI (2006) have recalculated the R&D capital for different values of g on an industry-level for France, Germany, and Italy using the ANBERD database and do not find significantly different results.

Assuming an additive relationship of the three pillars of the firm value – A, K, and I – it is possible to express the market value of the firm as a multiple of the weighted sum of the three assets HALL/ORIANI (2006):

(4)
$$V_{it} = q_t (A_{it} + \gamma K_{it} + \lambda I_{it})^{\sigma}$$

where q can be interpreted as the average market coefficient of total assets.¹⁰ If we assume constant returns to scale, $\sigma = 1$, $\gamma(\lambda)$ is referred to as the shadow value of the knowledge capital (other intangible assets) relative to tangible assets (HALL/MAIRESSE/MOHNEN (2009)). By taking the natural logs and subtracting log A_{it} from both sides, we obtain:

(5)
$$\log\left(\frac{V_{it}}{A_{it}}\right) = \log q_t + \log\left(1 + \gamma \frac{K_{it}}{A_{it}} + \lambda \frac{I_{it}}{A_{it}}\right)$$

In order to linearize the model, we use the approximation $log(1+x) \approx x$ according to the Taylor series and GRILICHES (1981) and obtain:

(6)
$$\log\left(\frac{V_{it}}{A_{it}}\right) = \log q_t + \gamma \frac{K_{it}}{A_{it}} + \lambda \frac{I_{it}}{A_{it}}$$

The left hand side of the equation can be viewed as the log of Tobin's Q^{11} (TOBIN/BRAINARD (1976)), and the coefficient γ can be interpreted as the relative shadow value of the knowledge capital to tangible assets, while $q_t\gamma$ is the absolute shadow value of the knowledge capital and reflects market participants' perception of the expected "overall effect of *K* on the discounted value and present and future earnings of the corporation" (HALL/ORIANI

⁹ SOMMERHOFF (2010) reports comparable depreciation rates for capitalized development projects in a sample of listed firms in Germany.

¹⁰ That is, q reflects the differential risk and monopoly position of the firms in the sample.

¹¹ The expression (V_{it}/A_{it}) can be viewed as an approximation of the market value over replacement value; in this special case excluding any intangible assets.

(2006)). Values of γ greater than 1 imply that investing in R&D enhances the firm market value more than proportionally.

Since we use hitherto unexplored data from rarely studied countries for the R&D-market value relationship, we run a basic OLS regression¹² with robust standard errors for the linearized model (6) including size (natural log of sales) to control for nonconstant returns in the value function as well as a full set of industry, year and country effects to assure the validity of our estimates¹³:

(7)
$$\log\left(\frac{V_{it}}{A_{it}}\right) = \log q_t + \gamma \frac{K_{it}}{A_{it}} + \lambda \frac{I_{it}}{A_{it}} + CONTROLS_{it} + \varepsilon_{it}$$

In line with a large body of evidence we expect $\gamma > 0$ (HALL (2000); HALL/ORIANI (2006); CHAN/LAKONISHOK/SOUGIANNIS (2001)). For V_{it} we use the market capitalization three months after fiscal year end¹⁴ and debt over book value of tangible assets (due to the very limited development of corporate bond markets in Europe; BLUNDELL/GRIFFITHS/VAN REENEN (1999)).

In order to analyze the incremental effect of a controlling shareholder on the value of R&D investments (H1), we create and include a dummy variable (CC_{it}) that is equal to unity when the main shareholder holds a control stake higher than 50% and interact the variable with *K*/*A*. Although control may effectively be achieved with less than half the ownership due to freeriding behavior of small shareholders, this would work against finding significant effects for *CC*.¹⁵ Accordingly, we estimate the following regression and expect $\beta_2 = 0$:

¹² As described in further detail, note that estimating fixed effects regressions would not be possible since the dummy for controlling ownership is constant over our sample period.

¹³ All of the following regressions have been re-estimated without the year, country, and industry dummies but in a random effects setting. These results did not deviate significantly from the results presented above.

¹⁴ This is in line with prior research (e.g. OSMA/YOUNG (2009)) to assess associations of released accounting information and the market's valuation.

¹⁵ However, we re-estimated results with the main shareholder holding a control stake of more than 33% with largely unchanged results (as in HALL/ORIANI (2006)).
(8)
$$\log\left(\frac{V_{it}}{A_{it}}\right) = \log q_t + \gamma \frac{K_{it}}{A_{it}} + \lambda \frac{I_{it}}{A_{it}} + \beta_1 C C_{it} + \beta_2 \frac{K_{it}}{A_{it}} * C C_{it} + CONTROLS_{it} + \varepsilon_i$$

Turning to H2, the analysis of whether development projects have a higher valuation compared to research projects, we decompose the knowledge stock into two separate parts by splitting up RDI_{it}, the R&D investment, into two components: research expenses and capitalized development costs. In order to assure consistency, we follow the same procedure to construct the research and the development stock as with the knowledge stock: This yields the research stock, RE_{it}, and the development stock, CDC_{it}. Since not all development project investments may meet the criteria for capitalization, it would be more accurate to split the knowledge stock into three components: research expenses, development expenses, and capitalized development costs. However, we are unable to discriminate between those alternatives because only a few firms in our sample provide this distinction in the notes to their annual reports. Thus, RE_{it} includes some expenses belonging to the development phase. Yet, if development expenses fail to meet the criteria for capitalization, we expect them to be more comparable to research projects (with respect to their NPV and market uncertainty). If that is not the case, it works against finding significant results that pertain to the differences between research and development projects. In a similar vein, some firms in our sample do not capitalize any development costs over the sample period. One explanation is that these firms are primarily engaged in research and have to expense their R&D (mandatory expensers). On the other hand, it is possible that these firms have development expenditures which do not meet the criteria for capitalization. We follow the assumption made by OSWALD (2008) that this latter explanation "is not that common based on the assumption that mangers who engage in R&D activities only undertake projects with a positive NPV, which suggests the development expenditures should meet the [...] conditions for capitalization."¹⁶ If this assumption is wrong, this likely adds noise to our

¹⁶ Multivariate results from a Probit regression in table 6 that includes the characteristics of capitlizers vs. (potentially mandatory) permanent expensers reveal that permanent expensers' R&D payoffs have greater uncertainty. We discuss these later in further detail.

examinations (s.a.). Therefore, we estimate the following regression to test H2 and expect $\gamma_2 > \gamma_1$:

(9)
$$\log\left(\frac{MV_{it}}{A_{it}}\right) = \log q_t + \gamma_1 \frac{RE_{it}}{A_{it}} + \gamma_2 \frac{CDC_{it}}{A_{it}} + \lambda \frac{I_{it}}{A_{it}} + CONTROLS_{it} + \varepsilon_{it}$$

In order to investigate the differential effect of the presence of a controlling shareholder on the market value of research (H3a) as well as development projects (H3b), we include *CC* by itself and interact it with *RE/A* and *CDC/A*. In line with monitoring benefits overshadowing the cost of expropriation risk for research projects, we expect $\beta_2 > 0$. For development projects, we expect a negative incremental effect as we conjecture the cost of expropriation risk is likely overshadowing the monitoring benefits, that is, $\beta_3 < 0$. Thus, we estimate the following regression:

(10)
$$\log\left(\frac{MV_{it}}{A_{it}}\right) = \log q_t + \gamma_1 \frac{RE_{it}}{A_{it}} + \gamma_2 \frac{CDC_{it}}{A_{it}} + \lambda \frac{I_{it}}{A_{it}} + \beta_1 CC_{it} + \beta_2 \frac{RE_{it}}{A_{it}} * CC_{it} + \beta_3 \frac{CDC_{it}}{A_{it}} * CC_{it} + CONTROLS_{it} + \varepsilon_{it}$$

For H4a, our test of whether managerial opportunism in the form of earnings management is detrimental to the value of development projects, we construct an indicator variable, *DCEM*_{it}, that is equal to unity when an increase in the capitalized proportion of R&D investments is likely driven by earnings incentives. In with recent studies management line (e.g., ATHANASAKOU/STRONG/WALKER (2011)), we assume that firms manage earnings to meet analysts' expectations (i.e., median consensus analyst forecast three months before fiscal vear end). Therefore following BABER/FAIRFIELD/HAGGARD (1991) and recent studies, we group firms based on the difference between median analyst forecast of earnings three months before fiscal year end (AF_{it}) and their level of pre-tax earnings before R&D (EBRD_{it}) investments in the current year, which yields AFBRD_{it}. Group 1 firms are performing so poorly that they do not meet analysts' forecast even before manipulating the capitalized proportion of R&D investment. Group 3 firms are successful enough that they would meet analyst forecast even if R&D

investment maintained at last year's level. Finally, Group 2 firms would not meet the consensus analyst forecast if they maintained R&D investment at last year's level, but can beat the consensus analyst forecast by increasing the capitalized proportion of development project investments. We identify a firm as belonging to group 1 if $AFBRD_t < 0$, group 2 if $0 < AFBRD_t < RDI_{t-1}$, and group 3 if $RDI_{t-1} < AFBRD_t$.

If group 2 firms, the firms with a high incentive to manage earnings, increase the capitalized proportion of their R&D investments, our indicator variable, $DCEM_{it}$, equals unity. Note that the variable only indicates a very likely situation of managerial opportunism. To test H4a, we include *DCEM* as a main effect and interacted with *CDC/A*. Accordingly, we estimate the following regression and expect $\beta_2 < 0$:

$$\log\left(\frac{MV_{it}}{A_{it}}\right) = \log q_t + \gamma_1 \frac{RE_{it}}{A_{it}} + \gamma_2 \frac{CDC_{it}}{A_{it}} + \lambda \frac{I_{it}}{A_{it}} + \beta_1 DCEM_{it} + \beta_2 \frac{CDC_{it}}{A_{it}} * DCEM_{it} + CONTROLS_{it} + \varepsilon_{it}$$

Finally to test whether controlling shareholders serve a mitigating role in situations of managerial opportunism, that is, help to mitigate credibility concerns over the capitalized proportion of R&D investment when that proportion has likely been utilized for earnings management purposes, we interact *DCEM* with *CC* as well as *CDC/A*. Hence, we regress the following equation and expect $\beta_6 > 0$ in line with H4b.

$$\log\left(\frac{MV_{it}}{A_{it}}\right) = \log q_t + \gamma_1 \frac{RE_{it}}{A_{it}} + \gamma_2 \frac{CDC_{it}}{A_{it}} + \lambda \frac{I_{it}}{A_{it}} + \beta_1 DCEM_{it} + \beta_2 CC_{it} + \beta_1 DCEM_{it} + \beta_2 CC_{it} + \beta_2 CC_{it} + \beta_3 \frac{CDC_{it}}{A_{it}} * DCEM_{it} + \beta_4 \frac{RE_{it}}{A_{it}} * CC_{it} + \beta_5 \frac{CDC_{it}}{A_{it}} * CC_{it} + \beta_6 \frac{CDC_{it}}{A_{it}} * DCEM_{it} * CC_{it} + CONTROLS_{it} + \varepsilon_{it}$$

3.4. Data and Sample

Our initial sample consists of all publicly listed companies in the "EU Industrial R&D Investment Scoreboard" (779 EU). The yearly published "EU

Industrial R&D Investment Scoreboard" presents information on the top 1,000 EU companies investing in R&D. The Scoreboard includes data on R&D investment along with other economic and financial data from the last four financial years. The Scoreboard has been prepared from firms' annual reports and accounts received by an independent data provider. To prepare the Scoreboard, a database of 8,437 EU and 2,398 non-EU firms' accounts was screened. The R&D investment included in the Scoreboard is the cash investment which is funded by the companies themselves. Where part or all of R&D costs have been capitalized, the additions to the appropriate intangible assets are included to calculate the cash investment and any amortization is eliminated. We use this sample as it is, to our knowledge, the only source providing data on R&D investment for EU firms for our sample period from 2005-2009. We start in 2005 as this is the year of mandatory IFRS adoption within the European Union. However, since the yearly Scoreboard offers data on R&D investments for some of our sample firms since 2000, we use the earliest R&D investment observation available to derive a robust knowledge stock by constructing a longitudinal time series for each firm from 2000 to 2009. Thus, the information has been aggregated under the assumption that the most current data represents the most accurate information as in some cases prior year's errors are being corrected for. The composed database was truncated annually at the level of 2% with respect to R&D intensity.¹⁷ Additionally, for the five-year period from 2005 to 2009 during which IFRS reporting has been mandatory for the consolidated reports of publicly listed EU firms the capitalized development cost portion as reported in the annual reports has been hand-collected.¹⁸ The data for all control variables has been obtained from Thomson Financial Worldscope. Data on analyst forecasts has been obtained from the Institutional Brokers Estimate System database (I/B/E/S).

¹⁷ Reducing the level to 1% yields qualitatively comparable results. The same holds true for the case of a 5% truncating level. Furthermore, winsorizing the dataset with respect to RDI intensity also yields qualitatively comparable results.

¹⁸ For example, the Volkswagen group as the most R&D intensive EU firm discloses on p. 243 of their annual report that "of the total research and development costs incurred in 2009, 1,947 million [...] met the criteria for capitalization under IFRS". From the recognized research and (prior and non-capitalized) development costs in the income statement of \oiint ,429m in 2009, \oiint ,586m relate to the amortization or impairment of development costs. Therefore, the R&D cash investment equals (\oiint ,947m + [\oiint ,429m - \oiint ,586]=) \oiint ,790m, which is the amount given for the Volkswagen group in the "EU Industrial R&D Investment Scoreboard" for 2010 p. 73.

Top shareholder data has been obtained from Bureau van Dijk's AMADEUS database. Because AMADEUS offers the latest available top shareholder information, that is, the current information, we are not able to observe changes in a shareholder's stake. This creates noise that should bias against finding significant results pertaining to any effects of corporate control. However, the study by THOMSEN/PEDERSEN (2000) indicates that ownership structure remains relatively stable over time in Europe.

Table 1a presents the sample selection. All publicly listed firms within the 2009 "EU Industrial R&D Investment Scoreboard" lead to a possible sample of 779 unique EU firms. There are two main sources that lead to a loss of observations: Data availability in the databases and insufficiency to collect information on capitalized development costs from firms' annual reports. We end up with 2,497 observations with information on capitalized development costs. Of these, 65% capitalize development costs during the sample period.

