Essays on IFRS 9 Hedge Accounting

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"What you get by achieving your goals is not as important as what you become by achieving your goals."

Henry David Thoreau

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List of Acronyms

AG	Aktiengesellschaft
ASC	Accounting Standard Codification
BACH	Bank for Accounts of Companies Harmonized
CFH	Cash flow hedge
CUD	Domestic currency unit
CUF	Foreign currency unit
CVA	Credit value adjustments
DAX	Deutscher Aktienindex
D/E	Debt-to-equity
DVA	Debit value adjustments
EC	European Commission
ECB	European Central Bank
eccbso	European Committee of Central Balance Sheet Data Offices
e.g.	exempli gratia (for example)
EPS	Earnings per share
ERICA	European Records of IFRS Consolidated Accounts
EU	European Union

EUR	Euro
FAF	Financial Analysts Federation
FASB	Financial Accounting Standards Board
FE	Fixed effects
FTSE	Financial Times Stock Exchange
f.v.	former version
FVH	Fair value hedge
FX	Foreign exchange
GAAP	Generally Accepted Accounting Principles
HA	Hedge accounting
HDAX	Hundert DAX
HNI	Hedge of a net investment in a foreign operation
IAS	International Accounting Standard
IASB	International Accounting Standards Board
I/B/E/S	Institutional Brokers Estimate System
i.e.	id est (that is)
IFRS	International Financial Reporting Standard
i.i.d.	independent and identically distributed
LME	London Metal Exchange
MDAX	Mid-cap-DAX
MTB	Market-to-book
no.	number
obs.	observations
OCI	Other comprehensive income

OLS	Ordinary least squares
PF	Portfolio
PL	Profit or loss
P&L	Profit and loss
ROE	Return on equity
SDAX	Small-cap-DAX
SDE	Stochastic differential equation
SFAS	Statement of Financial Accounting Standards
SIC	Standard Industrial Classification
S&P	Standard & Poor's
TCUD	Thousand CUD
TECDAX	Technology DAX
UK	United Kingdom
US	United States
VIF	Variance inflation factor

Chapter 1

Introduction

"I often say about IAS 39 (the standard on the recognition and measurement of financial instruments) that, if you understand it, you haven't read it properly — it's incomprehensible."

Sir David Tweedie[1]

Under the International Accounting Standard (IAS) 39 *Financial Instruments: Recognition and Measurement*, the accounting of financial instruments in general and hedge accounting in particular are known among standard setters, academic researchers, and practitioners to be extremely complex and rule-based. Back in 2001 already, the International Accounting Standards Board (IASB) intended to reform the accounting of financial instruments and to replace IAS 39 with the International Financial Reporting Standard (IFRS) 9 *Financial Instruments* (IASB, 2022). In 2008, the IASB responded to the desire of financial statement preparers, their auditors, and users to generate less complex and more principle-based requirements for financial instruments. They published a discussion paper entitled "Reducing Complexity in Reporting Financial Instruments" (IASB, 2008). The purpose of this discussion paper was to improve the financial instruments' measurement and hedge accounting requirements. In the following years, the IASB issued and

[1]Sir David Tweedie was the chairman of the IASB from 2001 to 2011. The statement is taken from a written interview in the Journal of Accountancy by Geoffrey Pickard: "Simplifying Global Accounting", 2007-07-01. Retrieved on 2022-05-25 from `https://www.journalofaccountancy.com/Issues/2007/Jul/SimplifyingGlobalAccountingSirDavidTweedieInterview.htm`.

added the distinct chapters of IFRS 9 and ultimately issued the standard in 2014 (IASB, 2022) with a mandatory effective date on 1 January 2018 (IFRS 9, para. 7.1.1). However, the IASB did not yet finalize the regulation for IFRS 9 hedge accounting, which is why currently, firms that use the voluntary rules on hedge accounting can still choose to apply either the hedge accounting model determined in IAS 39 or the one in IFRS 9 (IFRS 9, para. 7.2.21). This dissertation focuses on the hedge accounting requirements during the transition of IAS 39 towards IFRS 9.

Hedge accounting represents a special set of accounting rules that aims to reflect a firm's risk management activities in the financial statements (IFRS 9, para. 6.1.1). Firms can apply hedge accounting to designated hedging relationships consisting of a hedging instrument and a hedged item. The basic idea is that the hedging instrument, usually a derivative, and the hedged item are expected to develop offsetting changes in the respective fair values or cash flows (IAS 39, para. 9). Through hedge accounting, the offsetting changes in the fair values of the hedging instrument and the hedged item are simultaneously recognized in profit or loss (IAS 39, para. 85). According to the 'ordinary' accounting for financial instruments, known as the mixed model approach, firms have to record derivatives at fair value while they might record several hedged items at amortized cost. These accounting differences prevent the recognition of the offsetting effects and ultimately result in higher earnings volatility that is, in fact, economically not reasonable (Lüdenbach et al., 2022, §28a Rz 2). The rule-based approach in IAS 39 often compounds the application of the hedge accounting model. With IFRS 9, the IASB intends to provide relief. The major objective of the new hedge accounting model is to align hedge accounting more closely to risk management (IASB, 2014; McConnell, 2014).

Throughout my dissertation, I investigate differences in the hedge accounting techniques between IAS 39 and IFRS 9 (see Chapter 2), I investigate differences between firms applying IAS 39 or IFRS 9 hedge accounting (see Chapter 3), and I investigate differences in information asymmetry between IAS 39 and IFRS 9 applicants (see Chapter 4). I make use of different academic research methods. In Chapter 2, I choose a model-based approach to identify the effects of specific differences in certain aspects of the hedge accounting models. To do so, I employ the numerical computing software MATLAB. In

Chapters 3 and 4, I investigate empirical data. I compose a dataset that comprises data on firm characteristics and financial information retrieved via Datastream and data on hedge accounting hand-collected from annual IFRS reports. I use the statistical software R to conduct my empirical analyses. The different chapters of this dissertation consist of my three single-authored studies. In the following, I briefly outline the research questions, the applied methodologies, and the key findings of these studies, respectively.

Chapter 2 *"Hedge Accounting and its Consequences on Portfolio Earnings – A Simulation Study"* represents my peer-reviewed paper, published in the journal *Accounting in Europe*, 17 (2), pp. 204-237 in 2020.[2] In this paper, I analyze the effects of the different hedge accounting possibilities provided by IAS 39 and IFRS 9 on the portfolio earnings, i.e., profit or loss, of a cash flow hedge designated to reduce the exposure to foreign exchange rate risk. The objectives of this study are, first of all, to identify and quantify the effects of the different hedge accounting methods on portfolio earnings. Second, to examine the effects of varying macroeconomic factors on the hedging relationship and their influence on portfolio earnings. Third, to investigate for which firms the adoption of IFRS 9 hedge accounting is especially desirable or burdensome. For this purpose, I use a model-based approach that allows analyzing the described aspects on a transaction-based level by isolating a single hedging relationship from other business transactions.

The model consists of a non-financial firm that operates in the manufacturing sector and plans to buy raw material (a non-financial asset) from a foreign supplier for production purposes. In order to hedge the foreign currency risk arising from the cash flows associated with the purchase of the raw material denominated in foreign currency units, the firm enters a forward contract with a third party, a bank, and designates the hedging relationship as a cash flow hedge. The model set-up is a relatively simple presentation of a common hedging relationship. Various application guidelines and textbooks use such a hedging relationship for explanation and illustration issues, e.g., see Pricewaterhouse Coopers (2005), Pricewaterhouse Coopers (2017b), and Ramirez (2015). The value of novelty in this paper is first that I employ a Monte Carlo simulation approach that calculates the accounting entries related to the cash flow hedge based on random and uncertain processes.

[2]Including minor changes.