	Less	Remaining
Firms included in the "EU R&D Investment Scoreboard" 2009		1000
Less firms		
Not publicly listed	221	779
Potential firm-year observations (779 firms times 5 fiscal years)		3895
Less		
firm-years with insufficient data for analyses in: table 3	330	3565
firm-years with insufficient data for analyses or unable to	1402	2002
collect: table 4 & 5 column (1) firm years with insufficient shareholder data for analyses:	1483	2082
table 4 & 5 column (2)	492	1590
Capitalizers		1622
Permanent Expensers		875

 Table 1a: Sample Selection

Table 1b presents the distribution of the sample by country with the highest representation in Germany and the United Kingdom (approx. 50% of the observations in our sample) and by industry with the highest representation in the Electronics (26.80%), Machinery and Equipment (14.12%), Drugs, Cosmetics and Health Care (9.85%), Chemicals (7.01%) and Automotive (5.24%).

Country	Ν	%	Industry	Ν	%
Austria	90	4.32%	Aeropspace	38	1.83%
Belgium	56	2.69%	Apparel	20	0.96%
Denmark	58	2.79%	Automotive	109	5.24%
Finland	182	8.74%	Beverages	6	0.29%
France	194	9.32%	Chemicals	146	7.01%
Germany	567	27.23%	Construction	64	3.07%
Greece	4	0.19%	Diversified	84	4.03%
Hungary	10	0.48%	Drugs, Cosmetics & Health Care	205	9.85%
Italy	120	5.76%	Electrical	99	4.76%
Netherlands	103	4.95%	Electronics	558	26.80%
Spain	62	2.98%	Financial	14	0.67%
Sweden	179	8.60%	Food	79	3.79%
United Kingdom	457	21.95%	Machinery & Equipment	294	14.12%
			Metal Producers	34	1.63%
			Metal Product Manufacturers	73	3.51%
			Oil, Gas, Coal & Related		
			Services	29	1.39%
			Paper	32	1.54%
			Printing & Publishing	21	1.01%
			Recreation	39	1.87%
			Retailers	28	1.34%
			Textiles	11	0.53%
			Tobacco	9	0.43%
			Transportation	12	0.58%
			Utilities	78	3.75%
Total	2082	100%	Total	2082	100.00%

Table 1b: Sample Composition by Country and Industry

3.5. Empirical Results

In this section, we present the empirical results of our analyses. First, we present descriptive statistics for the regression variables. Second, we investigate the effect of corporate control on the market value of the knowledge stock (H1). Third, we investigate the differential valuation of research and development projects and the effect of corporate control on their market value (H2, H3a, and H3b). Fourth, we test the valuation impact of managerial opportunism and the mitigating role of controlling shareholders (H4a and H4b). Finally, we check the robustness of our results towards a potential selection bias.

3.5.1. Descriptive Statistics

Table 2 presents descriptive statistics for the regression variables. In Panel A we partition the sample for our analysis of H1 on control, that is, the existence of a controlling shareholder. Both subsamples are comparable with respect to their median size and stocks of R&D relative to their tangible assets. Also, their median R&D intensity, defined as R&D investment over assets, is similar. In Panel B, we separate the knowledge stock into a research stock and a development stock. The mean and median development stock relative to tangible assets is lower than the research stock relative to tangible assets, which is expected as our sample includes (potentially mandatory) permanent expensers that as previously discussed are likely to be predominantly engaged in research. Finally, in panel C we partition the observations with separate stocks for research and development on control: The median research and median development stock relative to tangible assets are comparable for both subsamples. While firms with a controlling shareholder are bigger than those without, their R&D intensity is similar.

3.5.2. Corporate Control and the Market Value of R&D

The first column in table 3 reports our results for the basic model, which we estimate to ensure consistency with prior studies. The results show that R&D capital is positively valued by the market. The coefficient of the knowledge stock is directionally as well as in its value in line with prior studies using the same model but other data (HALL (2000), HALL/ORIANI (2006)). Other intangible assets have a positive and significant coefficient, which is greater than the coefficient on the knowledge stock. The coefficient on size suggests that there is a small decreasing returns size effect. Again, these coefficients are in line with HALL/ORIANI (2006) both with respect to their sign as well as their value. However, the explained variation compared to the total variation is higher (47%), potentially resulting from the inclusion of country and industry controls.

Column (2) shows the result of our investigation of the impact of large shareholder control on the market value of R&D. We test against the null, as it is unclear whether monitoring benefits outweigh the costs of expropriation risk from controlling shareholders. The coefficient on the interaction of control and

Table 2: Descriptive Statistics

Panel A table 3 analysis

	Variable	N	mean	p50	sd	p5	p95
Corporate	log(MV/A)	234	3 0.502	0.429	0.725	-0.558	1.749
Control=0	K/A	234	3 0.380	0.190	0.476	0.011	1.258
	I/A	234	3 0.352	0.164	0.596	0.000	1.320
	Size	234	3 13.918	13.791	2.119	10.763	17.567
	R&D-Intensity	234	3 0.068	0.033	0.079	0.002	0.234
Corporate	log(MV/A)	122	2 0.189	0.137	0.717	-0.839	1.427
Control=1	K/A	122	2 0.278	0.168	0.344	0.012	0.923
	I/A	122	2 0.250	0.123	0.349	0.000	0.891
	Size	122	2 14.606	14.315	2.202	11.108	18.489
	R&D-Intensity	122	2 0.052	0.033	0.061	0.002	0.170
A 11	1 / 1 / 1 / 1 / 1 / 1	250	5 0.205	0.224	0 727	0.000	1 (57
All	$\log(MV/A)$	356	5 0.395	0.334	0.737	-0.666	1.65/
	K/A	356	5 0.345	0.180	0.438	0.012	1.161
	I/A	356	5 0.317	0.146	0.527	0.000	1.133
	Control	356	5 0.343	0.000	0.475	0.000	1.000
	Size	356	5 14.154	13.983	2.172	10.824	17.819
	R&D-Intensity	356	5 0.062	0.033	0.073	0.002	0.218

Panel B

table 4, column (1)

table 5, column (1)

Variable	Ν	mean	p50	sd	p5	p95
log(MV/A)	2082	0.423	0.381	0.703	-0.611	1.625
RE/A	2082	0.327	0.158	0.436	0.003	1.160
CDC/A	2082	0.052	0.008	0.134	0.000	0.226
I/A	2082	0.364	0.153	0.620	0.000	1.415
Size	2082	14.101	13.929	2.141	11.013	17.862
R&D-						
Intensity	2082	0.063	0.036	0.073	0.002	0.231

Panel C
table 4, column (2)
table 5, column (2)

	Variable	Ν		mean	p50	sd	p5	p95
Corporate	log(MV/A)		1016	0.558	0.518	0.694	-0.500	1.717
Control=0	RE/A		1016	0.370	0.159	0.482	0.003	1.388
	CDC/A		1016	0.049	0.009	0.113	0.000	0.223
	I/A		1016	0.442	0.196	0.764	0.000	1.690
	Size		1016	13.962	13.900	2.076	10.901	17.677
	R&D-							
	Intensity		1016	0.068	0.034	0.078	0.003	0.234
Corporate	log(MV/A)		574	0.217	0.166	0.627	-0.724	1.277
Control=1	RE/A		574	0.239	0.142	0.321	0.003	0.763
	CDC/A		574	0.044	0.007	0.125	0.000	0.179
	I/A		574	0.266	0.122	0.366	0.000	0.962
	Size		574	14.659	14.409	2.130	11.267	18.413
	R&D-							
	Intensity		574	0.051	0.032	0.057	0.002	0.162
All	log(MV/A)		1590	0.435	0.393	0.690	-0.578	1.625
	RE/A		1590	0.322	0.155	0.436	0.003	1.163
	CDC/A		1590	0.047	0.009	0.117	0.000	0.217
	I/A		1590	0.379	0.164	0.655	0.000	1.437
	Size		1590	14.213	14.081	2.121	11.063	17.819
	R&D-							
	Intensity		1590	0.062	0.033	0.071	0.002	0.218

All variables as defined in the appendix.

Table 3: Test of Model and the Effect of Corporate Control on the Knowledge

 Stock (H1)

		Model	H1
		Dependen	t Variable
Variables	Pred. sign	log(MV/A)	log(MV/A)
	C	(1)	(2)
		. ,	. ,
K/A	+	0.280***	0.257***
		(0.041)	(0.042)
I/A	+	0.377***	0.379***
		(0.025)	(0.025)
Size	-	-0.019***	-0.018***
		(0.006)	(0.006)
Corporate Control			-0.024
			(0.030)
Corporate	?		0.123*
Control*K/A			(0.070)
Country Dummies		Included	Included
Industry Dummies		Included	Included
Year Dummies		Included	Included
Constant		-0.001	-0.011
		(0.140)	(0.140)
Observations		3,565	3,565
R-squared		0.471	0.472

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 3 presents multivariate results from robust standard errors pooled OLS regressions with log(MV/A) as the dependent variable. Column (1) presents test results of the general hedonic pricing model. Column (2) presents test results of the incremental effect of a controlling shareholder on the value of R&D investments against the null. All variables as defined in the appendix.

the knowledge stock is positive and significant at the 10% level, which indicates that, on average, the presence of a major shareholder increases the market valuation of R&D. This result is in contrast to HALL/ORIANI (2006), who find a negative effect for France, Germany and Italy, which may be due to a different sample period (1989-1998) and the inclusion of countries with a stronger protection to outside investors. However, when we adjust the standard errors to be robust to correlation within firms across time, we do not find a significant effect¹⁹, which suggests that monitoring benefits and the risk of expropriation outweigh each other.

3.5.3 Differential Valuation of Research and Development Projects and the Role of Corporate Control

Table 4 presents our results for H2 and H3a/b. In line with our prediction, the first column reveals that development projects, i.e., the stock comprised of investments into development projects is valued higher than the stock comprised of investments into research projects (significant at the 1% level). While the relative shadow value of knowledge capital (i.e., R&D) was 0.28, development projects' relative shadow value to tangible assets is significantly higher than research projects' relative shadow value (0.77 vs. 0.17; all significant at the 1% level). Also, development projects' relative shadow value is higher than the relative shadow value of other intangible assets significant at the 1% level (0.77 vs. 0.36).

The second column of table 4 presents the results that pertain to the incremental effect of the existence of a controlling shareholder on the value of research and development projects. We predict and find a positive effect of corporate control on the value of research projects and a negative effect of corporate control on the value of development projects both significant at the 1% level. Compared to the first column, development project capital in firms without a majority shareholder is valued significantly higher with coefficients of 1.20 vs. 0.77. Having a majority shareholder reduces the valuation of the development knowledge stock substantially: The sum of the two coefficients for these firms is 0.11 (vs. 1.20 for the firms without a majority shareholder).

¹⁹ This is the only result which is not robust towards an estimation including firm-clustered standard errors.

		H2	H3a/b
		Dependen	t Variable
Variables	Pred. sign	log(MV/A)	log(MV/A)
		(1)	(2)
RE/A	+	0.167***	0.133***
		(0.041)	(0.046)
CDC/A	+	0.771***	1.207***
		(0.122)	(0.238)
I/A	+	0.366***	0.365***
		(0.025)	(0.026)
Size	-	-0.036***	-0.036***
		(0.007)	(0.00773)
Corporate Control			-0.006
			(0.0361)
Corp. Cont.*RE/A	+		0.184***
			(0.0681)
Corp. Cont.*CDC/A	-		-1.097***
			(0.266)
Country Dummies		Included	Included
Industry Dummies		Included	Included
Year Dummies		Included	Included
Constant		0 424***	0.235
Constant		(0.157)	(0.152)
		(0.137)	(0.132)
Observations		2,082	1,590
R-squared		0.538	0.550
1			-

Table 4: Differential Valuation of Research and Development Projects and theRole of Corporate Control (H2 and H3a/b)

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 4 presents multivariate results from robust standard errors pooled OLS regressions with log(MV/A) as the dependent variable. Column (1) presents test results of whether development projects have a higher valuation compared to research projects (H2). Column (2) presents test results of the incremental effect of a controlling shareholder on the value of research projects (H3a) as well as development projects (H3b). All variables as defined in the appendix.

Since these development projects qualify as an asset, we attribute this effect to the accrued risk of expropriation by the major shareholder that outweights monitoring benefits. On the other hand, the existence of a controlling shareholder impacts the valuation of the research knowledge stock positively, supposedly because of the monitoring role these shareholders serve. The sum of the two coefficients for these firms is 0.32 (vs. 0.13 for the firms without a majority shareholder) and, thus, the research knowledge stock's value is increased and now similar to the value of other intangible assets. Another interesting result evident from column 2 is that the difference in value of research and development projects is not significant anymore for the firms with a controlling shareholder (0.11 vs. 0.32).

3.5.4. Managerial Opportunism and the Role of Corporate Control

In table 5, we acknowledge that managers of capitalizing firms may take advantage of the vagueness of the conditions that have to be met for the capitalization of an investment when the incentives for earnings management on the firm-level are high. That is, by capitalizing an investment, managers achieve a one-time positive profit effect as these investments do not immediately affect profit, but only do so in later periods through amortizations. Therefore, we construct a dummy variable, DCEM, that equals 1 if the incentives for earnings management are high and managers increase the capitalized proportion of total R&D investment compared to the prior year, i.e., utilize capitalization of development costs for earnings management purposes, thereby potentially reducing the credibility/reliability of the development knowledge stock (H4a). In line with this prediction, we find a negative incremental effect of *DCEM* on the value of the development knowledge stock in column 1 of table 5 (significant at the 5% level). In fact, the development knowledge stock is essentially not valued at all if used for earnings management purposes as the sum of the two coefficients is 0.09. Another result evident in this column is that utilizing capitalization of development costs for earnings management purposes provides a significant discount to the firm value.

We exploit this form of earnings management as a setting of managerial opportunism and conjecture that, even though the accrued risk of expropriation

		H4a	H4b
		Dependen	t Variable
Variables	Pred. sign	log(MV/A)	log(MV/A)
		(1)	(2)
RE/A	+	0.177***	0.145***
		(0.041)	(0.048)
CDC/A	+	0.808***	1.358***
		(0.123)	(0.219)
I/A	+	0.365***	0.365***
		(0.025)	(0.025)
Size	-	-0.035***	-0.036***
		(0.007)	(0.008)
Corporate Control			-0.007
			(0.0361)
DCEM		-0.273***	-0.207**
		(0.078)	(0.098)
DCEM*CDC/A	-	-0.713**	-1.646***
		(0.356)	(0.318)
DCEM*Corp. Contr.			-0.002
			(0.175)
Corp. Cont.*RE/A	+		0.184***
			(0.070)
Corp. Cont.*CDC/A	-		-1.212***
			(0.248)
DCEM*Corp. Cont.	+		1.572*
*CDC/A			(0.705)
Country Dummies		Included	Included
Industry Dummies		Included	Included
Year Dummies		Included	Included
Constant		0.411***	0.494***
		(0.158)	(0.162)
		0.000	1 500
Observations		2,082	1,590
R-squared		0.543	0.558

Table 5: Managerial Opportunism and the Role of Corporate Control (H4a and H4b)

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5 presents multivariate results from robust standard errors pooled OLS regressions with log(MV/A) as the dependent variable. Column (1) presents test results of a negative impact of increases in the capitalized proportion of a firm's total R&D investment on the market value of development projects if these increases are likely driven by earnings management incentives (H4a). Column (2) presents test results of a positive impact of the existence of a controlling shareholder on the market value of development projects if earnings management related increases in the capitalized proportion of a firm's total R&D investment are likely (H4b). All other variables as defined in the appendix.

is detrimental to the value of development projects, controlling shareholders can mitigate concerns over the capitalized proportion of R&D investment by monitoring efforts when that proportion has likely been utilized for earnings management purposes. The second column of table 5 presents our multivariate results. While all other coefficients significantly attain their predicted signs and corporate control reduces the value of development projects, the triple interaction of *DCEM*, Control and the development knowledge stock has a positive incremental effect (significant at the 10% level). When earnings management using the capitalization of development costs is likely and impacts the value of the development knowledge capital negatively (now significant at the 1% level), a controlling shareholder can mitigate credibility concerns or potentially prevent managerial opportunism by their monitoring efforts.

3.5.5 Robustness Check: Selection Bias

As previously discussed, our sample includes firms that permanently expense R&D. In line with OSWALD (2008), we followed his assumption that these firms are mandatory expensers and primarily engaged in research activities. This engagement, however, may be treated as an endogenous choice. Similarly, capitalization of development costs can be treated as an endogenous choice²⁰ and these choices might be related to other factors that affect the valuation of R&D. Therefore, it is important to investigate whether the results from tables 3-5 are robust to a possible selection bias. As discussed by HALL/ORIANI (2006), the bias does not relate to our dependent variable; if being a firm primarily engaged in research activities or the choice to capitalize development costs is not related to the disturbance in the market value equation, selection introduces no bias.

To address this issue, we re-estimated all equations using the HECKMAN (1979) two-stage approach. In the first stage, we estimate a Probit model for the probability of capitalizing development costs. Using the estimated parameters from this model, the inverse Mills ratio is computed for all firms in

²⁰ It has been acknowledged that this requirement includes criteria that effectively make development cost capitalization a covert option that is discretionary (NOBES (2006)). In fact, the discretion in determining the amount to be capitalized was one of the reasons for the FASB to reject the selective capitalization method (GORNIK-TOMASZEWSKI/MILLAN (2005)).

the sample. In the second stage, we estimate all regressions including the inverse Mills ratio as a control variable.

LEV/SARATH/SOUGIANNIS (2005) and BEAVER/RYAN (2000) show that the effect of capitalization on measured profitability is related to the firm's life cycle stage. In line with prior literature (e.g., OSWALD (2008)), we include seven variables to capture a firm's life cycle stage: intra-industry percentile ranks of earnings variability, market to book ratio, R&D intensity, firm beta, R&D program success – defined as the difference between the market capitalization and the book value of equity over the sum of current year's and lagged R&D spending – and size. Additionally, we include earnings sign.

Table 6 reports the results from our estimation of the Probit model. The dependent variable is CAP, an indicator variable equal to 1 if the firm has capitalized development costs during the sample period (hence, equal to 0 for permanent expensers). Results reveal that firms with a smaller variability in earnings, positive earnings, bigger firms, firms with a smaller market to book ratio, more R&D intensive firms, those with a higher beta and those that are more successful with their R&D programs are more likely to capitalize development costs.²¹ Table 7 presents the second stage including the endogeneity control. The inverse Mills ratio is significant throughout all estimations, consistent with selection bias. However, all of our results and inferences are fully supported with one exception pertaining to the incremental monitoring benefits from controlling shareholders when development projects are surrounded by potential managerial opportunism (H4b): The coefficient, although still positive, ceases to be significant; however, we suspect this result may be driven by lack of observations. Only around 4% of our sample observations, that is, 53 observations are classified as likely managing their earnings using the capitalization of development costs and of these only 30% have a controlling shareholder. Since these results largely confirm our tests

²¹ For a sample of UK firms, which unlike ours is dominated by expensing firms, OSWALD (2008) finds the following factors to be positively related to the choice to capitalize development costs: Firms with greater earnings variability, greater firm leverage and those that are more successful with their R&D programs are more likely to capitalize their development costs. Also, firms with negative earnings, smaller firms, firms with less R&D intensity and those firms not in steady-state with respect to their R&D programs are more likely to capitalize their development expenditures.

Variables	Pred. Sign	Dependent Variable CAP
Earnings Variability	+	-0.005***
		(0.001)
Positive Earnings	-	0.337***
		(0.075)
Size	-	0.003**
		(0.001)
Market to Book	+	-0.004***
		(0.001)
R&D-Intensity	+	0.002*
		(0.001)
Beta	-	0.006***
		(0.001)
R&D-Value	+	0.000***
		(0.000)
Constant		0.012
		(0.139)
Observations		2,212
Pseudo R squared		0.035

Table 6: Probit for Characteristics of Capitalizers vs. permanent Expensers

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

 χ^2

86.070

Table 6 presents multivariate results from a robust standard errors Probit regression with an indicator variable CAP as the dependent variable in order to assess the characteristics of development cost capitalizing firms vs. permanent expensers. CAP is an indicator variable equal to 1 if a firm capitalizes during the sample period. All other variables as defined in the appendix.

		tabl	e 3	tab	le 4	table 5	
		Model H1		H2	H3a/b	H4a	H4b
		Dependent Variable		Depender	nt Variable	Dependen	t Variable
		log(MV/A)	log(MV/A)	log(MV/A)	log(MV/A)	log(MV/A)	log(MV/A)
Variables		(1)	(2)	(3)	(4)	(5)	(6)
K/A	+	0.256***	0.231***				
		(0.036)	(0.039)				
RE/A	+			0.173***	0.149***	0.183***	0.161***
				(0.041)	(0.047)	(0.042)	(0.048)
CDC/A	+			0.795***	1.259***	0.835***	1.413***
				(0.127)	(0.243)	(0.128)	(0.223)
I/A	+	0.374***	0.375***	0.369***	0.369***	0.368***	0.370***
		(0.023)	(0.023)	(0.024)	(0.024)	(0.024)	(0.024)
Size	-	-0.007	-0.007	-0.024***	-0.021***	-0.023***	-0.021**
		(0.006)	(0.006)	(0.008)	(0.008)	(0.008)	(0.008)
Corporate Control			-0.035		0.013		0.011
			(0.029)		(0.037)		(0.037)
Corp. Cont.*K/A	?		0.129**				
			(0.064)				
Corp. Cont.*RE/A	+				0.155**		0.154**
					(0.072)		(0.075)
Corp. Cont.*CDC/A	-				-1.071***		-1.180***
					(0.278)		(0.260)
DCEM						-0.282***	-0.243**
						(0.079)	(0.098)
DCEM*Corp. Cont.							0.144
							(0.167)
DCEM*CDC/A	-					-0.678*	-1.547***
						(0.362)	(0.324)
DCEM*CDC/A	+						0.974
*Corp. Cont.							(0.750)
IMR		0.773***	0.776***	0.641***	0.723***	0.649***	0.736***
		(0.082)	(0.082)	(0.094)	(0.107)	(0.093)	(0.107)
Constant		-0.726***	-0.714***	0.255	0.464**	0.218	0.434**
		(0.149)	(0.149)	(0.186)	(0.185)	(0.186)	(0.187)
Observations		3,062	3,062	1,944	1,513	1,944	1,513
R-squared		0.508	0.509	0.549	0.560	0.556	0.569

Table 7: Results from Tables 3-5 including the inverse Mills Ratio

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 7 reproduces the multivariate results from tables 3-5 including the inverse Mills ratio as a control variable. Column (1) presents test results of the general hedonic pricing model. Column (2) presents test

results of the incremental effect of a controlling shareholder on the value of R&D investments against the null. Column (3) presents test results of whether development projects have a higher valuation compared to research projects (H2). Column (4) presents test results of the incremental effect of a controlling shareholder on the value of research projects (H3a) as well as development projects (H3b). Column (5) presents test results of a negative impact of increases in the capitalized proportion of a firm's total R&D investment on the market value of development projects if these are likely driven by earnings management incentives (H4a). Column (6) presents test results of a positive impact of the existence of a controlling shareholder on the market value of development projects if earnings management related increases in the capitalized proportion of a firm's total R&D investment are likely (H4b). All regressions include a full set of year, country and industry dummies. All other variables as defined in the appendix.

without endogeneity control, we conclude sample selection is not driving our results.

Finally, we also check whether corporate control influences the probability of capitalizing development costs by adding it to the model of table 6, obtaining the inverse Mills ratio and by adding the endogeneity control in the second stage. Although we do not report the results, we observe that corporate control influences the probability to capitalize positively (significant at the 5% level). In the second stage, the inverse Mills ratio is significant throughout all estimations, consistent with selection bias. However, all of our previously described results and conclusions from table 7 are fully confirmed.

3.6. Conclusion

This paper examines the opposing effects of corporate control, monitoring benefits vs. costs of expropriation, on the value of firms' innovation activities, distinguishing between research and development. We investigate this issue using a sample of European firms, who bear high information asymmetries as indicated by their relatively high mean R&D intensity of 7.5%. Upon mandatory adoption of International Financial Reporting Standards effective 2005, these firms disclose capitalized development project investments. Also, prior studies have documented that several traded firms have a main shareholder holding a stake of more than 50% in continental European countries.

We argue that expropriation is more likely to occur when explorations are being exploited (development projects) than for mere explorations (research projects) supposedly due to a lower market uncertainty and a higher NPV of development projects. Additionally, we conjecture that the potential for benefits from monitoring activities is higher for exploration due to higher agency costs from the owner-manager conflict for research projects.

Using market value as an indicator of the firm's expected returns from R&D investments, we find evidence that development projects have a significantly higher value compared to research projects and that having a majority shareholder increases the value of research projects and reduces the value of development projects. This suggests that monitoring benefits outweigh

the cost of expropriation for research projects. The risk of expropriation seems to dominate for development projects, which is consistent with their higher market value. Even though the main effect of a controlling shareholder on the expected returns of development projects is negative, we exploit a setting of managerial opportunism around development projects to find some evidence of incremental monitoring benefits from controlling shareholders that influence development projects' value positively in these situations.

Overall, our results suggest that the relationship between corporate control and value of innovation activities is not monotonic but moderated but affected by the composition of the R&D activity. These findings are pertinent to the broader question of whether large shareholders are detrimental to firm value. Our results suggest that monitoring benefits from large shareholders exist and overshadow expropriation risk for exploration activities, while expropriation risk overshadows monitoring benefits for activities with a higher market value, that is, exploitations of exploration activities.

We extend the literature on the economics of innovation and corporate governance by providing evidence of the market valuation of different types of innovation activities arising from corporate control for hitherto unexplored data from rarely studied countries, which has important implications for the interaction of firms, markets and institutions, e.g., the recent debate on R&D financing in the European Union (HALL/ORIANI (2006)).

Our results may not generalize to a broader set of firms that is less R&D intensive or private, because our sample is comprised of public firms and is characterized by a primary investment (R&D). It is noteworthy, however, that many countries, particularly the United States, continue to deny the capitalization of development costs without a requirement to provide detailed disclosures. Given the convergence efforts between the FASB and IASB to eliminate differences between U.S. and international financial reporting standards, as well as SEC considerations to require or allow U.S. firms to report under IFRS, our results are also likely to be of interest to standard setters and regulators since they show that development costs have a higher market valuation and the distinction between research and development projects is important for outside investors in order to assess the risk of expropriation.