Second, I contrast the impact of choosing between the hedge accounting regimes of IAS 39 and IFRS 9 on portfolio earnings and how this choice might vary among macroeconomic factors. IAS 39 and IFRS 9 provide different hedge accounting possibilities for a cash flow hedge as described above. Due to specific and diverse accounting rules, portfolio earnings are affected differently. With the help of the developed model, I simulate the accounting entries and the respective portfolio earnings of these different possibilities. In a first step, I use a perfectly effective hedge. In a second step, I insert a source of ineffectiveness to the model. In a third step, I conduct a parameter analysis with varying macroeconomic input factors. Even though simulation approaches are less examined in the accounting literature (Labro, 2015), they grant interesting insights (Balakrishnan & Penno, 2014) and seem particularly important when analyzing equally acceptable accounting methods. The analyses show that, on the one hand, the hedge accounting possibilities determined by IFRS 9 lead to lower portfolio earnings and less volatility in portfolio earnings during the time period of the hedging relationship compared to the possibilities determined by IAS 39. Moreover, portfolio earnings react less sensitive to changes in foreign exchange rates. On the other hand, portfolio earnings react more sensitive to changes in the volatility of foreign exchange rates.[3]

In Chapter 3 *"Determinants of Hedge Accounting according to IAS 39 and IFRS 9 – Evidence from Germany"*, I conduct an empirical analysis to investigate the hedge accounting practices of German non-financial firms listed in DAX30, MDAX, SDAX, or TECDAX. The observation period covers three years, from 2017 to 2019. This time horizon focuses on the general transition of IAS 39 towards IFRS 9 in 2018. However, the transition period related to hedge accounting is ongoing and extraordinary. Even though the European Union (EU) already endorsed the standard, the length of the transition period for hedge accounting is not yet defined. Thus, firms are truly free to make their choice without any foreseeable time constraints. This unique setting reveals firm preferences

[3]In Chapter 2, the references of the IFRS refer to the 2019 blue books of the IFRS Standards. The cited paragraphs are equal to the paragraphs in the 2022 blue books. Since Chapter 2 embeds my already published paper, I remain with the original citations. All other IFRS references refer to the standards required in 2022, unless specified differently. For the sake of brevity, I refrain from distinguishing between the two versions of the standards in the text. The bibliography at the end of this dissertation considers this aspect.

concerning firms' hedge accounting practices. I distinguish hedge accounting practices according to the type and extent of risk exposures (commodity price risk, interest rate risk, foreign exchange rate risk) a firm aims to mitigate using financial instruments and the type and extent of the hedging relationships (fair value hedge, cash flow hedge, hedge of a net investment in a foreign operation) a firm designates. The two main research questions in this paper are (i) Which non-financial firms opt for the new IFRS 9 hedge accounting rules? and (ii) Do IFRS 9 hedge accounting applicants differ from IAS 39 hedge accounting applicants? The first research question refers to the period prior to the introduction of IFRS 9 in 2018 (pre-period). The second one refers to the period after IFRS 9 was introduced (post-period).

To address these research questions, I compile a dataset with hedge accounting-related data hand-collected from annual IFRS reports and firm characteristics and financial information retrieved via Datastream. The data on hedge accounting includes information about the applied hedge accounting regime (IAS 39 or IFRS 9) as well as about the different hedge accounting practices in use. I employ non-parametric tests to analyze univariate differences between firms that opt for IFRS 9 hedge accounting and firms that stay with IAS 39. Moreover, I use different sets of logistic regression models for adopting and applying IFRS 9 hedge accounting. I conduct all analyzes separately for the pre- and post-period. Through the manual data collection, I observe that none of the sample firms early adopt IFRS 9 hedge accounting in 2017 - the majority of 75% start applying the new rules in 2018. The adoption rate is highest for DAX30 constituents. My statistical analyses show that firms with a relatively high extent of commodity risk exposures and designated fair value hedges while applying IAS 39 in the pre-period opt for IFRS 9 hedge accounting from 2018 onwards with high probability. In the post-period, IFRS 9 hedge accounting applicants are characterized by a relatively high extent of commodity and interest rate risk exposures and designated fair value hedges. Firms with a relatively high extent of foreign exchange rate risk exposure rather stay with the hedge accounting regime of IAS 39.

Chapter 4 *"IAS 39 vs IFRS 9 Hedge Accounting – Evidence on Analysts' Earnings Forecast Quality from Germany"* presents another empirical study. The work focuses on

information asymmetries between firm managers and external stakeholders. As proxies for information asymmetry, I use sell-side analysts' earnings forecast quality measured through forecast dispersion among analysts and forecast error. The objective of this study is to analyze whether the IASB succeeds in aligning hedge accounting more closely to risk management strategies through IFRS 9. The observation period covers five years, from 2015 to 2019. Three years (2015-2017) refer to the period prior to the general transition of IAS 39 to IFRS 9 and two years (2018-2019) refer to the period thereafter. I use a German sample of non-financial firms that are listed in DAX30, MDAX, SDAX, or TECDAX and apply hedge accounting during the observation period. I compile a dataset with hedge accounting-related data hand-collected from annual IFRS reports and firm characteristics and financial information retrieved via Datastream. The ongoing and extraordinary transition period of IFRS 9 hedge accounting leads to a co-existence of two hedge accounting regimes in the market, IAS 39 and IFRS 9. Accompanied by the transition period is also the mandatory application of IFRS 7 disclosure amendments on hedge accounting from 2018 onwards.

I employ cross-sectional ordinary least squares (OLS) regressions to investigate whether and how the voluntary application of IFRS 9 hedge accounting and the mandatory IFRS 7 disclosure amendments affect analysts' earnings forecast quality. Moreover, I use a difference-in-differences research design to examine the exclusive effect of IFRS 9 hedge accounting on analysts' earnings forecasts. I find that the differences in forecast quality between IAS 39 and IFRS 9 hedge accounting applicants are statistically insignificant and economically small. The results of my study suggest that analysts do not improve or impair their forecasting quality, indicating that the informational effect of both hedge accounting regimes seems to be similar. Several robustness tests, controlling for a possible self-selection bias, and using bid-ask spreads as an alternative proxy for information asymmetry confirm my findings.

Finally, Chapter 5 concludes this dissertation. It summarizes the main findings of my work on hedge accounting and provides a result discussion. Final remarks refer to policy implications, and an outlook for future research is given.

Chapter 2

Hedge Accounting and its Consequences on Portfolio Earnings - A Simulation Study[4]

Abstract

In this paper, I analyze the consequences of cash flow hedge accounting on portfolio earnings of firms focusing on main changes between IFRS 9 and IAS 39. For this purpose, I develop a simulation study which illustrates the quantitative effects on the accounting entries according to the currently applicable hedge accounting methods. It is especially addressed what accounting differences arise and how these distinctions may affect a firm's earnings. Furthermore, I examine to which firms early switching becomes especially desirable or burdensome. This information is particularly useful to managers and investors. The paper shows that portfolio earnings are affected differently. In the model, IAS 39 may lead to higher or lower earnings for increasing deviations between foreign and domestic interest rates. Additionally, sensitivity to volatility changes varies among the methods. Moreover, a partly ineffective hedging relationship does not necessarily decrease earnings compared to its fully effective counterpart.

Keywords: IFRS 9, IAS 39, hedge accounting, derivatives, risk management

[4]This chapter represents my published peer-reviewed paper, see Müller (2020), including a few minor changes.

2.1 Introduction

Economic entities face financial risks coming from their business activities. Depending on the type of economic entity and its specific business activities, financial risks might arise amongst others from future changes in interest rates, exchange rates, equity prices or commodity prices. In order to reduce or eliminate their exposures to financial risks, entities often make use of financial instruments within their risk management strategies. The use of financial derivatives has increased tremendously over the last decades (Hull, 2018). In 2018, the European Securities and Markets Authority documented an increasing trend even noticeable during a single year: In 2017, the European derivatives markets have grown from initially EUR 605tn notional amount to EUR 660tn at year-end (European Securities and Markets Authority, 2018). This reflects a growth of more than 9%. An increasing trend is also observable in the use of financial instruments in corporate risk management (Panaretou et al., 2013) and as such, also in corporates' financial reporting. Thus, the importance of derivatives is no longer limited to finance, but has essentially grown also in the field of accounting.

The International Accounting Standard (IAS) 39[5] introduced standardized reporting of financial derivatives. Ever since, entities record derivative instruments as assets or liabilities at their fair values and recognize changes in their values through the income statement. This results in higher earnings volatility compared to the former approach of historical cost accounting. However, when fulfilling specific requirements, IAS 39 allows for hedge accounting. From an investor perspective, hedge accounting aims to give a better understanding about how a company manages its risk. From an accounting perspective, it represents a special form of rules: Hedging instrument and hedged item develop offsetting changes and build together a hedging relationship. This set of rules permits to record changes in the fair values of the hedging instrument and the hedged item simultaneously in the income statement and thus lowers earnings volatility. According to 'normal' accounting rules, simultaneous reporting of revenues and expenses is often not possible. Nevertheless, also when applying hedge accounting, profit or loss might be affected. IAS

[5]IAS 39 was issued in 1999 and endorsed by the European Union (EU) in November 2004. The EU effective date was 1 January 2005.

39 has always been strongly criticized due to high complexity and heavily restricted rules (IFRS 9, para. BCE.177). The new standard for the accounting of financial instruments, International Financial Reporting Standard (IFRS) 9, attends to address this criticism. IFRS 9 is mandatory for firm years beginning on or after 1 January 2018 (IFRS 9, para. 7.1.1). The application of hedge accounting is optional according to IAS 39 as well as to IFRS 9 (IFRS 9, para. 6.1.2).