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3.8. Appendix

Definition of Variables

MVt	Market capitalization _t + total debt _t
RDI _t	R&D investment _t
δ	Depreciation rate; =0.15
g	Growth rate; =0.08
K _t (initial)	$RDI_t/(\delta+g)$
K _t	$(1-\delta)^*K_t+RDI_t$
A _t	Total assets _t - other intangible assets _t
CDCt	Capitalized development costst
REt	$(RDI_t - CDC_t)$
It	Other intangible assets _t
Size _t	$ln(Sales_t)$
CC _t =Corporate	
Control	=1 if top shareholder's stake $\geq 50\%$
AFt	Median analyst forecast of earnings three months before fiscal year end_t
EBRD _t	$Earnings_t - taxes_t - RDI_t$
AFBRD _t	AF _t -EBRD _t
Group 2 _t	$0 < AFBRD_t < RDI_t$
CR _t	CDC _t /RDI _t
DCEM _t	=1 if Group 2=1 & $CR_t > CR_{t-1}$
Earnings	
Variability _t	Intra-industry percentile rank (Variance(Earningst - taxest))
Positive Earnings _t	$Earnings_t - taxes_t > 0$
Market to Book _t	Intra-industry percentile rank (Market capitalization _t / Common equity _t)
R&D-Intensity _t	Intra-industry percentile rank (RDIt / Total assetst)
Betat	Intra-industry percentile rank(beta _t)
R&D-Value _t	(Market capitalization _t - Common equity _t) / $RDI_t + RDI_{t-1}$

4. Recognition vs. Disclosure of Fair Values¹

4.1. Introduction

The reporting requirements under IFRS offer real estate firms an option to measure their primary asset class, investment properties, at fair value or at cost with a corresponding fair value disclosure. The choice was included to give preparers and users time to gain experience with using a fair value model and to allow time for countries with less-developed property markets and valuation professions to mature. During its deliberations to remove this choice in 2003, the IASB decided not to eliminate the choice, but rather to keep the matter under review with a view to reconsidering the option to use the cost model at a later date. This decision was made for two reasons: The IASB noted that more time is needed for the aforementioned events to take place and requiring the fair value model would not converge with the treatment required by most of its liaison standard-setters, most notably the FASB (IAS 40.BC12). Also recently, the IASB has issued a request for views on future agenda projects, to which our study could pertain (IASB (2011)). Our study offers evidence that addresses the reconsideration of requiring all real estate firms to report their investment property at fair value. This could potentially have profound consequences for future convergence efforts between IASB and FASB since, e.g., U.S. real estate investment trusts (REITs) currently report property assets under historical cost and rarely voluntarily report fair values, e.g., for reasons of litigation (MULLER/RIEDL/SELLHORN (2011)).

Hence, we investigate whether recognizing or disclosing financial reporting information, that is, investment property fair values, results in more informative earnings. Also, we investigate differences in reliability of recognized and disclosed fair values as information attributes. BERNARD/SCHIPPER (1994) identify a scarcity of evidence towards the question of whether recognition and disclosure are substitutes because the accounting environment delivers few settings that enable studies to compare recognition vs. disclosure for the same item of information.² While there was considerable

¹ This chapter is based on Müller, Maximilian, Edward J. Riedl and Thorsten Sellhorn, 2011, "Recognition vs. Disclosure of Fair Values", Working Paper, WHU – Otto Beisheim School of Management and Boston University.

 $^{^{2}}$ This still applies to the current state of the literature with the notable exception of ABOODY (1996) in his study of pricing differences between recognized vs. disclosed write downs for

heterogeneity within the European real estate industry as to whether a fair value information for their primary asset, real estate owned for rental streams and/or capital appreciation (investment property), was required under domestic GAAP, the adoption of International Financial Reporting Standards (IFRS) in the European Union effective January 1, 2005, has significantly changed these reporting requirements, which makes our setting unique: One group of our sample of IFRS-applying European investment property firms reports their primary asset, investment property, at fair value (fair value model) and another group at cost with a respective fair value disclosure in the footnotes (cost model). The disclosure enables us to adjust cost model firms' earnings to 'as if' fair value earnings. This allows us to test whether recognition and disclosure are substitutes in terms of their earnings informativeness.

To examine the earnings informativeness consequences of recognition vs. disclosure of investment properties, we use the earnings response coefficient from a regression of returns on earnings. Informativeness is the ability of financial statement information to capture or summarize information (FRANCIS/SCHIPPER (1999)), and its empirical operationalization is motivated by the basic result of the models developed by HOLTHAUSEN/VERRECCHIA (1988) and KOTHARI (2001): Noise in a signal reduces the price reaction to the signal (HANLON/MAYDEW/SHEVLIN (2008)). Noise is defined to be the difference between reported and economic earnings, while economic earnings measure a firms "real" change in value (i.e., we assume economic earnings equal returns). Therefore in a regression of returns on earnings, earnings that are less noisy imply a higher coefficient (earnings response coefficient) and are, thus, more informative. We conjecture that earnings calculated under the fair value model have a higher informativeness than earnings based on the cost model because rental income and changes in fair value are inextricably linked as integral components of financial performance of an investment property. Also, we observe that several firms switch from the cost model to the fair value model. Our investigation of these firms' reasons to migrate from the cost model to the fair value model indicates that the fair value model evolved as the best practice industry standard. These firms state that application of the fair

the oil and gas industry as well as few other studies with different settings discussed in section section 3.

value model increases comparability with competitors, gives a fairer presentation, and a better reflection of market conditions. The latter directly relates to our test of informativeness.

Comparing the response coefficients for fair value and cost model firms, we hypothesize and find that earnings determined under the fair value model are more informative than earnings determined under the cost model. When we adjust cost model earnings to incorporate the disclosed information about the fair value of the investment property portfolio to obtain 'as if' fair value model earnings, we continue to observe differences in earnings informativeness. Subsequent analyses indicate that this difference, at least partially, is attributable to systematic differences in reliability between recognized and disclosed fair values. Our findings suggest, recognition and disclosure are not substitutes and market participants adequately acknowledge differences in information attributes when processing fair value information. Since our firms choose between cost and fair value model, we perform all our tests with an endogeneity control, that is, we obtain the inverse Mills ratio from a Probit regression that models the choice between the cost and fair value model. Results indicate that bigger firms, firms with a higher investment property intensity, and firms from countries that required some form of fair value information before the switch to IFRS are more likely to adopt the fair value model.

We add to the literature in several ways: First, we investigate the previously unstudied question of recognition vs. disclosure for fair values of long-lived non-financial assets, which is a question of importance to standard setters and practitioners alike (BERNARD/SCHIPPER (1994)). An accounting choice that offers the options of recognition and disclosure is often the consequence of a trade-off (in other words, a compromise resulting from different paradigms as well as political forces). We add evidence in favor of the reconsiderations of the IASB to require the fair value model with mandatory usage of external appraisers. Our evidence suggests that external appraisers and transparent disclosures regarding the reliability of fair value estimates should be mandated even if accounting flexibility regarding the subsequent measurement of investment property remains.

Second, as investment property is the primary asset for our sample firms, averaging around 70% of their total assets, we contribute to the earnings quality research by being one of the first studies to present evidence on how a fair value accounting model impacts earnings quality (DEFOND (2010)). Apart from discussions of how a fair value accounting model would likely impact earnings quality factors, e.g., PENMAN (2009) for intangibles, there is little evidence with the notable exception of DIETRICH/HARRIS/MULLER (2000), who find that firms make accounting choices related to fair value estimates of investment properties to boost earnings and time asset sales to help smooth earnings before raising debt. Because the findings of several papers suggest poor earnings quality impacts information asymmetry³ (e.g., that FRANCIS/LAFOND/OLSSON/SCHIPPER (2004), examine who the relation between the cost of equity capital and seven earnings attributes, and BHATTACHARYA/DESAI/VENKATARAMAN (2007)), this paper complements studies examining the effects of mandating the provision of fair value information for long-lives tangible assets on firms' information asymmetry (MULLER/RIEDL/SELLHORN (2011)) by discriminating between recognized and disclosed fair values.

Finally, we add to the growing body of literature on international differences in IFRS implementation by documenting considerable heterogeneity in the model choice⁴, comparable to QUAGLI/AVALLONE (2010), that is partially driven by pre-IFRS reporting requirements. While this is in line with the extant evidence (JOOS/LANG (1994); ASHBAUGH/PINCUS (2001); KVAAL/NOBES (2010)), we also document that an industry best practice can evolve over time when IFRS is in place for several years. This pertains to recent studies on the voluntary vs. mandatory adoption of IFRS and the phenomenon that mandated IFRS adoption may just be the adoption of a label for some firms (DASKE/HAIL/LEUZ/VERDI (2011)). By offering a transition option, migration over time is possible and a likely source of an increase in industry-wide comparability (rather than mandating the fair value model upon IFRS adoption).

³ For theoretical research on this issue, see LAMBERT/LEUZ/VERRECCHIA (2007) as well as EASLEY/O'HARA (2004).

⁴ For a review, see FIELDS/LYS/VINCENT (2001).

Our results are subject to several limitations. First, since we focus on the primary asset of a specialized industry, the sample size in our analyses is comparably small and our findings may not generalize to other fair value settings. However, as outlined by MULLER/RIEDL/SELLHORN (2011), real estate constitutes one of the largest asset classes in the world and several other standard-setters have not yet adopted fair value accounting. Because the fair value model seems to be best practice within the real estate industry⁵ and the IASB aims at converging its standard with worldwide standard-setters, our evidence could be relevant beyond our sample.

Second, as we document a migration from the cost to the fair value model over our sample period, differences in the informativeness of earnings derived from recognized vs. disclosed fair value estimates may not persist as market demand may force fair value disclosing firms (i.e., cost model firms) to a more serious commitment to transparency, that is, to transition to the fair value model or to increase the reliability of their fair value estimates.

Finally, our sample period from 2005-2009 includes the years of the financial crisis and our results show that fair value model firms' market value of equity has been strongly hit, and, as we document, this may explain some of our less robust findings. Thus, an extension of the sample period including information from the annual reports of 2010 and 2011 will increase the power of our tests. Also, a closer examination of the crisis impact of fair value model vs. cost model firms may benefit the ongoing discussion of whether fair value measurement amplified the crisis (LAUX/LEUZ (2009); LAUX/LEUZ (2010)), but with a focus on the fair value of long-lived tangible assets.

4.2. Background

IAS 40 – Investment Property defines investment property as "property (land or a building—or part of a building—or both) held (by the owner or by the lessee under a finance lease) to earn rentals or for capital appreciation or both, rather than for: (a) use in the production or supply of goods or services or for administrative purposes; or (b) sale in the ordinary course of business" (IAS 40.5). Since investment property is the primary asset for our sample firms

⁵ For the US, MULLER/RIEDL/SELLHORN (2011) report that professional analysts commonly construct fair-value-type measures of property assets, that are user-derived, not firm-supplied, estimates.

(averaging 70% of their total assets), their business model mainly involves "acquiring [...], managing and selling [retail, commercial, residential, and industrial] real estate to generate profits through rentals and/or capital appreciation" (MULLER/RIEDL/SELLHORN (2011)). Within Europe, around 180 firms are publicly traded with an aggregate market capitalization of \notin 150 billion on December 31, 2005. Half of these are from Europe's three largest economies (UK: 27.61%⁶; Germany: 12.69%; France: 9.70%)⁷.

MULLER/RIEDL/SELLHORN (2008) provide detailed information on the distinct features of domestic GAAP with respect to the accounting requirements for investment property within Europe prior to IFRS adoption. Exhibit 1 reproduces their information. Art. 33 of the Fourth Council Directive 78/660/EEC allows member states three approaches to account for investment property: Accordingly, several continental-European countries require that investment property be accounted for under the cost model (Group 1 in Exhibit 1, e.g., Germany, France, Italy, Spain), while national GAAP in several other countries (Group 2, most notably, the UK) require revaluation of investment property through equity (i.e., not net income). A third group of countries allows firms the flexibility to choose between these two models.

By means of Regulation 1606/2002, the EU required publicly traded European companies to prepare consolidated financial statements using IFRS instead of country-specific accounting rules. Subsequent to initial recognition at cost, IAS 40 requires firms to choose between the cost model and the fair value model. While the previously described cost model is extended by a required disclosure of the fair value of all investment properties in the notes (IAS 40.79 (e)), the fair value model is most closely related to the revaluation model with the important difference that all changes in fair value be reported in the income statement (IAS 40.35). Firms are encouraged, but not required, to

⁶ This is potentially due to more developed equity markets in Anglo-American countries (LA PORTA/LOPEZ-DE-SILANES/SHLEIFER/VISHNY (1997)) as well as greater expertise within the UK property market (e.g., MULLER/RIEDL (2002)).

⁷ See table 1b for a detailed distribution of our sample firms by country.

Country	Group Cost	Revaluation	Notes
AUSTRIA	1 Yes	No	
FINLAND	1 Yes	No	
FRANCE	1 Yes	No	Revaluation is permitted, but rare in practice, as surpluses are taxed.
GERMANY	1 Yes	No	
ITALY	1 Yes	No	While depreciation is not mandatory; fair value is prohibited.
NORWAY	1 Yes	No	
SPAIN	1 Yes	No	
DENMARK	2 No	Yes	Revaluation is required if investment property is the firm's main activity.
GREECE	2 No	Yes	Applies a variant of the revaluation model.
UNITED			
KINGDOM	2 No	Yes	
BELGIUM	3 Yes	Yes	Revaluations are allowed under certain circumstances.
NETHERLANDS	3 Yes	Yes	Disclosure of fair value is required.
POLAND	3 Yes	Yes	
SWEDEN	3 Yes	Yes	Disclosure of fair value is required.
SWITZERLAND	3 Yes	Yes	

Exhibit 1: Pre-IFRS domestic GAAP Treatment of Investment Property⁸

Exhibit 1 presents the pre-IFRS domestic accounting treatment for investment property assets, indicating whether domestic GAAP required the cost model ("Cost Model"), revaluation model ("Reval Model"), or allowed a choice (i.e., indicated with a "Yes" in both the cost and revaluation model columns).

⁸ According to MULLER/RIEDL/SELLHORN (2008), p. 15.

make us of external appraisers to determine reliable fair value estimates (IAS 40.32). Also, it is only allowed to migrate from the cost model to the fair value model; the reverse is not allowed (IAS 40.31). Therefore, all of our sample provide fair values of their investment properties upon IFRS adoption.

Comparing both models, IAS 40.31 states that "it is highly unlikely that a change from the fair value model to the cost model will result in a more relevant presentation". Also, the IASC/IASB noted that the fair value model is the desirable option (IAS 40.B48) because it provides "more useful information" and "rental income and changes in fair value are inextricably linked as integral components of the financial performance of an investment property and measurement at fair value is necessary if that financial performance is to be reported in a meaningful way" (IAS 40.B44). Furthermore, "investment property generates cash flows largely independently of the other assets" (IAS 40.B45). However, the IASC/IASB included a choice to give preparers and users time to gain experience with using a fair value model and to allow time for countries with less-developed property markets and valuation professions to mature (IAS 40.BC12).

To validate these arguments and generate some anecdotal evidence for our hypotheses in section 4, we investigated arguments brought forward by 11 firms that switch from the cost model to the fair value model during our sample period from 2005-2009. Exhibit 2 presents these firms' statements from the accounting policy section within the notes to the consolidated financial statements. The given reasons for switching reveal that the fair value model evolved to be the best practice standard within the European investment property industry upon IFRS adoption. Our conclusion is supported by the "Best Practice Policy Recommendations" issued by the European Public Real Estate Association (EPRA (2008)). Therefore, firms switch to increase comparability with their competitors. Also, switching firms state/acknowledge that the fair value model gives a fairer, more transparent picture of the financial condition, which is more closely aligned to market conditions. Finally, one firm also refers to the (previously described) explicit recommendation of the fair value model in IAS 40.

Exhibit 2: Migration Reasons

2006	Statements		
Affine	The Affine Group elected to apply, as of January 1, 2006, the preferred method in		
	IAS 40, namely to recognize investment property at its fair value via income.		
Alerion	This item includes the real estate and buildings held to earn rental income. Real		
	estate investments are valued at fair value through the income statement as		
	permitted by IAS 40. The fair value of investment property is determined on the		
	basis of valuations carried out by independent consultants.		
Inmobiliaria	In 2006, the Colonial Group decided to change its accounting criterion for		
Colonial	measuring property, plant and equipment for own use and investment property from		
	cost to fair value. This change in criteria was made in order to simplify comparisons		
	with other listed European real estate companies, which predominantly use the		
	market value method and also because it gives a truer and fairer view of the Group's		
	equity.		
Metrovacesa	In 2006, the Metrovacesa Group has decided to change the method it uses for		
	recording its investment property in the accounts, from cost to market value. This		
	change has been made in order to make it easier to compare with other European		
	listed companies, which for the most part use the market value method, and because		
	it considers that this method gives a truer picture of the value of the Group's assets.		
Nieuwe	The real estate investments are included at fair value as at balance sheet date. The		
Stehen	fair value is determined quarterly based on internal appraisals and regularly tested		
	against appraisal values made by independent authorized experts. Starting on 1		
	January 2006, Nieuwe Steen Investments is publishing its figures on the basis of		
	fair values, after having always published its financial reports based on acquisition		
	values. As part of the change, the financial overviews were prepared on the basis of		
	fair values for the first time in the publication of the figures for 2006Q1. The		
	principal changes and effects on shareholders' equity and the indirect investment		
	result were described in detail in the 2005 annual financial statements. In view of		
	the explicit regulation of IFRS and for practical reasons, the company has decided		
	to move to financial reporting based on fair value in 2006.		
Stil werk	In the consolidated financial statements of Stil werk Real Estate Group, the fair		
	value method has been applied.		
2007			
------------	--		
Deutsche	A significant reason for the reassessment of the portfolio was the change in the		
Wohnen	measurement of investment property (IAS 40 Investment Property) in the balance		
	sheet from the cost method to the fair value method as of December 31, 2007. From		
	now on, the market value of our housing stock can be directly gathered from the		
	consolidated balance sheet-which reflects an international balance sheet and		
	transparency standard and a logical step for us.		
Docks	The company chose the method of fair value and recorded as income in the account		
Lyonnaise	"Fair value of investment property" at each balance sheet date a loss or profit		
	arising from the change in fair value of each investment property.		
IVG	Since the fair value method in the meantime established itself in the valuation of		
Immobilien	investment properties in the capital market as a best practice, IVG will convert to		
	the fair value method in 2007. In the future, the market value of these properties are		
	included in earnings.		
Pirelli	Investment property is initially measured at cost including transaction expenses, and		
	is subsequently reported at fair value, with the effects of changes in fair value		
	reflected in profit or loss. The fair value of investment property reflects market		
	conditions at the balance sheet date and is the price at which the property could be		
	exchanged between knowledgeable, willing parties in a transaction based on the		
	principle of mutual independence.		
Sparkasse	Sparkassen Immobilien AG changed the accounting method for its investment		
	property to the fair value model under IAS 40 from 1.1. 2007 onwards. This ensures		
	a better comparability with international competitors, since fair value has now		
	become established as the most usual accounting approach for real estate		
	companies.		

Exhibit 2 presents statements from the accounting policy section within the notes to the consolidated financial statements for firms that switched from the cost to the fair value model during our sample period (2005-2009).

4.3. Related Literature

Disclosure might be an effective means of communication; the question whether it can be considered as a substitute for recognition in terms of fully impounded information into market prices remains relatively open due to the scarcity of appropriate research settings. There is extant evidence indicating that footnote disclosures are not totally ignored by capital markets, and some might argue that evidence of market sophistication is strong enough to support the conclusion that prices at least approximately reflect such disclosures (BERNARD/SCHIPPER (1994)). Examples of footnote disclosures associated with stock prices are unrealized gains/losses for banks (BARTH (1994)), unrecognized pension obligations (LANDSMAN (1986); BARTH (1991)), unrecognized changes in the value of oil and gas reserves (HARRIS/OHLSON (1987)), and unrecognized R&D assets (HALL (1993)).⁹ Following the efficient-market hypothesis of informationally efficient financial markets, some academics even developed priors that the distinction between recognition and disclosure may not be sufficiently important (i.a. BEAVER (1973)). Such beliefs rest on the assumption that the public information set is sufficiently rich that the choice between recognition and disclosure cannot reveal any value-relevant information not already known. Thus, these views do not allow for the possibility that recognition *itself* might be information. BERNARD/SCHIPPER (1994), however, state that any presumption that recognition and disclosure are equivalent in their pricing consequences cannot be supported by direct evidence from the academic literature.

Experimental research (e.g., HARPER JR/MISTER/STRAWSER (1987), BLOOMFIELD/LIBBY (1996) and recently VIGER/BELZILE/ANANDARAJAN (2008)) suggests that whether an item is recognized or disclosed influences financial statements users' perceptions. Studies with an empirical archival research design investigate implications of recognition versus disclosure of other accounting items (e.g., stock options, and post-retirement benefits): E.g., ABOODY (1996) aims at extending findings from experimental research on perceptions to pricing consequences in a unique setting, comparable to this paper's setting, within the oil and gas industry and the results indicate that the

 $^{^9}$ The amount of the unrecognized intangible R&D asset *per se* is not disclosed, but expenditures on R&D are. The empirical studies essentially test whether stock prices reflect some aggregation of R&D.

effect of footnote disclosure on price differs from the effect of recognition. These studies face a self-selection bias. Other papers use a setting where a new standard requires recognition of a previously disclosed item: For example, DAVIS-FRIDAY/FOLAMI/LIU/MITTELSTAEDT (1999) provide evidence that a disclosed estimate of an anticipated liability for retiree benefits other than pensions prior to the year of recognition receives less weight than the recognized liability in market value association tests. These studies encounter the problem of changing information between the pre- and post-adoption period.

Other papers support the notion that recognition and disclosure are not substitutes. For a sample of US banks that simultaneously hold recognized and disclosed derivatives AHMED/KILIC/LOBO (2006) find the valuation coefficients on disclosed derivatives not to be significant, the valuation coefficients on recognized derivatives, however, to be significant. ESPAHBODI/ESPAHBODI/REZAEE/TEHRANIAN (2002) examine the equity price reaction to the pronouncements related to accounting for stock-based compensation. They document that firms exhibit significant abnormal returns around the issuance of the exposure drafts proposing to require recognition of stock-based compensation costs, and also around the event reversing that decision to require disclosure only (while encouraging recognition). These findings suggest that disclosure is not a substitute for recognition.

4.4. Hypothesis Development

Due to the paradigm of informationally efficient markets, many academics developed priors that the distinction between recognition and disclosure may not be sufficiently important (BEAVER (1973)). However, experimental research (e.g. HARPER JR/MISTER/STRAWSER (1991; BLOOMFIELD/LIBBY (1996)) as well as early evidence from IFRS adoption for the value relevance of investment property fair values LOURENÇO/CURTO (2008) suggests a potential difference. It is difficult to disentangle a potential difference as it could be due to either incomplete processing of disclosed items, or a greater emphasis placed on recognized items because they are viewed as more relevant and/or reliable (BERNARD/SCHIPPER (1994)).

Therefore, it is an open question whether measuring investment property at fair value provides more informative earnings due to the verifiability of potential fair values that can hardly be observed in active or even thin markets. Still, prior literature finds evidence that firms providing investment property fair values have lower information asymmetry relative to those not providing these fair values at all. In addition, firms that do not provide investment property fair values prior to IFRS adoption continue to have higher bid-ask spreads even after the required provision of these values subsequent to mandatory adoption of IFRS (MULLER/RIEDL/SELLHORN (2011)).

Informativeness is the ability of financial statement information to capture or summarize information (FRANCIS/SCHIPPER (1999)) and its empirical operationalization is motivated by the basic result of the models developed by HOLTHAUSEN/VERRECCHIA (1988) and KOTHARI (2001): Noise in a signal reduces the price reaction to the signal HANLON/MAYDEW/SHEVLIN (2008). Therefore in a regression of returns on earnings and changes in earnings, earnings that are less noisy imply a higher coefficient (earnings response coefficient) and are, thus, more informative. Noise (η_t) is defined to be the difference between reported (E_t) and economic earnings (e_t) (that is, $E_t=e_t+\eta_t$), while economic earnings measure a firms "real" change in value (i.e., we assume economic earnings equal returns [that is, $R_t=e_t$]). We model noise to have zero mean and variance σ_{η} . As demonstrated by HANLON/MAYDEW/SHEVLIN (2008) for the basic regression of returns on earnings, we substitute returns with economic earnings and reported earnings

with $e_t + \eta_t$. Hence, the earnings response coefficient (ERC) equals $\frac{\sigma_e^2}{\sigma_e^2 + \sigma_\eta^2}$

assuming e_t and η_t are uncorrelated. Also, for reasons of simplicity, we assume that there exists no bias (such as unconditional conservatism). Within this framework, the ERC is decreasing in the variance of noise: i.e., earnings that contain less noise have a higher earnings response coefficient.

Under the efficient markets hypothesis, the market is provided with the fair value information both for firms using the fair value model and the cost model and processes the information completely, i.e., it is included in returns.

Usually, the fair value of an investment property is determined by discounting cash flow projections based on reliable estimates of future cash flows, similar to a share valuation process. Therefore, recognizing and measuring investment property at fair value, should be less noisy compared to earnings determined on a cost basis, as, under the efficient markets hypothesis, a gain in fair value recognized in earnings should correspond more closely to a gain in market value as opposed to not recognizing a gain in fair value in earnings.¹⁰ Also, our comparison of the fair value and the cost model as well as the evidence from switching firms presented in section 2 suggests that the fair value model reflects market conditions better. Finally, the fair value model allows performance benchmarking with direct property market indices, such as IPD (EPRA (2008)). Therefore, we expect

H1: the earnings response coefficient for earnings determined under the fair value model is higher than the earnings response coefficient for earnings determined under the cost model.

The notion that more persistent earnings *innovations* are assigned greater value in securities markets is well documented (KORMENDI/LIPE (1987); COLLINS/KOTHARI (1989); ALI/ZAROWIN (1992); GIVOLY/HAYN (2000)); therefore, if fair value model firms' earnings innovations are more transitory than cost model firms' earnings innovations, we would expect a downward bias of our estimates of fair value model firms' earnings response coefficients induced by persistence. That is, if a downward bias exists, it works against finding more informative earnings for fair value model firms (H1). Based on the finding by BEAVER/MORSE (1978) and OU/PENMAN (1989) that extremely high (low) earnings-price ratios indicate that earnings are transitorily high (low), and non-extreme earnings-price ratios indicate that earnings are predominantly permanent, we construct a proxy for earnings persistence in line with e.g. CHENG/LIU/SCHAEFER (1996). After including and interacting the proxy, our inferences do not change.

Any difference in noise components that results from fair value gains on investment property not being included in earnings may be eliminated by

¹⁰ Even in 'bad times' when certain events may trigger impairments, the market value change that fair value earnings incorporate is likely different from the impairment recognized under the cost model and more closely related to this value change.

adjusting earnings determined on a cost basis.¹¹ The resulting earnings number is the one that would have arisen if the firm had originally accounted for its investment properties under the fair value model. After this elimination and under the efficient markets hypothesis, there should be no remaining difference in earnings response coefficients. However, prior literature (as previously described) documents that recognized and disclosed fair values are not substitutes, potentially due to a lower actual/perceived reliability of fair values that would induce a pricing discount. This explanation is likely given that mandatory fair value accounting real estate firms generate less precise fair value estimates compared to firms that provided fair values prior to IFRS adoption (MULLER/RIEDL/SELLHORN (2011)). Only one firm in our sample that applies the cost model under IFRS is not a mandatory adopter of fair value accounting. Therefore, we expect that

H2: the earnings response coefficient for earnings determined under the fair value model is higher than the earnings response coefficient for earnings determined under the cost model and adjusted to the fair value model.

While H2 adjusts for differences in the (subsequent) measurement of investment properties, prior literature acknowledges two alternative sources of noise: Market failure to impound fully the information from the footnotes due to some kind of irrationality or information processing bias *or* an appropriate discount as the lack of recognition reveals that the item is observed with less precision (BERNARD/SCHIPPER (1994)). The latter explanation would be in line with the efficient markets hypothesis.

As investment property fair values are estimates of realizable value, an appropriate benchmark for their reliability would be fair value gains and losses on disposals—which reflect the difference between realized selling prices in open market transactions and the most recent annual fair value estimates for the sold properties. It is reasonable to argue that fair value estimates are less reliable to the extent they differ from subsequent selling price realizations, and that market prices anticipate that. Another possible benchmark would be whether firms use external appraisers as recommended by IAS 40 to generate

¹¹ The following section will detail the developed adjustment formula.

fair value estimates (MULLER/RIEDL (2002)). By testing for differences in reliability between fair value and cost model firms, any remaining differences can potentially be attributed to incomplete processing. Cost model firms' fair values may be less reliable as their managers' incentive to obtain high quality fair values may be lower, potentially due to fewer consequences tied to fair value amounts (e.g., bonus plans may depend on cost earnings) or because no external appraiser have been used to generate fair value estimates. Furthermore, GONCHAROV/RIEDL/SELLHORN (2011) find that firms disclosing fair values have lower audit fees compared to firms that recognize fair values, which may be a proxy for their incentive to commit to the independent verification of their fair values (BALL/JAYARAMAN/SHIVAKUMAR (2011)). Hence, we expect that

H3: there exist systematic differences in reliability between recognized and disclosed fair value estimates.