Prior studies mainly focus on firms' underlying motivation (hedging vs. speculation) to use financial derivatives, e.g. Guay (1999), Bodnar et al. (1995), Chernenko & Faulkender (2011), or on differences in firm risk following the implementation of derivative programs in general, e.g. Zhang (2009), Lins et al. (2011), rather than on the quantitative effect of hedge accounting itself. This is largely due to endogeneity concerns of risk and derivative use and the difficulties arising from that in empirical research (Campbell et al., 2019). To my knowledge, no study to date contrasts the impact of choosing between specific hedge accounting regimes on non-financial firms' portfolio profit or loss and how this choice might vary among different macroeconomic factors, e.g. interest rates and spot exchange rate volatilities. Throughout this work, I define portfolio profit or loss as the positive or negative earnings resulting from the hedging relationship. Comparing the hedge accounting regulations of IAS 39 and IFRS 9 is currently of high interest because of an ongoing transition period: Companies are allowed (on a company basis) to choose between IAS 39 and IFRS 9 hedge accounting regulations. Thus, companies apply both standards simultaneously. This treatment is exceptional and only valid until the International Accounting Standards Board (IASB) finalizes the regulation of macro hedging (IFRS 9, para. BC6.104).

The objectives of this paper are (i) to evaluate the consequences on portfolio earnings based on the application of different hedge accounting regulations under IAS 39 and IFRS 9, (ii) to examine the consequences on portfolio earnings based on different macroeconomic factors which influence the hedging relationship, and (iii) to analyze firms' desirability or burden of early switching from IAS 39 to IFRS 9. For this purpose, I develop a simulation study of a model non-financial company which is exposed to exchange rate risk and applies hedge accounting to mitigate this risk exposure. I investigate the possibly

applicable sets of hedge accounting methods. Four of them refer to IAS 39, two of them to IFRS 9. The simulation approach intends to extract the effects on earnings of different hedge accounting regimes in order to get insights on possibly hidden aspects in empirical research. The results of this study help on the one hand accountants, standard setters, and regulators, and on the other hand managers and investors. The resulting quantifications give them a guideline about the impact of the currently applicable accounting methods in terms of hedging relationships on firms' income statements. Moreover, they get an understanding about how differences between these methods arise. For a cash flow hedge of foreign currency risk, the analysis shows that diverse accounting methods affect portfolio profit or loss differently. With IAS 39, higher portfolio earnings may be generated as long as the foreign interest rate exceeds the domestic interest rate. However, the opposite is true for the inverse interest rate relation. In addition, this simulation study shows that, depending on the relation between domestic to foreign interest rate, adding a source of ineffectiveness to the hedging relationship may lead to higher portfolio earnings of specific hedge accounting methods, while leading to lower portfolio earnings of other hedge accounting methods, compared to their respective fully effective hedging relationship counterparts. Moreover, the paper illustrates different sensitivities to exchange rate volatility changes of the various accounting methods.

This paper contributes to the research in the field of accounting for derivatives in several ways. First, the paper combines financial derivative valuation with financial accounting. Generally, simulation methods are less examined in the accounting literature (Labro, 2015). Nevertheless, they grant access to interesting insights also in accounting (Balakrishnan & Penno, 2014). The developed Monte Carlo simulation approach enables to calculate accounting figures based on random and uncertain processes of the underlying of financial derivatives. Dependent on the input parameters of the simulation, the impact of a broad variety of financial instruments can be analyzed. Moreover, the simulation allows to show how dynamic variation of different input parameters affects the decision of applying specific hedge accounting methods. In that sense, the analyses give insights on desirability or burden of firms to switch from IAS 39 to IFRS 9. Second, the analyses add to the literature that investigates the impact of firms' financial derivatives on risk

management. While Guay & Kothari (2003) find as a main result in their study that only a small extent of firm risk is hedged through derivatives, they also underline that mainly decentralized processes, like e.g. transactions, drive the use of derivative instruments for hedging purposes of non-financial firms. That is, the use and impact of financial instruments might be of high importance on a subsidiary level, but not on a consolidated level. The presented simulation approach allows to analyze the effects of specific hedging relationships as well as of specific hedge accounting methods on a transaction-based level. Third, this study contributes to the literature of derivative accounting changes. The approach gives insights on the portfolio earnings consequences due to differences in the accounting treatment of hedging relationships under IAS 39 and IFRS 9. To underline the contribution of this work, I develop predictions derived from previous research as well as from the specific hedge accounting regulation which are subsequently analyzed and discussed.

The remainder of the paper is organized as follows. Section 2.2 gives an overview of the institutional background and related academic research. In Section 2.3, I describe the model set-up and the applied method to evaluate the hedging relationship. In Section 2.4, I present and discuss numerical results of hedging relationships. Finally, Section 2.5 concludes.

2.2 Background

This section gives an institutional background on the accounting reform of financial instruments, especially on hedge accounting. Moreover, I present existing literature related to hedge accounting. At the end of each subsection, I formulate predictions which I analyze with the help of the developed simulation model.

2.2.1 Financial Instruments - Hedge Accounting Reform

Historically, IFRS regulations on hedge accounting can be dated back to 1999 when the International Accounting Standards Committee first issued IAS 39. After the EU endorse-

ment in November 2004, *IAS 39 Financial Instruments: Recognition and Measurement* became effective and mandatorily applicable for EU entities reporting under IFRS for firm years beginning on or after 1 January 2005. Besides, first *IAS 32 Financial Instruments: Disclosure and Presentation* and since 2007 also *IFRS 7 Financial Instruments: Disclosures* completed the regulations on financial instruments. These regulations standardized the accounting of derivatives and other financial instruments, henceforth (Beisland & Frestad, 2013) and enhanced reporting transparency and derivative usage in risk management (Panaretou et al., 2013). Prior to IAS 39, firms applied the historical cost approach. Due to this approach, a firm's income statement did often not reflect financial instruments and potential losses were hidden until maturity (Gigler et al., 2007). Nevertheless, opponents have always criticized IAS 39, mainly because of its high complexity and heavily restricted rules (IFRS 9, para. BCE.177).

In order to simplify the accounting for financial instruments, the IASB replaced IAS 39 with *IFRS 9 Financial Instruments* after several years of development and improvement. In July 2014, the IASB issued the finalized version. IFRS 9 contains three parts: 1) classification and measurement, 2) impairment, and 3) hedge accounting, consisting of general, so-called micro hedge accounting, as well as of macro hedge accounting. Generally, IFRS 9 applies for firm years beginning on or after 1 January 2018 (IFRS 9, para. 7.1.1). However, according to IFRS 9, para. 7.2.21, at initial application of IFRS 9, companies may select to still apply the hedge accounting policy of IAS 39 or to apply the new requirements of Chapter 6 *Hedge accounting* of IFRS 9, henceforth. In case a company decides to continue the hedge accounting requirements of IAS 39 at initial IFRS 9 application, the company can modify its accounting policy and start applying the new hedge accounting requirements of IFRS 9 at the beginning of any reporting period. This option is valid until the IASB finalizes the macro hedging project of IFRS 9 (IFRS 9, para. BC6.104). In order to qualify for hedge accounting, hedging instruments, hedged items, and hedging relationships themselves have to meet different criteria as reported by IAS 39, para. 72-88 and IFRS 9, para. 6.2-6.4. Amongst others, these criteria are[6]: A formal designation and documentation of the company's risk management objective

[6]The choice and summary of qualifying criteria is aligned to the selection given by Pricewaterhouse Coopers (2016).

and strategy, of the hedging instrument, the hedged item, the nature of the risk being hedged, and of the hedge effectiveness.[7] Companies have to assess effectiveness testing prospectively and retrospectively according to IAS 39. IFRS 9 requires only prospective testing. While IAS 39 focuses mainly on quantitative measures (IAS 39, para. 88), IFRS 9 gives priority to the economic relationship between hedging instrument and hedged item (IFRS 9, para. 6.4.1(c)). Hedge accounting regulations under IFRS 9 adhere to the hedge accounting models existing under IAS 39. The standards differentiate between fair value hedges, cash flow hedges, and hedges of a net investment in a foreign operation. IAS 39, para. 89 and IFRS 9, para. 6.5.8 define the accounting of fair value hedges. The idea of fair value hedge accounting is to recognize value changes of the hedging instrument immediately in profit or loss and also any gain or loss on the hedged item attributable to the hedged risk. So, 'income recognition of the value changes of the hedged item [is shifted] forward in time' (Glaum & Klöcker, 2011, p. 463). IAS 39, para. 95-99 and IFRS 9, para. 6.5.11 prescribe regulations on cash flow hedges. Cash flow hedge accounting recognizes changes in the fair value of the hedging instrument in equity to the extent of which the hedge is effective. Changes of the hedging instrument are reclassified to profit or loss only at the time when the hedged item affects profit or loss. Thus, 'the recognition of value changes of the hedging instrument in profit or loss is deferred to a later point in time' (Glaum & Klöcker, 2011, p. 463). IAS 39, para. 102 and IFRS 9, para. 6.5.13-14 contain rules concerning hedges of a net investment in a foreign operation.[8] One of the main changes between IAS 39 and IFRS 9 affects the accounting of the non- designated part of the hedging instrument in a hedging relationship. Assuming the designated hedging instrument is defined as only a part of the financial derivative, the non-designated part is accounted for differently according to IAS 39 with respect to IFRS 9. Explicitly speaking, if a company uses, e.g. a forward contract to hedge an underlying risk, the company is allowed to designate as hedging instrument either the entire forward contract or only the spot element of the financial instrument depending on what is defined in its

[7] Hedge effectiveness requirements differ between IAS 39 and IFRS 9. Detailed regulation is given in IAS 39, para. AG105-AG113A and in IFRS 9, para. B6.4.1-B6.4.3.

[8] Hedges of a net investment in a foreign operation are relatively rare compared to fair value and cash flow hedges. A detailed description of this model is irrelevant for the understanding of the paper.

individual risk management strategy.[9] The concrete hedge accounting possibilities would be the following:

Hedge accounting possibilities according to IAS 39

(I) Designation of the entire forward contract as hedging instrument. Changes in the fair value of the forward are recognized in other comprehensive income, and are reclassified to profit or loss as a reclassification adjustment in the period(s) in which the raw material acquired affects profit or loss (IAS 39, para. 98(a)).

(II) Designation of the entire forward contract as hedging instrument. Changes in the fair value of the forward are recognized in other comprehensive income, and are included in the initial cost of raw material (IAS 39, para. 98(b)).[10]

(III) Designation of the spot element of the forward contract as hedging instrument. Changes in the fair value of the spot element are recognized in other comprehensive income, and are reclassified to profit or loss as a reclassification adjustment in the period(s) in which the raw material acquired affects profit or loss (IAS 39, para. 98(a)). The forward element is accounted for in profit or loss (IAS 39, para. 95-96).

(IV) Designation of the spot element of the forward contract as hedging instrument. Changes in the fair value of the spot element are recognized in other comprehensive income, and are included in the initial cost of raw material (IAS 39, para. 98(b)). The forward element is accounted for in profit or loss (IAS 39, para. 95-96).

Hedge accounting possibilities according to IFRS 9

(V) Designation of the entire forward contract as hedging instrument. Changes in the fair value of the forward are recognized in other comprehensive income as cash flow hedge reserve (IFRS 9, para. 6.5.11(a)) and are included in the initial cost of the raw material (IFRS 9, para. 6.5.11(d)(i)).

[9] The specification of a financial derivative (partly or entirely) as hedging instrument is called a *designation*. In case the derivative is only partly designated as hedging instrument, the part which is excluded from the hedging relationship is the so-called *non-designated* part.

[10] The inclusion of the cash flow hedge reserve in the initial cost of raw material is referred to as 'basis adjustment' in Tables 2.5 to 2.16. This term is not used in the wording of the issued standards, but in the bases for conclusions, e.g. IAS 39, para. BC155.

(VI) Designation of the spot element of the forward contract as hedging instrument. Changes in the fair value of the spot element are recognized in other comprehensive income as cash flow hedge reserve (IFRS 9, para. 6.5.11(a)) and are included in the initial cost of the raw material (IFRS 9, para. 6.5.11(d)(i)). The forward element is accounted for in a separate component of equity in other comprehensive income (IFRS 9, para. 6.5.15-16).

Please note that hedge accounting possibilities (II) and (V) are equal in terms of their accounting regulations. Referring to distinctions between IAS 39 and IFRS 9, methods (IV) and (VI) differ the most. As described above for a forward contract and its non-designated forward element, the same is true for a separated time value of an option contract when only the intrinsic value of the option is designated as hedging instrument, as well as for a separated foreign currency basis spread of a financial instrument (IAS 39, para. 74, 95-96, IFRS 9, para. 6.5.15-16). The different accounting rules (I) to (VI) lead to temporal diverse recognition of the non-designated part in a company's income statement. Thus, hedging relationships affect earnings differently. Section 4 illustrates these accounting differences and discusses main results.

Based on the specific accounting possibilities (I) to (VI) presented above, several predictions (P) may be developed. Since hedge accounting methods (III) and (IV) prescribe the non-designated forward element to be accounted for in profit or loss, I pose the first prediction as follows:

P1: IAS 39 (III) and (IV) lead to more volatile portfolio earnings during the time-period of the hedging relationship than does IFRS 9 (VI).

Due to the fact that IFRS 9 (VI) intends to recognize the non-designated forward element in other comprehensive income and to include it in the initial cost of inventory (IFRS 9, para. 6.5.15-16), portfolio earnings should be lower compared to IAS 39 (IV). This may suggest the following prediction:

P2: IFRS 9 (VI) portfolio earnings are more sensitive to changes in macroeconomic factors than are IAS 39 (IV) portfolio earnings.

Moreover, in case the hedge occurs to be at least in parts ineffective, I predict the following:

P3: The ineffectiveness impacts all hedge accounting methods in the same manner.

2.2.2 Related Literature

In accounting, academic literature concerning financial derivatives and their consequences on a firm's cost of capital, earnings management, and firm value has been extensively researched compared to the field of hedge accounting. Generally, studies on the association of a firm's derivative use and its firm risk find mixed results. While some studies find evidence that derivative use increases firm risk (see e.g., Bodnar et al., 1995), others identify negative correlation (see e.g., Guay, 1999).

According to the literature review of Campbell et al. (2019), previous studies concerning derivative accounting changes show theoretical as well as empirical research streams, both with partially contradictory results. While theoretical literature focuses mainly on fair value and hedge accounting treatment, empirical studies principally aim attention at the effects resulting from adopting derivative accounting programs.

DeMarzo & Duffie (1995) and Melumad et al. (1999) argue in their theoretical studies that the accounting for derivatives influences hedging strategies and possibly leads to suboptimal hedging. In their experimental study, Chen et al. (2013) show that under fair value accounting, managers make suboptimal hedging decisions. Gigler et al. (2007) analyze mark-to-market accounting in the case of cash flow hedges. Their model allows them to identify circumstances under which the said accounting method provides an early warning to outsiders of a firm's potential financial distress. Beisland & Frestad (2013) examine mark-to-market accounting with respect to earnings smoothness. In another model-based theoretical analysis, Frestad (2018) shows that for the aim of predictable earnings, non-financial firms optimize their hedging strategy as well as the choice of fair value or hedge accounting, simultaneously. Pirchegger (2006) and Nan (2011) use an approach through specific agency models. Nan (2011) finds that immediately recognized gains and losses from ineffective hedges according to SFAS 133 regulation motivates speculation purposes. Pirchegger (2006) identifies a model in which the principal prefers hedging over no hedging and hedge accounting in case of enormous risk exposure differences over periods.

In terms of empirical research, Guay (1999) and Allayannis & Weston (2001) were among the first to use a dummy variable to determine whether firms make use of derivatives or not. Guay (1999) finds a negative relation between derivative use and firm risk. Allayannis & Weston (2001) verify a positive association of firm value and derivative use. In his examination on real effects of SFAS 133 in terms of risk management activities, Zhang (2009) uses a similar approach. His analysis is based on an exogenous shock in terms of the initiation of the derivative program due to SFAS 133 effective date.[11] The author finds that firms behave more carefully in their risk management after SFAS 133 adoption. Also, Singh (2004) uses an indicator variable in terms of SFAS 133. He finds no significant differences neither in the use of financial instruments on a firm-level nor in earnings or cash flow volatilities. Panaretou et al. (2013) analyze the effect of IFRS hedge accounting in a European setting. They find that earnings are more predictable under IFRS hedge accounting regulation. Lins et al. (2011) and Glaum & Klöcker (2011) use international survey evidence. Lins et al. (2011) find a substantial effect of fair value reporting on risk management for almost half of the survey respondents. Glaum & Klöcker (2011) survey German and Swiss non-financials that all apply hedge accounting. Their results indicate that accounting methods influence or even determine hedging strategies.