4.5. Research Design and Data

We test earnings informativeness by examining the slope coefficients of pooled OLS regressions with firm-clustered, robust standard errors as well as fixed effects regressions with robust standard errors¹² of annual returns on annual earnings (2005-2009). Following HANLON/MAYDEW/SHEVLIN (2008), FRANCIS/SCHIPPER/VINCENT (2005) as well as EASTON/HARRIS (1991), tests for the level of, change in as well as the level and change in earnings will be reported. Therefore, the following models are estimated:

(1) $R_{it} = \alpha_0 + \alpha_1 Cost_{it} + \alpha_2 E_{it} + \alpha_3 E_{it} Cost_{it} + \varepsilon_{it}$

(2)
$$R_{it} = \alpha_0 + \alpha_1 Cost_{it} + \alpha_2 \Delta E_{it} + \alpha_3 \Delta E_{it} Cost_{it} + \varepsilon_{it}$$

(3) $R_{it} = \alpha_0 + \alpha_1 Cost_{it} + \alpha_2 E_{it} + \alpha_3 E_{it} Cost_{it} + \alpha_4 \Delta E_{it} + \alpha_5 \Delta E_{it} Cost_{it} + \varepsilon_{it}$

where R_{it} is firm i's 12-month cumulative raw return for fiscal year t¹³, *Cost_{it}* is an indicator variable, equal to one if investment property is measured at cost, E_{it} is a firm i's earnings for fiscal year t, scaled by market value of

¹² We do not report the results for the fixed effects regressions; however, our inferences do not change.

¹³ We truncate the dependent variable R_{it} at the 5th and 95th percentile in order to mitigate the effect of extreme outliers. As we compare the ability of accounting earnings to capture economic earnings, winsorizing would potentially yield inadequate comparisons.

equity_{t-1}. For (1) and (2), if $\alpha_3 < 0$ the fair value model is more informative. For (3), if $\alpha_3 + \alpha_5 < 0$ the fair value model is more informative.

In our tests, we include controls commonly used in the earnings response coefficient literature: $SIZE_{it}$, firm *i*'s reported total assets¹⁴, measured at the end of the fiscal year *t*; obtained from Worldscope; MTB_{it} , firm *i*'s market capitalization, divided by the firm's *i* reported common equity, both measured at the end of the fiscal year *t*; obtained from Worldscope; $LEVERAGE_{it}$, firm *i*'s reported short-term plus long-term debt, divided by the firm's total assets, both measured at the end of the fiscal year *t*, obtained from Worldscope; $LOSS_{it}$, an indicator variable equal to 1 if firm *i*'s reported net income before extraordinary items in year *t* is negative, and 0 otherwise; coded using data from Worldscope.

To further investigate a potential difference (that is, H2), the following adjustment formula has been developed:

(4)
$$E_{FV,t} = E_{C,t} + BV_{C,t-1} - BV_{C,t} + FV_t - FV_{t-1} - ((FV_t - BV_t) * \tau)$$

where E_{FV} equals earnings as if investment properties were recognized at fair value, E_C equals earnings under the cost model, BV_C equals book value of investment properties measured under the cost model (hand-collected), FV_C equals fair value of investment properties as disclosed (hand-collected) and τ equals the average corporate income tax rate obtained from the Federation of International Trade Associations. After adjusting, the regressions (1), (2) and (3) will be re-run with adjusted values for the cost firm observations.

As the recognition of investment properties results from exercise of managerial discretion, firms self-select into the fair value and the cost model (fair value recognizers and disclosers). Therefore, we employ a Heckman two-stage estimation procedure adapting findings from choice models developed by QUAGLI/AVALLONE (2010) as well as MULLER/RIEDL/SELLHORN (2008) for the first stage and add the inverse Mills ratio to the informativeness regressions in order to control for selection bias. Assuming some sort of required fair value

¹⁴ Prevailing literature uses logarithms of total assets, market capitalization or sales. However, logarithmic presentation of accounting numbers shrinks values too much and would lead to multicollinearity of the control variable with the earnings variable when interacted with earnings.

information on investment properties prior to IFRS adoption within countries' national GAAP is an efficient response to the demand for that information (BALL/KOTHARI/ROBIN (2000)), we expect firms located in these countries to choose the fair value model. Therefore, we include an indicator variable (PRE_GAAP_{it}) that equals one if the domestic GAAP of the firm's country of domicile, assessed just prior to IFRS adoption, allows or requires fair values of investment properties on the balance sheet (that is, under the revaluation model), and 0 otherwise. We expect that this argument also holds on the firmlevel. Hence, we include a variable that captures the extent to which investment property represents a firm's main business (i.e. the value of investment property divided by total assets), IP-INTENS_{it}. To further capture a firm's commitment to transparent reporting, we include an indicator variable equal to 1 if a firm is member of the European Public Real Estate Association (EPRA_{it}; hand-collected), and 0 otherwise. Also, we include size to control for the effects of the information environment. In larger, more liquid real estate markets reliable market-based fair values and model-based fair values derived using sophisticated valuation technology and expertise are more likely to be available than in smaller, less liquid markets. Hence, we expect the liquidity of the real estate market to positively influence the decision for fair value accounting (MLIQ_{it}; obtained from the Investment Property Databank). To control for economies of scale in providing specialized services, we include an indicator variable equal to 1 if a firm is audited by a Big 4 audit company. Finally, we include an indicator variable that is equal to 1 if the firm switches from the historical cost model to the fair value model subsequent to IFRS adoption. We expect switching firms to anticipate that they will switch at some earlier point in time when they adopt IFRS; e.g., our anecdotal evidence suggests that some firms waited for an industry best practice to evolve. Also, anecdotal evidence from auditors suggests that some firms had planned to adopt IFRS using the fair value model but the valuation process took too long. Since those firms potentially behave differently from 'pure' cost model firms and more like fair value firms, we control for the switchers.

Following DIETRICH/HARRIS/MULLER (2000) and in line with MULLER/RIEDL/SELLHORN (2011), fair value model firms will be compared to cost model firms with respect to the accuracy of fair value estimates relative to

selling price to further investigate a remaining potential difference after adjusted values are used for the tests. Accuracy is defined as the variance of fair value gains and losses on disposal (scaled by the fair value of the property sold). In order to draw conclusions, we estimate and compare the variances for fair value model and cost model firms by means of an F-test. Higher values represent greater differences between realized selling prices and the most recent fair value estimates for property sold; i.e., less accurate fair value estimates. Accordingly, we calulate *PROP_DISP_GL_{it}/PROP_DISP*_{it} for each firm-year observation in which investment property is sold, where *PROP_DISP_GL*_{it} is the fair value gain or loss on investment properties sold and *PROP_DISP*_{it} is the fair value as of the balance sheet date for investment properties sold.¹⁵ Finally, we also compare fair value and cost model firms with respect to the use of external appraisers to generate fair value estimates. Data for these measures is hand-collected from firms' income statements and footnote disclosures.¹⁶

4.6. Sample and Descriptive Statistics

For our regression analyses we use the same sample of firms as MULLER/RIEDL/SELLHORN (2011) in their analysis of mandatory fair value accounting and its effects on information asymmetry. Table 1a gives an overview of their sample selection process, beginning with all firms traded on European Economic Area (EEA) stock exchanges that are classified as real estate firms in Thomson Financial Worldscope (N = 741). Firms, that do not

¹⁵ As many historical cost firms do not provide the amount of investment property sold, for some historical cost firm-year observations the fair value amount of investment property sold is determined by the ratio of the book value of investment property sold and the book value of all investment property multiplied with the fair value of all investment property. This implies the assumption that the relative value difference of fair value and book value of the investment property sold does not significantly deviate from the average ratio of fair value and book value of the firm's investment property.

¹⁶ For some observations, firms did not have property sales in a given year or a required amount was not obtainable from the financial statements as this is not a disclosure required by IAS 40.

Table 1a: Sample Selection

	Less	Remaining
Firms traded on European Economic Area (EEA) stock exchanges classified as real estate in Thomson Financial Worldscope and active as of 12/15/2006		417
Less firms:	-	
not reporting under IFRS in the first fiscal year of mandatory IFRS adoption	-160	257
not operating in the investment property business	-55	202
that are subsidiaries	-9	193
for which no annual reports were found	-4	189
for which the cost versus fair value model decision for the first fiscal year of		
mandatory IFRS adoption could not be obtained,	-3	186
for which the fair value of investment property in the first fiscal year of		
mandatory IFRS adoption could not be obtained	-8	178
Potential firm-year observations (178 firms times 5 fiscal years)		890
Less:		
firm-years in which firm is not publicly-traded (e.g., merged, bankrupt)	-68	822
firm-years with insufficient data for analyses in table 3: Regressions $(1)/(2)/(3)/(4)/(5)/(6)$		358/367/359/368/359/368
firm-years with insufficient data for analyses in table 4: Regressions $(1)/(2)/(3)/(4)/(5)/(6)$		378/384/499/502/499/502
Remaining firm-year observations table 3: Regressions $(1)/(2)/(3)/(4)/(5)/(6)$		464/455/463/454/463/454
Remaining firm-year observations table 4: Regressions $(1)/(2)/(3)/(4)/(5)/(6)$		444/438/323/320/323/320

report under IFRS, that are not investment property firms, that are subsidiaries, or for which the required annual reports or IAS 40 reporting information were not available are excluded, leading to a possible sample of 178 unique firms and 890 possible firm-year observations (178 firms times five fiscal years). We then exclude firm-years in which the firm either is not publicly-traded, is merged, or dead, leaving 822 possible firm year observations. We furthermore exclude firm-years in which the firm lacks sufficient data for the analyses (including the Heckman-procedure).

Table 1b presents the choice of the cost versus fair value model under IAS 40 and provides several insights: 25.37% of all firms chose the cost model in the year of IFRS adoption, while 74.63% of all firms chose the fair value model. 11 (35.3%) of cost model firms switch in the years after IFRS adoption from the cost model to the fair value. Closer examination indicates that firms migrated exclusively to the fair value model in six countries, most notably the UK. In four countries, firms moved mostly to fair value, with only limited application of the cost model. Finally, in the continental-European countries, France, Germany, Italy, and Spain, there is considerable variation in the choice between the cost and the fair value model. In these countries, cost model firms represent the majority group. Also, these countries required cost model accounting under their domestic GAAP for investment properties prior to IFRS adoption.

Table 2 presents our results from a Probit regression examining the determinants of firms' decisions to choose the cost model. The dependent variable is Cost, an indicator if the firm chooses the cost model. While column (1) presents the results solely for the first year of IFRS adoption, column (2) shows the results for all observations throughout our sample period. We find that firms from countries that allowed or required fair value information of investment properties within pre-IFRS domestic GAAP are more likely to adopt the fair value model (significant at the 1% level). Also, firms with higher investment property intensity are more likely to adopt the fair value model (significant at the 10% and 1% level respectively). Results also indicate that bigger firms are more likely to adopt the fair value model (significant at the 5% level for all observations). Our results for the variable that identifies firms that

Country	Fair Value	Cost	
AUSTRIA	6		1
BELGIUM	10		1
DENMARK	3		0
FINLAND	3		0
FRANCE	4		9
GERMANY	6		11
GREECE	4		1
ITALY	2		5
NETHERLANDS	7		1
NORWAY	2		0
SPAIN	2		5
SWEDEN	9		0
SWITZERLAND	5		0
UNITED KINGDOM	37		0
Total	100		34

 Table 1b: Model Choice by Country

Table 1b presents the model choice by country of those firms in our sample with sufficient data for the subsequent analyses in their first year of IFRS adoption.

		Dependent Variable		
		Cost	Cost	
VARIABLES	Pred. sign	(1)	(2)	
Size	-	0.000	-0.000**	
		(0.000)	(0.000)	
Big4	-	0.082	0.079	
		(0.383)	(0.178)	
Switcher	+	1.827***	-0.138	
		(0.582)	(0.241)	
EPRA	-	-0.537	-0.216	
		(0.494)	(0.218)	
PRE_GAAP	-	-1.109***	-1.182***	
		(0.230)	(0.123)	
MLIQ	-	-0.003	0.028*	
		(0.053)	(0.015)	
IP-Intensity	-	-1.139*	-0.833***	
		(0.589)	(0.264)	
Constant		1.246*	0.637***	
		(0.641)	(0.218)	
Observations		133	539	
Pseudo-R ²		0.556	0.457	

Table 2: Probit Regression Examining the Determinants of Firms' Decisions to choose the Cost Model

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 2 presents the results from a Probit regression examining the determinant of the choice to use the cost model. Column 1 reports the results for all observations in the first year of IFRS adoption. Column 2 reports the results for all observations throughout the sample period. All variables as defined in the appendix.

switch from the cost model to the fair value model subsequent to IFRS adoption suggest that these firms represent a significant group of all cost observations; i.e., it is important to discriminate between switching firms and 'pure' cost firms. The model fit with a probability $>\chi^2 = 0.00$ and a pseudo R² of 0.457 and 0.556 respectively indicates a good fit of our selection model.

Table 3a provides descriptive statistics on the variables for the regressions in table 4. Table 3a reveals that both subsamples are relatively comparable. While mean and median earnings as well as earnings changes are very similar, we observe that fair value firms are larger than cost firms. However, cost firms exhibit higher mean and median returns.¹⁷ It is important to note that both returns and earnings show high standard deviations for the fair value firms, whereas the cost model firms' earnings have a smaller standard deviation. As we transform earnings with disclosures from the footnote, we present in table 3b comparisons for relevant values of our cost vs. fair value (transformed) data for the cost firms. While mean and median fair values of our sample firms' investment property portfolio are higher than their book values, mean and median transformed (as well as changes in) earnings are relatively comparable. However, we observe a higher standard deviation for both transformed values.

4.7. Empirical Results

In this section, we present the empirical results of our analyses. First, we test H1 by investigating whether cost model firms' earnings are less informative than fair value model firms' earnings. Second, after adjusting cost model firms' earnings using footnote disclosures about investment property fair values, we test whether these transformed earnings are less informative than fair value model firms' earnings (H2), i.e., whether the difference in informativeness diminishes. Third to test H3, we test whether fair value model firms' estimates.