Besides the theoretical and empirical studies listed above, Guay & Kothari (2003) provide an empirical study with an integrated 'simulation' component. The authors analyze a sample of 234 large non-financial corporations, randomly selected, which all make use of financial derivatives. They examine the magnitude of risk exposure a non-financial firm can hedge at most through financial instruments. To better identify the extent of possible hedged firm risk, Guay & Kothari (2003) provoke an extreme 'shock' to each firm's derivative portfolio. They force a simultaneous change in the risk bearing assets by three standard deviations each. In order to identify the magnitude of risk exposure being hedged by derivatives, the authors examine sensitivities of cash flows and market values of all derivative portfolios, respectively. The authors find only little changes in cash flow and market value sensitivities. They question the economic importance of the usage of financial instruments by firms in terms of hedging purposes. However, they also point out

[11] The lack of an exogenous shock is one of the critiques of the approach in Guay (1999) commented by other researchers (Campbell et al., 2019).

that hedging decisions might be highly economically relevant on division levels but are potentially too small to be identified on a company level.

Gebhardt et al. (2004) analyze different accounting regulations for financial derivatives in the banking industry and their consequences on banks' financial statements. They give insights on the accuracy of these diverse accounting treatments in terms of the underlying economic activities. In a current paper, Pierce (2020) examines the magnitude of the decrease in earnings volatility due to hedge accounting application in an empirical setting. His work is based on disclosure analysis of non-financial firms. The results suggest that hedge accounting decreases earnings volatility.

Concerning papers relating to IFRS 9, so far, the majority are descriptive, e.g. Singh (2017), Önüt & Hachmeister (2017). They particularly highlight the adjustments according to the new regulation. However, researchers analyze differences between IAS 39 and IFRS 9 mainly institutionally. By contrast, Rohatschek & Hochreiter (2013) present an accounting example on the time value of an option for a time-period related hedged item according to the IFRS 9 review draft on hedge accounting published in September 2012. In his book, Ramirez (2015) provides case studies on 'real-life' hedging relationships and IFRS 9 hedge accounting methods.

Due to the fact that quantitative effects of a specific hedging relationship are measurable within the developed simulation model and based on the findings of Guay & Kothari (2003), I suggest the following predictions in terms of hedge accounting in relation with earnings:

P4: The impact of hedge accounting on earnings on a company level is relatively low.

P5: The impact of hedge accounting on portfolio earnings is economically relevant.

My study combines the comparison of hedge accounting regulations of IAS 39 and IFRS 9 with transaction-based analyses to better identify and quantify the effects of different hedge accounting methods. Furthermore, the study adds analyses of changing macroeconomic factors to improve the overall understanding of hedge accounting on a transaction-based level.

2.3 Methodology and Research Design

To show the different consequences on portfolio earnings among the various hedge accounting possibilities over time, I make use of a Monte Carlo approach to generate the relevant values of the hedging instrument and the hedged item for each accounting method. For this purpose, I develop a model consisting of a company which enters a financial contract with a bank in order to hedge the financial risk the company is exposed to through its business activities with a supplier. Portfolio earnings are the model company's profit or loss generated from the transactions caused by entering the business relationship with the supplier and by entering the forward contract with the bank.

2.3.1 Model Set-up

The model company contains crucial characteristics of an average listed non-financial firm in the manufacturing sector which operates internationally. I define an average listed non-financial firm based on the specifications given in the monthly report 07.2019 of *Deutsche Bundesbank*. According to the report, the average non-financial manufacturing company is listed in the Prime Standard of Frankfurt Stock Exchange and has to publish consolidated financial statements under IFRS quarterly or semiannually. Moreover, the capital structure of the company consists of approximately 30% equity and 70% debt.[12] Please note that the conducted simulation study is not restricted to a company listed in the Prime Standard but can be adopted to companies in any other country where IFRS accounting regulation is applied. Country and sector specific characteristics of capital structures can be retrieved amongst others from the website of European Central Bank (ECB), or from databases of the European Committee of Central Balance Sheet Data Offices (eccbso), the Bank for Accounts of Companies Harmonized (BACH) database or the European Records of IFRS Consolidated Accounts (ERICA) database.[13]

I assume the model company to be exposed to a wide range of risks on the basis of its

[12] The exact values can be found in `https://www.bundesbank.de/resource/blob/650832/f281569dddce240532e394fc17a05d52/mL/ix10-data.pdf`, retrieved on 2019-05-03.

[13] E.g., country and sector specific characteristics of EU countries can be found in `https://www.ecb.europa.eu/pub/pdf/scpsps/ecb.sps.21.en.pdf`, retrieved on 2020-05-13 or `https://www.eccbso.org/wba/pubblica/database.asp`, retrieved on 2020-05-13.

business activities. Apart from strategic and operating risks, it is mainly exposed to financial risks, explicitly speaking to foreign exchange rate risk. This is due to the fact that its cash flows are often generated in foreign currencies. In order to reduce the exposure to foreign exchange rate risk, the company makes use of financial instruments and designates them as hedging instruments. Consistent with its risk management strategy, the company defines such derivatives as part of cash flow hedge relationships, specifically meaning that cash flows are hedged. Hence, the model company applies the optional regulations of hedge accounting which allows to recognize revenues and expenses of the hedged item and the hedging instrument, simultaneously in the income statement.

In the model, I assume the company to purchase 10,000,000 units of a non-financial asset, e.g. raw material, from a supplier for its production processes. Both companies enter a business relationship in terms of the non-financial asset. Purchase and delivery are determined as a highly probable forecast transaction. The defined unit cost of raw material is of foreign currency unit (CUF) 1. The raw material is planned to be delivered in 1 year from now and payment is planned to be settled in 1.5 years from now. Due to its exposure to foreign currency exchange rate risk [CUD/CUF], with CUD being the domestic currency unit, the company aims to hedge the highly probable forecast transaction of CUF 10,000,000. The hedged item is determined to be a transaction related hedged item.[14] To hedge the two-sided risk described above, the model company enters a forward contract with a third party, a bank. Designating a forward contract as a hedging instrument is plausible in this model due to IFRS 9, para. B6.5.5.[15] Moreover, many industrial companies with business activities outside their home countries make use of forward contracts to hedge against the risk arising from foreign currency transactions.

Table 2.1 summarizes the characteristics of the hedged item and the corresponding hedging instrument. They show identical critical terms. Nominal amount, maturity, and underlying match perfectly. Hence, the characteristics imply a qualitative economic relationship between hedged item and hedging instrument (IFRS 9, para. B6.4.4+14). Correspondingly, the hedge ratio is 100%. Moreover, it is assumed that hedged item and hedging

[14] IFRS 9 explicitly distinguishes the accounting of the non-designated part of a hedging instrument for a hedged item being transaction or time-period related (IFRS 9, para. 6.5.15).

[15] Similar hedging relationships are also used in Pricewaterhouse Coopers (2005) and Pricewaterhouse Coopers (2017b) as well as in Ramirez (2015).

Table 2.1: Model parameters for the simulation of accounting entries and resulting portfolio earnings

Hedged item			
Nature of risk being hedged	Highly probable forecast transaction		
Hedged amount [CUF]	N_{hedge}	=	10,000,000
Inception date[a]	$t_{inception}$	=	0
Delivery date [reporting periods][b]	$t_{delivery}$	=	4
Cash payment date [reporting periods][c]	$t_{payment}$	=	6
Hedging instrument			
Derivative	Currency forward contract[d]		
Notional amount [CUF]	N_0	=	10,000,000
Current spot exchange rate [CUD/CUF]	S_0	=	1.35
Start date[e]	t_0	=	0
Maturity date [reporting periods][f]	T	=	6
Simulation parameters[g]			
Domestic interest rate (per reporting period)	r_d	=	0.050
Foreign interest rate (per reporting period)	r_f	=	0.055
Volatility of spot exchange rates	σ	=	0.100

[a] $t_{inception}$ is the date on which the model company decides to hedge the foreign currency risk.
[b] $t_{delivery}$ is the date on which delivery of raw material is scheduled.
[c] $t_{payment}$ is the time in reporting periods in which the model company expects to pay the invoice.
[d] Forward contract to buy CUF 10,000,000
[e] t_0 is the starting date of the forward contract.
[f] T is the time to maturity in reporting periods of the forward contract.
[g] The ratio of initial domestic to foreign interest rates is chosen according to realistic ranges of Euro Area interest rates and United States interest rates in past years as stated by European Central Bank and United States Federal Reserve, respectively. This information is taken from `https://tradingeconomics.com`. Initial volatility of spot exchange rates is chosen arbitrarily. I investigate the influence of varying simulation parameters in the parameter analysis in Section 2.4.3.

instrument qualify for hedge accounting, as well as that value changes resulting from the economic relationship are not dominated by the effect of credit risk. That is, neither of the two transactions, neither the transaction between model company and supplier nor the transaction between model company and bank, are assumed to default. Simulated fair values are credit risk-free. Thus, credit value adjustments are negligible in the base case model. Please note that in Table 2.1, time is referred to in reporting periods. Assuming quarterly reporting, 1 year is divided in 4 reporting periods.

As mentioned above, the model company reports under IFRS. Moreover, it has already made use of hedge accounting in past years. Therefore, the current standard for finan-

cial instruments, IFRS 9, leaves the decision with the company whether to apply hedge accounting regulations of IFRS 9 or IAS 39 (IFRS 9, para. 7.2.21). The concrete hedge accounting possibilities applicable for the specific hedging relationship the model company entered are methods (I) to (VI) as described in detail in Section 2.2.1.
The idea behind the simulation approach presented in this paper is to analyze the effects of different hedge accounting methods on the company's portfolio earnings separately from other economic influences which occur independently of the firm's risk management. Therefore, I calculate accounting outcomes according to the different hedge accounting possibilities described above. Due to the more or less continuously changing underlying (here: foreign currency exchange rates [CUD/CUF]),[16] I approximate continuous accounting outcomes. The approximation serves to identify changes of the hedging relationship which are 'invisible' due to the fact that intra reporting period changes are not recorded, instead of valuing only the outcomes which are observable at the end of each reporting period.

2.3.2 Applied Method

In finance, derivative pricing is usually conducted based on a sequence of random variables over continuous time, which is called a stochastic process (Hirsa & Neftci, 2014). Asset prices follow stochastic processes as they change continuously and uncertainly in value (Hull, 2018). Brownian motion is a basic continuous stochastic process which represents an important tool to model asset prices in continuous time (Hirsa & Neftci, 2014). A stochastic process $W_{S,t}$ is a (standard) Brownian motion with $W_{S,t} \in [0, T]$, if the following properties hold (Hirsa & Neftci, 2014):

- $W(0) = 0$
- $W(t)$ is continuous in time t
- $W(t)$ is normally distributed with zero mean and variance t and has stationary increments

[16] In real world, trading hours restrict continuity of time. However, academia identifies continuous-time processes as very useful (Hull, 2018).

- If $0 \leq s \leq t \leq T$, the increment $W(t) - W(s)$ does not depend on $W(s)$. In addition, $W(t) - W(s)$ is normally distributed with $(W(t) - W(s)) \sim N(0,\ |t - s|)$.

For more detailed information concerning Brownian motions, please see Hirsa & Neftci (2014).

The model of *geometric Brownian motion* describes the behavior of asset prices which can be characterized by the stochastic differential equation (SDE)

$$dS_t = \mu S_t dt + \sigma S_t dW_{S,t} \quad , \tag{2.1}$$

where S_t is the asset price at time t and $W_{S,t}$ is a Brownian motion with $W_{S,t} \sim N(0,\ 1)$. The process of the asset price has a constant drift μ and a constant volatility σ (Hull, 2018). Like for ordinary differential equations, also the approximation or numerical solution of SDEs gains accuracy through higher order terms in Taylor series expansion.[17] However, Taylor series expansion needs to be combined with the calculation rules of Itô's lemma when applying it to stochastic frameworks.[18] According to Itô's lemma, it is possible to calculate "the stochastic process followed by a function of a variable from the stochastic process followed by the variable itself" (Hull, 2018, p. 313). Based on a function f of S and t and Eq. (2.1), Taylor series expansion combined with Itô's lemma leads to

$$df(S,t) = \left(\frac{\partial f(S,t)}{\partial S} \mu S + \frac{\partial f(S,t)}{\partial t} + \frac{1}{2} \frac{\partial^2 f(S,t)}{\partial S^2} \sigma^2 S^2 \right) dt + \frac{\partial f(S,t)}{\partial S} \sigma S \ dW(S,t) \quad . \tag{2.2}$$

Eq. (2.2) is aligned to Hull (2018, p. 311). Detailed information concerning numerical solutions of SDEs can be found in e.g. Kloeden & Platen (1992) or Hirsa & Neftci (2014). For simulation purposes, it is either possible to directly simulate S_t or to simulate $\ln(S_t)$. $\ln(S_t)$ is a continuously differentiable function and therefore adds accuracy to the approximation through higher order terms in the Taylor series expansion. Using

[17] See Taylor (1997).
[18] See Itô (1951).

$f(S,t) = \ln(S_t)$ in Eq. (2.2) leads to

$$df(S,t) = d\ \ln(S_t) = \left(\mu - \frac{1}{2}\sigma^2\right) dt + \sigma\ dW_{S,t} \quad , \tag{2.3}$$

with constant drift $\mu - \frac{1}{2}\sigma^2$ and constant volatility σ. Thus, the change in $\ln(S)$ has a normal distribution with $N((\mu - 1/2\sigma^2)\Delta t,\ \sigma^2\Delta t)$ (Hull, 2018). Eq. (2.3) shows a continuous-time process. Such a process can be simulated using discrete-time approximations. The simplest approximation method is the Euler scheme (Glasserman, 2003). For discretization, the time interval $[0,\ T]$ is divided in j discrete subintervals. Each subinterval is of length Δt. Accordingly, all relevant values are simulated at time points $t_j = j\Delta t$ with $j = 1,\ ...,\ m$ and $m = T/\Delta t$. The discrete version of Eq. (2.3) results in

$$S_{t_{j+1}} = S_{t_j} \exp\left(\mu - \frac{1}{2}\sigma^2\right)\Delta t + \sigma\sqrt{\Delta t}\epsilon_{j+1} \quad , \tag{2.4}$$

where $\epsilon_1, \epsilon_2, ..., \epsilon_m$ is a sequence of independent and identically distributed (i.i.d.) standard normal variables.

In order to model the spot component of the currency forward, I assume that the underlying exchange rate S follows the geometric Brownian motion given in Eq. (2.1) with $\mu = r_d - r_f$ where r_d is the domestic and r_f is the foreign interest rate, respectively[19]:

$$dS_t = (r_d - r_f)S_t dt + \sigma S_t dW_{S,t} \quad . \tag{2.5}$$

The Euler discretization is then given by

$$S_{t_{j+1}} = S_{t_j} \exp\left((r_d - r_f) - \frac{1}{2}\sigma^2\right)\Delta t + \sigma\sqrt{\Delta t}\epsilon_{j+1} \quad . \tag{2.6}$$

Based on the interest rate parity, the forward exchange rate is given by

$$F_0 = S_0 \exp\Big((r_d - r_f)T\Big) \tag{2.7}$$

[19] In Wystup (2017), the author uses also a geometric Brownian motion to simulate exchange rates. However, he aims to use it for the purpose of effectiveness testing.

(Hull, 2018, p. 121), with F_0 being the forward exchange rate and S_0 being the spot exchange rate at time t_0, respectively. Since I am interested in the 'realized' accounting outcomes at time t, rather than on today's expected hypothetical future outcomes at some future date t, I calculate the forward exchange rate F_t based on the respective spot exchange rate using

$$F_{t_{j+1}} = S_{t_{j+1}} \exp\Big((r_d - r_f)(T - t_{j+1})\Big) \quad . \tag{2.8}$$

The forward points are calculated as the resulting interest rate differential between the currencies of the forward contract at time t (Pricewaterhouse Coopers, 2005):

$$f_{t_{j+1}} = F_{t_{j+1}} - S_{t_{j+1}} \quad . \tag{2.9}$$

Generally, Monte Carlo simulation represents a sampling method of random outcomes (Hull, 2018). It is a tool to model uncertainty. Moreover, Monte Carlo simulation allows for including and solving path-dependency. Since the idea behind the approach presented in this work is to not only calculate the accounting outcomes at specific reporting dates, but to also get an impression about their evolution over time, the path-dependency of exchange rates needs to be included. Using this fundamental idea of Monte Carlo, I approximate the accounting outcomes of the hedging relationship. Since this tool is widely used in derivative pricing and risk management (Glasserman, 2003), transferring the approach to accounting numbers which are based on derivatives seems reasonable. To do so, I calculate possible exchange rate paths with the current spot exchange rate S_0 as starting point and m subintervals using Eq. (2.6) which is based on the one-dimensional geometric Brownian motion given in Eq. (2.1). Spot exchange rates, forward rates, and forward points are calculated by

$$\hat{S}_n = \frac{1}{n}\sum_{j=1}^{n} S_{t_j} \quad , \qquad \hat{F}_n = \frac{1}{n}\sum_{j=1}^{n} F_{t_j} \quad , \qquad \hat{f}_n = \frac{1}{n}\sum_{j=1}^{n} f_{t_j} \quad , \tag{2.10}$$

which are aligned to the Monte Carlo estimate given in Glasserman (2003).
Based on the formulae given above, the fair value (FV) of the hedging instrument H is

calculated by

$$FV(H_{t_j}) = (H_{t_j} - H_{t_0})\, e^{-r_d(T-t_j)} \quad , \tag{2.11}$$

where H_{t_j} is the result of the multiplication of the notional amount of the hedging instrument with the respective forward or spot exchange rate at time t_j, dependent on whether the model company chooses to designate the entire forward contract as hedging instrument (possibilities (I), (II) or (V)), or only the spot element of the financial contract (possibilities (III), (IV) or (VI)). $e^{-r_d(T-t_j)}$ represents the continuous discount rate at time t_j.