¹⁷ Further analyses indicate that this may be due to the financial crisis in 2007 and 2008: While fair value model and cost model firms a firms have very comparable mean and median returns for 2005 and 2006, the fair value model firms' have been hit more severely by the financial crisis.

		Ν	mean	p50	sd	p5	p95
Fair Value	Return	366	0.011	-0.003	0.349	-0.545	0.609
	Е	366	0.068	0.097	0.243	-0.356	0.346
	DE	366	-0.020	0.007	0.209	-0.457	0.249
	Size	366	3756324	1230743	6173307	45107	1.96E+07
	M2B	366	1.134	1.027	0.686	0.510	1.905
	Loss	366	0.218	0	0.414	0	1
	Leverage	366	0.394	0.401	0.181	0.053	0.697
Cost	Return	88	0.142	0.158	0.363	-0.380	0.701
	E	88	0.062	0.044	0.129	-0.033	0.248
	DE	88	0.006	0.006	0.177	-0.182	0.255
	Size	88	1241468	619939.5	1882193	37208	4631716
	M2B	88	2.441	1.618	2.739	0.786	8.936
	Loss	88	0.147	0	0.357	0	1
	Leverage	88	0.417	0.447	0.199	0.019	0.682
Total	Return	454	0.036	0.042	0 355	-0 539	0.646
Total	E	454	0.050	0.042	0.335	-0.337	0.040
		454	0.007	0.000	0.223	-0.310	0.330
		434	-0.013	1072102	0.205	-0.431	1.905+07
	Size	454	3268863	10/3102	5690109	380/1	1.80E+07
	M2B	454	1.388	1.105	1.445	0.540	3.250
	Loss	454	0.205	0	0.404	0	1
	Leverage	454	0.399	0.408	0.184	0.041	0.697

Table 3a: Descriptive Statistics

Table 3b: Further Descriptive Statistics

	Ν	mean	p50	sd	p5	p95
Investment Property at						
Cost	84	691725.3	110608.8	1273334	2352	2466108
Fair Value	84	994249.6	177010.9	1833850	2046.7	3998009
E	84	0.058	0.042	0.125	-0.033	0.238
E (transformed)	84	-0.013	0.006	0.231	-0.479	0.266
ΔΕ	55	-0.016	0.005	0.203	-0.318	0.255
ΔE (transformed)	55	-0.010	-0.008	0.293	-0.485	0.789

All variables as defined in the appendix.

4.7.1 Fair Value vs. Cost Earnings (H1)

Table 4 presents our results for H1 for equations (1) to (3) each ex- and including controls. We find significant positive earnings response coefficients as well as positive significant coefficients for the linear combination of earnings and earnings changes in every specification. Except for model (1), a regression of returns on earnings excluding controls, we find a significant negative incremental effect for cost model firms' earnings in all following models; thus, confirming H1. As predicted, these results show that fair value model firms' earnings are more closely associated with economic earnings, that is, their earnings are more informative because they include less noise. Throughout models (1) to (6), the interacted controls attain their predicted signs, though not always significant. The inverse Mills ratio remains insignificant.¹⁸ Note that because the model choice is an independent variable in our estimations rather than the dependent variable, if the process generating the model choice (and the resulting disturbance) is not related to the disturbance in the returns-earnings regression, no bias will be introduced. Given the good fit of our selection model, this indicates that self-selection is not an influential factor in the returns-earnings relationship that biases our results. The earnings changes as well as earnings and earnings changes regressions including controls (model (4) and (6)) seem to best account for the variability in our data set in terms of their \mathbb{R}^2 .

4.7.2 Fair Value vs. Transformed-to-Fair-Value Earnings (H2)

Table 5 presents our results for H2: We estimate equations (1) to (3) and transform the cost model firms' earnings with their relevant fair value disclosures to obtain as if fair value model earnings for the cost model firms. Also as for H1, we run each regression ex- and including controls and find significant positive earnings response coefficients as well as positive significant coefficients for the linear combination of earnings and earnings changes in every specification. Our results for the interaction of earnings (earnings changes as well as earnings and earnings changes) and our cost model firm dummy indicate consistent evidence for the notion that recognition and disclosure are *not* equivalent. Regressing returns on transformed earnings

¹⁸ We tried different specifications of our first stage model, interacting the IMR with earnings and earnings changes as well as excluding the inverse mills ratio with unchanged results.

			(1)	(2) Earnings	(3) Earnings	(4) Δ Earnings	(5) Earnings	(6) Earnings
			Earnings	with controls	changes	with controls	and	and $\Delta Earnings$
	VARIABLES	Pred. sign	_				ΔEarnings	with controls
Main							U	
Variables	Е	+	0.563***	1.663***			-0.130	0.692***
			(0.141)	(0.233)			(0.098)	(0.257)
	ΔE	+			0.867***	1.584***	0.989***	0.986***
					(0.111)	(0.246)	(0.159)	(0.295)
	Cost	+	0 174***	0 276***	0.132***	0 154***	0.084**	0 179***
	6051	I	(0.040)	(0.050)	(0.043)	(0.043)	(0.041)	(0.060)
	F*Cost	_	-0.292	-0.946**	(0.013)	(0.013)	0.764**	0.017
	L Cost		(0.353)	(0.420)			(0.331)	(0.609)
	AE *Cost	_	(0.555)	(0.420)	-0 977***	-0 83/***	_1 3 99***	-0 888***
		-			(0.247)	(0.212)	(0.226)	(0.328)
Control	E*Size	_		0.000	(0.247)	(0.213)	(0.220)	-0.000
Variables and				(0.000)				(0.000)
Constant	E*M2B	+		0.043				0.025
	F*Loss			(0.050)				(0.062)
	E LOSS	-		(0.217)				(0.269)
	E*Leverage	-		-0.816***				-0.085
	4 T * C'			(0.270)		0.000**		(0.406)
	ΔE*Size	-				(0.000		(0.000)
	ΔE*M2B	+				-0.017		-0.017
						(0.013)		(0.016)
	ΔE^*Loss	-				-0.513***		-0.012
	AF*L everage	_				(0.193) -1.034***		(0.223)
						(0.203)		(0.502)
	IMR		-0.030	-0.031	-0.024	-0.030	-0.025	-0.029
	0		(0.020)	(0.022)	(0.020)	(0.020)	(0.020)	(0.021)
	Constant		(0.0278)	-0.153	(0.028^{***})	(0.015)	(0.015)	(0.030)
Test for	Ε+ ΔΕ		(0.017)	(01020)	(01011)	(01010)	0.860***	1.678***
significance							(0.112)	(0.281)
of linear	F*Cost⊥ ∆F *Cost						-0.636*	-0.871**
combination							(0.342)	(0.431)
	Observations		464	155	463	151	163	<u>/15/</u>
	R-squared		0 1/4		0.232	0.281	0.240	
	K-syuareu		0.144	0.234	0.232	0.201	0.240	0.303

Table 4: The Informativeness of Fair Value vs. Cost Earnings (H1)

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 4 presents six regressions ((1) Returns on earnings; (2) returns on earnings including controls; (3) returns on earnings changes; (4) returns on earnings changes including controls; (5) returns on earnings and earnings changes; (6) returns on earnings and earnings changes including controls) in order to test the differential earnings informativeness of cost vs. fair value earnings captured in the incremental effect E*Cost, Δ E *Cost and the linear combination of both respectively (H1). All variables as defined in the appendix.

			(1)	(2) Earnings	(3) Earnings	(4) ΔEarnings	(5) Earnings	(6) Earnings
			Earnings	with controls	changes	with controls	and	and $\Delta Earnings$
	VARIABLES	Pred. sign					∆Earnings	with controls
Main								
Variables	E	+	0.564***	1.401***			-0.057	0.871***
			(0.141)	(0.230)			(0.111)	(0.289)
	ΔE	+			0.648***	1.090***	0.705***	0.418
					(0.125)	(0.280)	(0.160)	(0.353)
	Cost	+	0.147***	0.221***	0.041	0.050	0.056	0.130**
			(0.049)	(0.054)	(0.055)	(0.057)	(0.055)	(0.0614)
	E*Cost	-	-0.310	-0.664**			0.709***	0.520*
			(0.250)	(0.331)			(0.270)	(0.266)
	$\Delta E * Cost$	-			-0.611***	-0.533**	-0.965***	-0.573*
					(0.213)	(0.241)	(0.218)	(0.292)
Control Variables and	E*Size	-		0.000				0.000
Constant	E*M2B	+		0.019				-0.049
				(0.045)				(0.042)
	E*Loss	-		-0.817***				-1.069^{***}
	E*Leverage	-		-0.677***				-0.119
				(0.244)				(0.457)
	ΔE*Size	-				0.000***		0.000
	ΔE*M2B	+				-0.024		-0.019
						(0.017)		(0.019)
	ΔE^*Loss	-				-0.264		0.239
	ΛE*Leverage	-				-0.761		-0.247
						(0.471)		(0.555)
	IMR		-0.022	-0.020	-0.040	-0.042	-0.036	-0.029
			(0.021)	(0.021)	(0.025)	(0.026)	(0.024)	(0.024)
	Constant		-0.027	-0.124***	-0.050***	-0.058***	-0.044**	-0.149***
Test for	E + AE		(0.017)	(0.024)	(0.013)	(0.017)	0.648***	1 290***
significance	$\mathbf{E} + \Delta \mathbf{E}$						(0.126)	(0.3532)
of linear	E*Coat AE *Coat						(0.120)	(0.3332)
combination	$E^{*}COSI + \Delta E^{*}COSI$						-0.230	(0.304)
comonation	Obcomunitions		111	120	272	220	(0.300)	(0.304)
	Doservations Decement		444	438	525 0 157	520 0.201	323 0.176	520 0.284
	K-squared		0.141	0.228	0.137	0.201	0.170	0.284

Table 5: The Informativeness of Fair Value vs. 'as if' Fair Value Earnings (H2)

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 5 presents six regressions ((1) Returns on earnings; (2) returns on earnings including controls; (3) returns on earnings changes; (4) returns on earnings changes including controls; (5) returns on earnings and earnings changes; (6) returns on earnings and earnings changes including controls) in order to test the differential earnings informativeness of as if fair value cost vs. fair value earnings captured in the incremental effect E*Cost, Δ E *Cost and the linear combination of both respectively (H2). The earnings for cost observations have been transformed according to the formula in section 5. All variables as defined in the appendix.

for the cost model firms, we find a significant negative incremental effect for cost model firms' earnings informativeness in models (2), (3), and (4). It is important to note that the sample size decreases significantly as we run models (3)-(6) with transformed changes in earnings as the transformation requires three firm year observations to obtain one transformed earnings changes observation: this is why we interpret our results as giving an indication that calls for further support with an increased sample size. Again, the inverse Mills ratio remains insignificant, inconsistent with self-selection biasing our estimates. The indicated differences in earnings informativeness between recognition and disclosure can be attributed to either defects or frictions in processing of market participants or a different processing due to the attributes of the fair value information revealed by recognition or disclosure. In order to test one of these explanations (that is, H3), we turn to our reliability tests in the following section.

4.7.3 Reliability of Recognized vs. Disclosed Fair Values (H3)

We present our tests of systematic reliability differences between recognized and disclosed fair values in table 6. Comparing the scaled fair value gain/loss variances of historical cost firms to fair value firms by means of an Ftest in panel A, we fail to find that the variance observed for historical cost firms is bigger than the one for fair value firms (i.e. the probability of wrongly accepting the hypothesis that the variance is bigger for historical cost firms is 16.36%). After analyzing the gain and loss distributions separately, a possible explanation may be that fair value firms have been particularly struck by the financial crisis and were forced to distress sales. Furthermore, the rapid price decline during the financial crisis might have led to abnormally high differences between realized prices and the most recent fair value estimates on the balance sheet.

Thus, we conduct a second F-test in panel B of table 6, in which we exclude all firm-year observations with a fair value loss on investment property sold (0 firm-year observation for historical cost model 47 firm-year observations for fair value model firms). When comparing the variances of the two groups, we find that the variance of scaled fair value gains of historical

Table 6: Test of systematic Differences in Reliability between Recognized and Disclosed Fair Value Estimates

<u>Panel A:</u> F-test: Historical Cost Firms vs. Fair Value Firms with respect to Variance of Fair Value Gains and Losses on Disposal

	Ν	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
HC firm-year	21	0.247	0.057	0.262	0.128	0.367
FV-firm year	254	0.091	0.014	0.228	0.063	0.119
combined	275	0.103	0.014	0.234	0.075	0.131
						F=1.324
ratio = ad(IIC) / ad(EV)						

ratio = sd(HC) / sd(FV)

Ha: ratio < 1	Ha: ratio $! = 1$	Ha: ratio < 1
Pr(F < f) = 0.836	Pr(F > f) = 0.327	Pr(F < f) = 0.164

<u>Panel B:</u> F-test: Historical Cost Firms vs. Fair Value Firms excluding Loss Observations with respect to Variance of Fair Value Gains and Losses on Disposal

	N	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
HC firm-year	21	0.248	0.057	0.262	0.128	0.367
FV-firm year	207	0.148	0.013	0.180	0.123	0.172
combined	228	0.157	0.013	0.190	0.132	0.138
						F= 2.131
ratio = $sd(HC) / sd(FV)$						

ratio = sd(HC) / sd(FV)

Ha: ratio < 1	Ha: ratio $! = 1$	Ha: ratio < 1
Pr(F < f) = 0.996	Pr(F > f) = 0.009	Pr(F < f) = 0.005

11						
	Ν	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
HC firm-year	100	0.531	0.050	0.502	0.430	0.630
FV-firm year	450	0.680	0.022	0.467	0.637	0.723
combined	550	0.652	0.020	0.477	0.613	0.693
diff		-0.150	0.052		-0.253	-0.047
						t = -2.866

<u>Panel C:</u> t-test: Historical Cost Firms vs. Fair Value Firms with respect to Mean of External Appraiser

diff = mean(HC) - mean(FV)

Ha: diff < 0	Ha: diff $!= 0$	Ha: diff > 0
Pr(T < t) = 0.002	$\Pr(T > t) = 0.004$	Pr(T > t) = 0.998

Table 6 presents tests with respect to differences in reliability between cost model and fair value firms. Panel A presents an F-test comparing the variance of fair value gains and losses on disposal scaled by the fair value of the property sold (*PROP_DISP_GL*_{*i*,*t*}/*PROP_DISP*_{*i*,*t*}) of fair value model and historical cost model firms. Panel B presents an F-test comparing the variance of fair value gains and losses on disposal scaled by the fair value of the property sold (*PROP_DISP_GL*_{*i*,*t*}/*PROP_DISP*_{*i*,*t*}) of fair value model and historical cost model firms. Panel B presents an F-test comparing the variance of fair value gains and losses on disposal scaled by the fair value of the property sold (*PROP_DISP_GL*_{*i*,*t*}/*PROP_DISP*_{*i*,*t*}) of fair value model and historical cost model firms excluding loss observations. Panel C presents a two-group mean-comparison t-test comparing means of the variable external appraiser for cost model and fair value firms.

cost firms is significantly greater than the variance of fair value firms at the 1% level (the probability of wrongly accepting the hypothesis is 0.45%).