Using the characteristics summarized in Table 2.1, I develop a model with a highly efficient hedging relationship to which I refer throughout my work as 'base case model'. I simulate the hedging instrument. As described above, the hedging instrument can consist either of the total forward contract or of just the spot component of the derivative. In a second step, I include the non-financial asset as hedged item in the model. Finally, I generate the accounting outcomes of the hedging relationship and the portfolio earnings of the model company for the various accounting possibilities (I) to (VI). For simulation purposes, I generally assume one reporting period, which I define as a quarter of a year, to have 65 trading days. Accordingly, the length of one subinterval is $\Delta t = 1/65$. The more simulation paths used, the more the simulation result converges to the 'true' value. In order to get a converged solution of portfolio earnings, I define a convergence criterion. This criterion is fulfilled, if portfolio earnings in T deviate less than 0.5% for increasing simulation paths n, with n increasing by factor 10. I undertake the simulation study using the numerical computing software MATLAB.

2.4 Numerical Results and Discussion

In this section, I present and discuss the numerical results of the above presented model. First, I analyze the base case model as described in Section 2.3.2 in which the hedging relationship is perfectly efficient as the hedging instrument and the hedged item show identical critical terms, see Table 2.1. In a next step, I extend the base case model by including a source of ineffectiveness in the set-up which leads to a partly inefficient hedging

relationship and consequently also to different accounting entries and portfolio earnings on the model company side. Explicitly speaking, I assume that due to changes in the expected payment date of the raw material, critical terms of hedging instrument and hedged item slightly disagree. Third, I conduct a parameter analysis of different macroeconomic factors. The macroeconomic factors considered for this analysis are domestic interest rates and volatilities of spot exchange rates. Finally, I check whether the results of the evaluated analyses still hold for companies with different capital structures. Moreover, I add credit and debit value adjustments to the model. Credit and debit value adjustments result from including contract parties' default risk in the model. I analyze their impact on the model company's portfolio earnings as well as on its returns on equity in terms of the different accounting possibilities. Please note that this study only examines the time frame of the specific hedging relationship ending in T. Future periods are not further investigated within these analyses.

2.4.1 Base Case Model

The above described base case model, where no sources of ineffectiveness are included, leads to the portfolio earnings presented in Tables 2.5 to 2.10, depending on the different accounting possibilities. In addition, at the respective reporting dates, the tables show stocks of asset and liability accounts as well as of profit and loss accounts involved in the accounting of the hedging relationship.[20] Among the various possibilities, the accounting entries are partly distinctive. These distinctions depend on (i) the applied standard, IAS 39 vs. IFRS 9 (IFRS 9, para. 7.2.21), and (ii) the designated hedging instrument, entire forward contract vs. spot element (IAS 39, para. 74, IFRS 9, para. 6.2.4). In the following, I explain the composition of the main accounting entries at specific points in time.
As determined in Table 2.1, the forward contract defines the model company's purchase of CUF 10,000,000 at the current forward rate F_0. In the model, the contracted amount of the forward is CUD 13,101,015 with a spot element of CUD 13,500,000 and forward points of (CUD 398,985), as $F_0 = 1.31 < 1.35 = S_0$. At inception, the fair value of a forward contract is zero (Hull, 2018) and so are the fair values of the spot element and

[20]Please note that the terms of the accounts are chosen intuitively.

forward points, respectively. At time $t = 1$, the purchase of CUF 10,000,000 is equivalent to a forward price of CUD 13,101,765. The corresponding spot element of the forward contract is CUD 13,433,438, the corresponding forward element is (CUD 331,673). Using Eq. (2.11), I calculate the fair value of the forward contract which results in CUD 585. The fair values of the respective spot and forward element are (CUD 51,838) and CUD 52,423. The *Derivative* account records the accumulated fair value changes in the financial instrument (here: the forward contract) which is chosen to be part of the hedging relationship. At inception, the fair value of the forward contract is zero (Hull, 2018). Therefore, at $t = 0$, the *Derivative* account displays an entry of zero throughout the different methods (I) to (VI) in Tables 2.5 to 2.10. At $t = 1$, the fair value change of CUD 585 of the forward contract is recorded in the account. In the same manner as described above, I calculate the fair value changes of the forward contract at reporting dates $t = 2, \ldots, 6$. At maturity, the derivative is settled and derecognized. Fair value changes in the hedging instrument are recognized in the cash flow hedge reserve as part of other comprehensive income which here is reflected by the account called *CFH (OCI)*. Fair value changes in the hedging instrument are reclassified to profit or loss at the same time at which also the hedged item affects profit or loss (here: in $t_{payment} = 6$). On the one hand, the accounting entries depend on whether the entire forward (possibilities (I), (II), (V)) or only the spot element (possibilities (III), (IV), (VI)) is designated as hedging instrument. Consequently, at $t = 1$, the *CFH (OCI)* account records CUD 585, the fair value change of the entire forward, for methods (I), (II), and (V) and (CUD 51,838), the fair value change of the spot element, for methods (III), (IV), and (VI). On the other hand, the accounting entries depend on whether the changes in fair value recognized in other comprehensive income are included in inventory, explicitly speaking, in the initial cost of raw material (possibilities (II), (IV), (V), (VI)), or not (possibilities (I), (III)). Therefore, the *CFH (OCI)* account regarding methods with basis adjustment (possibilities (II), (IV), (V), and (VI)) shows accumulated fair value changes of zero at delivery date $t = 4$, respectively. In case of designating only the spot element as hedging instrument (possibilities (III), (IV), (VI)), fair value changes in the non-designated part of the hedging instrument, the forward element, are recognized either in profit or loss (possibilities (III), (IV)) through the account *Fwd*

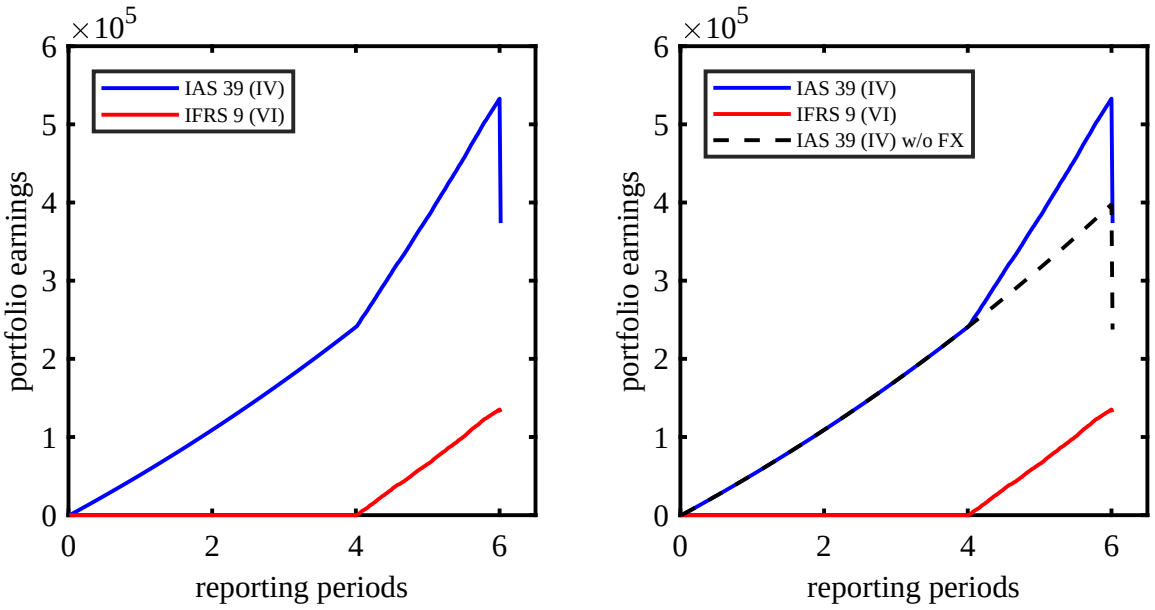
element (PL) or in a separate OCI component in equity (possibility (VI)) through the account *Fwd element (OCI)*, dependent on the applied hedge accounting standard, IAS 39 or IFRS 9. Referring to methods (III) and (IV), at $t = 1$, the *Fwd element (PL)* account records the fair value change of the forward element of CUD 52,423. Referring to method (VI), the *Fwd element (OCI)* account records this change in fair value. As possibility (VI) follows the cost of hedging approach, in $t_{delivery}$, the fair value changes recognized in *Fwd element (OCI)*, are included in inventory, similar to the cash flow hedge reserve. *Inventory* is recognized in the same named account at $t_{delivery}$. As described above, the accounting entry varies in dependence of whether the OCI component(s) is reclassified to inventory and included in the initial inventory cost (possibilities (II), (IV), (V), (VI)) or not (possibilities (I), (III)). In the account named *Payable*, the trade payable is firstly recognized in $t_{delivery}$. The amount is calculated as the product of the notional amount of the hedged item and the respective spot exchange rate at time t ($N_{hedge} \cdot S_t$). Foreign exchange (FX) difference is part of profit or loss. The account *FX diff (PL)* recognizes the net gain or loss of the payable. The *Cash* account is affected at the settlement date of derivative and payable, here: $t = 6$. The entry amount equals the initially contracted amount at the fixed forward exchange rate F_0 (CUD 13,101,015).