MULLER/RIEDL (2002) document that reliability differences attributable to differential monitoring by appraisers can affect information asymmetry. Hence, as another source of reliability difference between recognition and disclosure firms, we hand-collect information from the notes to the financial statements on whether firms follow the recommendation in IAS 40.32 to determine the fair value of an investment property on the basis of a valuation by an independent appraiser who holds a recognized and relevant professional qualification and has recent experience in the location and category of the investment property being valued. Accordingly in panel C of table 6, we conduct a two-group mean-comparison t-test that yields that fair value model firms use appraisers, on average, more often (significant at the 1% level).

Taken together, this evidence indicates that differences in the reliability of fair values across fair value model and historical cost model firms exist and that fair value estimates by fair value model firms are more reliable than estimates of historical cost model firms. Our results are in line with the findings by MULLER/RIEDL/SELLHORN (2011): Their evidence suggests that there are fundamental fair value reliability differences between firms that mandatorily provide fair values with IFRS adoption and those that did so prior to IFRS adoption. However, it is important to note that the firm-year observations for historical cost firms is fairly small because a disclosure of the fair value amount of investment property sold is not mandatory for cost model firms; that is, the firms identified in MULLER/RIEDL/SELLHORN (2011) as mandatory adopters are likely firms that adopted the fair value model upon IFRS adoption.

4.8. Conclusion

This paper investigates whether recognition and disclosure of fair values are equivalent in their informativeness in the unique setting of the Euorpean real estate industry where recognition and disclosure can be observed and compared for the same item of information: Fair values of investment properties that are recognized or disclosed under IFRS. Upon IFRS adoption, the relevant standard, *IAS* 40 – *Investment Property*, requires all firms to recognize or disclose investment property fair values (and recognize investment property at amortized cost). The fair value information, either recognized or disclosed, is of particular importance to our sample firms as it represents their primary asset, averaging about 70% of their total assets.

In line with predictions, empirical results reveal that fair value based earnings are more informative than cost based earnings, that is, fair value based earnings are less noisy and more in alignment with economic earnings (i.e., returns). When we adjust these cost model earnings for the disclosed fair values from the notes to the financial statements, our results indicate that cost model firms' 'as if' fair value earnings continue to be less informative. While this finding could be evidence of either incomplete processing of disclosed items, or a greater emphasis placed on recognized items because they are viewed as more relevant and/or reliable, additional analyses indicate that our finding is partially attributable to the lower reliability of disclosed fair values: Disclosed fair values are less often estimated by external appraisers and, apart from the financial crisis, are less accurate when compared to selling prices. We use the same sample as MULLER/RIEDL/SELLHORN (2011) as our starting point and partition the sample based on the recognition vs. disclosure of fair values in the post-IFRS adoption period. Hence, our results complement their finding that information asymmetry differences between mandatory fair value adopters and firms that provided fair value information prior to IFRS adoption are not completely eliminated after IFRS adoption.

Overall, the results suggest that recognizing long-lived tangible assets at fair value results in more informative earnings compared to measuring them at cost. Mandated disclosures for cost model firms do not eliminate informativeness differences, partially because differences in reliability of fair value estimates between fair value and cost model firms remain. These results call for more disclosures in quantity and standardization on information attributes: that is, the way fair value estimates have been obtained/generated; *IFRS 13 – Fair Value Measurement*, a recently issued standard that provides a *IFRS*-wide framework and guidance on fair value measurement, is a first step towards that path. Finally, our findings address deliberations of the IASB to remove the cost model for real estate firms and, more recently, a request for views as part of their agenda consultation (IASB (2011)). Because we observe the migration of a significant proportion of our sample firms towards the fair value model during the sample period, recognizing investment property at fair value appears as having evolved to be *the* industry standard. Our findings deliver an explanation: Earnings that result from applying the fair value model are more informative.

We note that the sample size in our analyses is comparably small and, because we focus on the primary asset of a specialized industry, our findings may not generalize to other fair value settings. However, if future convergence efforts between the FASB and IASB triggered changes to current US GAAP towards a fair value model or if the SEC allowed US firms to report under IFRS, our findings should likely be of interest to other policy makers apart from the IASB, most notably the SEC/FASB in the US with commercially owned real estate estimated at \$5.3 trillion.

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4.10. Appendix

Definition of Variables

RETURN _{i,t}	firm <i>i</i> 's annual return, measured by the total return index, starting 3
	months after fiscal year t -1 and ending 3 months after fiscal year t
Cost _{i,t}	an indicator variable equal to 1 if firm <i>i</i> measures investment property
	at historical cost and equal to 0 if investment property is measured at
	fair value
E _{i,t}	firm <i>i</i> 's reported net income before extraordinary items of fiscal year <i>t</i>
SIZE _{i,t}	firm i 's reported total assets, measured at the end of the fiscal year t
$\mathrm{MTB}_{\mathrm{i},\mathrm{t}}$	firm i 's market capitalization, divided by the firm's i reported common
	equity, both measured at the end of the fiscal year t
LOSS _{i,t}	an indicator variable equal to 1 if firm <i>i</i> 's reported net income before
	extraordinary items in yeart t is negative, and 0 otherwise
LEVERAGE _{i,t}	firm <i>i</i> 's reported short-term plus long-term debt, divided by the firm's
	total assets, both measured at the end of the fiscal year t
IMR	is the inverse Mills-ratio calculated by including the following decision
	variables: PRE_GAAP (an indicator variable equal to 1 if the firm i 's
	country of domicile, assessed just prior to IFRS adoption, allows or
	requires fair values of investment properties on the balance sheet, and 0
	otherwise), EPRA_MEMBER (an indicator variable equal to1 if firm <i>i</i>
	is an EPRA member in the year of IFRS adoption, and 0 otherwise),
	B4_AUDIT (an indicator variable equal to 1 if firm i employs a large
	(i.e., Big 4) auditor in the year of IFRS adoption, and 0 otherwise),
	IP_INTES (firm i's investment property divided by its total assets in
	the year of IFRS adoption), and MKT_LIQ (property market turnover
	in firm i's country of domicile in the year of IFRS adoption)
$PROP_DISP_GL_{i,t}$	firm <i>i</i> 's fair value gain or loss on investment properties sold in period t
PROP_DISP _{i,t}	firm <i>i</i> 's fair value as of the balance sheet date for investment properties sold in period t

5. Conclusion

The empirical studies included in this thesis have addressed economic consequences of financial reporting flexibility. I defined financial reporting flexibility as a feature of an accounting system, which has two dimensions: First, accounting choices between two or more ways of recognizing, measuring and/or presenting a firm within the system. Second, flexibility to portray more detailed information compared to other financial reporting systems. To the extent accounting choices or more detailed information affect the information set of parties or contractual outcomes, accounting flexibility has economic consequences.

I studied financial reporting flexibility for European IFRS firms for several reasons: First, IFRS have the objective to provide decision-useful information, which is beneficial to investigations of economic consequences. Also, IFRS are more principles-based as opposed to rules-based, which yields flexibility and observable discretionary behavior. This discretion can be exploited to reveal firm-level incentives that drive the application of an option. In turn, the application of an option likely yields observable, economic consequences. Second, the European Union mandates the application of IFRS for publicly traded firms in their consolidated financial statements since 2005, which makes post-adoption years observable in an economic area with different institutional features that contributed to the evolution of heterogeneous accounting traditions.

Hence, from a vast range of overt and covert options inherent in IFRS, I developed and exploited three settings to study the economic consequences of financial reporting flexibility. First, I chose the flexibility to capitalize some parts of a firm's innovation activity, that is, development costs. The capitalization of development costs involves considerable discretion with respect to the cut off between research and development activities (flexibility within and higher flexibility across standards), but also contributes to get a deeper understanding of the composition of a firm's R&D activity in terms of exploration and exploitation of exploration (more flexibility to portray the innovation activities compared to other financial reporting systems). I study this issue for top-R&D-investing firms in order to observe flexibility about a

primary investment to these firms and, hence, to strengthen the power of the setting.

The results pertaining to the first option reveal that managers trade-off accounting earnings management (increasing the capitalized amount of total R&D investment) and real earnings management (cut R&D investment) to meet earnings benchmarks. This trade-off seems to be influenced by the business cycle: That is, during the financial crisis firms with strong earnings management incentives within the EU increased their capitalization ratio, while they were more reliant to real earnings management prior to the crisis. Comparing R&D growth for EU firms and a sample of matched top-R&Dinvesting US firms, EU firms with a more aggressive capitalization behavior during the crisis have a higher R&D growth. This finding is attributable to lower flexibility provided under US GAAP since US firms must expense virtually all of their R&D investment (and do so in order to meet earnings benchmarks). Hence, internationally divergent accounting rules, i.e., higher financial reporting flexibility under IFRS compared to US GAAP, affect R&D investment.

A second study exploits the flexibility to portray a firm's R&D activity in more detail. Flexibility can illustrate how the value of a firm's innovation activity varies in different elements that compose the R&D activity of a firm. Starting with the base line result that development projects have a higher value compared to research projects, the study uses the information on research and development projects to address the net-benefits/costs of corporate control. The opposing effects of monitoring benefits and the cost of expropriation overshadow each other depending on the innovation activity. While corporate control impacts the value of research projects positively, that is, monitoring benefits play a more important role for these investments; corporate control impacts the value of development projects negatively. This suggests that once exploration activities yield potential assets that are further developed and exploited, the risk of expropriation and the underpricing resulting from it is higher than monitoring benefits attributable to corporate control. Financial reporting flexibility helps to highlight these effects.

For the third empirical study included in this thesis, I exploit the choice between the cost and fair value models to account for investment properties. Under US GAAP and other financial reporting systems, real estate firms report property assets under the cost model and rarely report fair values. Interestingly, IFRS also mandate fair value disclosures when firms apply the cost model for their investment property. Hence, firms are provided with flexibility towards how to account for their investment property, but deliver the same item of information, fair values of their investment property, either recognized or disclosed. As prior studies indicate that the application of the fair value model is an industry-driven phenomenon, I focus on the European real estate industry. As with the top-R&D-investing firms, investment property is primary asset class for these real estate firms. Also, prior to mandated IFRS adoption, member states varied considerably in the way investment property had to be accounted for.

Hence, the third study included in this thesis examines whether financial reporting flexibility over the measurement (cost vs. fair value) and location of an information (recognized vs. disclosed) yields outcomes that are differentially informative and, if they are, what the likely source for these different outcomes is. Empirical results are largely in line with predictions and suggest that recognition and disclosure are not substitutes: Fair value earnings are more informative than cost model firms, even if cost model firms earnings are adjusted to 'as if' fair value earnings. To rule out the explanation of incomplete information processing, we attribute differences in informativeness to the lower reliability of disclosed fair values. Therefore, financial reporting flexibility over the location of an information seem to impact the actual reliability, thus, the information set of investors. Though descriptive, another important observation from this study is that an industry best-practice evolves over time within the European real estate industry. While most prior studies have argued that domestic accounting practices if permitted under IFRS remain, we document that this only holds true for the first years of IFRS adoption and industry-effects need to be considered.

Taken together, these findings suggest that financial reporting flexibility can have profound economic consequences within and across systems. Also, these findings lay out potentially fruitful avenues for future research: An effect on R&D investment due to higher flexibility towards different earnings management strategies will likely have output effects. Future research could address these output effects that due to the nature of investment in innovation activities will have a time lag of three to seven years. In order to increase the strength of these tests, this would necessitate to incorporate different measures of output, such as (citation-weighted) patents or new product innovations as has been done in the literature on the economics of innovation.

While financial reporting flexibility to portray a more detailed picture of a firm's R&D activity identifies more valuable innovation activities at the firm-level, it helps to document first evidence on differential valuation impacts of corporate control. Future research could refine the measurement of corporate governance mechanisms and investigate how results vary with different controlling shareholder and manager-types: For example, corporate control of a family and a family CEO in place will likely have a different impact on the value of a firm's R&D activity compared to corporate control of a hedge fund and a new manager put in place. Likewise, it would also be interesting to investigate whether different forms of corporate control trigger different forms of investment behavior. Also, our refinement of the composition of a firm's R&D activity in terms of research and development projects could likely contribute to the mounting literature on the application of a real options logic towards the valuation of R&D: The effect of different forms of uncertainty on the value of knowledge capital is likely moderated by the composition of the innovation activities in terms of exploration and exploitation.

Finally, financial reporting flexibility over the accounting method for investment property can also be studied as the flexibility over the location of presenting fair value information. Both forms of flexibility matter in terms of earnings informativeness and change the information set of investors. Since this is the only observable application of fair value accounting to long-lived tangible assets, future research could study different consequences. It is an open question of how fair value and cost model firms have adjusted contractual arrangements (such as, compensation and debt contracts) and whether they did so differently. Since the fair value model has evolved to be the industry-
standard within Europe, the real economic effects of such a new equilibrium remain unstudied.