To sum up, the entries of the accounts *Derivative*, *Payable*, *Cash*, and *FX diff (PL)* do not change due to the selected accounting possibility. The entries of the accounts *CFH (OCI)*, *Fwd element (OCI)*, *CFH (PL)*, *Fwd element (PL)*, and *Inventory* depend on the chosen hedge accounting method.

The last column of Tables 2.5 to 2.10 shows the accumulated portfolio earnings of the different accounting possibilities on the respective reporting dates. The accounting outcomes are calculated based on a Monte Carlo simulation as described in Section 2.3.2. Using the convergence criterion as defined in Section 2.3.2, with $n = 500{,}000$ simulation paths, a converged solution of portfolio earnings is obtained. The converged solution of portfolio earnings differs less than 0.5% from portfolio earnings simulated using $n = 5{,}000{,}000$ simulation paths. It is observable that accounting possibilities (III) and (IV) differ distinctly from the others in terms of portfolio earnings volatility. That is, comparing portfolio earnings generated by these two methods at different points in time during the

hedging relationship, displays a much more volatile development with considerably more fluctuations in contrast to the other methods. Due to the fact that the non-designated forward element is recognized in profit or loss according to these accounting possibilities, the model company's income statement is continuously affected over the lifetime of the hedging relationship. Possibilities (III) and (IV) themselves differ in portfolio earnings only at time T. The difference is caused by the cash flow hedge reserve. While possibility (IV) intends to include the cash flow hedge reserve in the initial cost of inventory, possibility (III) does not. This leads to an approximately 280% higher profit at maturity when applying possibility (IV) instead of possibility (III). Ramirez (2015) examines case studies on hedging relationships of forecast sales analyzing some of the accounting possibilities presented in this work. Given the hedging relationship and the static parameters he uses, similar results are observed. The portfolio earnings difference in possibility (I) compared to possibilities (II), (V), and (VI) arises also from the different accounting of the cash flow hedge reserve. Focusing only on the accounting entries at the given reporting dates might give the impression that portfolio earnings volatility is relatively high for possibilities (III) and (IV), but relatively low for the other methods.

In Figure 2.1, portfolio earnings are depicted over time on a daily basis for accounting possibilities (IV) and (VI). As mentioned above, these two methods differ distinctly from each other due to the diverse recognition of the non-designated forward element. The figure depicts the shapes based on the base case model with $r_d < r_f$ as given in Table 2.1. Spot and forward rates are slightly downward sloping with $S_0 > F_0$. The graphs illustrating the designation of the spot element according to IAS 39 and IFRS 9 show the expected horizontal, non-volatile line in the range from t_0 to $t_{delivery}$ for possibility (VI) in which the non-designated forward element is reflected in other comprehensive income. I find a monotonically increasing line in the said range for possibility (IV), where the forward element is recognized in profit or loss. After recognizing the inventory delivered in $t_{delivery} = 4$, the increasing volatile courses of both graphs result from the variation in foreign exchange differences as well as from value changes in the forward element and the cash flow hedge reserve. Referring to possibility (VI), most of the difference arises from foreign exchange differences while only a relatively small part of the difference arises from



(a) (b)

Figure 2.1: The graphs show accumulated portfolio earnings on a daily basis for accounting possibilities (IV) and (VI) of the hedging relationship according to IAS 39 and IFRS 9 excluding ineffectiveness in (a) and showing in addition the impact of foreign exchange differences in (b). The used input parameters are: $N_0 = N_{hedge} = 10{,}000{,}000$, $S_0 = 1.35$, $r_d = 0.05$, $r_f = 0.055$, $\sigma = 0.1$, $t_0 = t_{inception} = 0$, $t_{delivery} = 4$, and $T = t_{payment} = 6$.

value changes in the forward element and the cash flow hedge reserve. Referring to possibility (IV), Figure 2.1 (b) clearly shows that the upward sloping trend appears due to the recognition of the forward element in profit or loss. Here, the black dashed line depicts accounting possibility (IV) without the foreign exchange recognition. The recognition of foreign exchange differences after $t_{delivery}$ strengthens the increase even more. For the specific accounting entries, see Tables 2.8 and 2.10. As predicted in *P1*, the results show that IAS 39 (III) and (IV) lead to more volatile portfolio earnings during the time-period of the hedging relationship than does IFRS 9 (VI), see Tables 2.7, 2.8, and 2.10.

Table 2.2 shows the mean value as well as the standard error and the 95%-confidence interval of the accumulated portfolio earnings of accounting possibilities (I) to (VI) at maturity T of the hedging relationship. The 95%-confidence intervals of accounting methods (IV)

and (VI) range from 373,015 to 374,425 and from 131,086 to 132,629. The confidence intervals of these two methods do not overlap. Thus, hedge accounting possibilities (IV) and (VI) lead to significantly different portfolio earnings at maturity.

Table 2.2: Mean, standard error, and 95%-confidence intervals of accumulated portfolio earnings for accounting methods (I) to (VI) at maturity T for n = 500,000 simulation paths

	Mean	Standard error	95%-confidence intervals
IAS 39(I)	133,492	2,672,916	[126,083; 140,901]
IAS 39(II)	131,857	278,427	[131,086; 132,629]
IAS 39(III)	133,492	2,672,916	[126,083; 140,901]
IAS 39(IV)	373,720	254,362	[373,015; 374,425]
IFRS 9(V)	131,857	278,427	[131,086; 132,629]
IFRS 9(VI)	131,857	278,427	[131,086; 132,629]

Impact on ROE

In this paragraph, I show the impact of the different accounting methods on the model company's return on equity (ROE). I calculate the ROE by relating the model company's portfolio earnings to its equity. As already mentioned in Section 2.3.1, I assume the model company to be an average manufacturing firm with a capital structure of approximately 30% equity and 70% debt. Based on the information given in the monthly report 07.2019 of *Deutsche Bundesbank*, I assume the company to have total assets of CUD 6.75bn and equity of CUD 1.97bn, resulting in a debt-to-equity (D/E) ratio of 2.4.[21]

Table 2.3: ROE and $\Delta\text{ROE}_{\text{IAS 39(IV)}}$ for the different accounting methods (I) to (VI)

	D/E	IAS 39 (I)	IAS 39 (II)	IAS 39 (III)	IAS 39 (IV)	IFRS 9 (V)	IFRS 9 (VI)
ROE[a]	70/30	0.0068%	0.0067%	0.0068%	0.0190%	0.0067%	0.0067%
$\Delta\text{ROE}_{\text{IAS 39(IV)}}$[b]		-64.28%	-64.72%	-64.28%	0%	-64.72%	-64.72%

[a] ROE is calculated by relating the model company's portfolio profit or loss to its equity.
[b] $\Delta\text{ROE}_{\text{IAS 39(IV)}}$ is calculated referring to IAS 39(IV) as a benchmark.

Table 2.3 displays the ROEs for the different accounting methods (I) to (VI) calculated

[21] The amounts are calculated based on the information given in `https://www.bundesbank.de/resource/blob/650832/f281569dddce240532e394fc17a05d52/mL/ix10-data.pdf`, retrieved on 2019-05-03, for an average production firm in the Prime Standard at Frankfurt Stock Exchange.

based on the base case model. In line with the amounts in portfolio earnings of Table 2.8, Table 2.3 shows the largest ROE with 0.0190% for accounting possibility (IV). Taking this value as a benchmark, all other methods display an at least 64% smaller ROE. Possibilities (II), (V), and (VI) show the largest negative deviation with -64.72%. Prediction *P4* suggests that the impact of hedge accounting on earnings on a company level is relatively low. In order to assess this prediction, I calculate the average ROE[22] of HDAX[23] non-financial companies. Financial companies (SIC codes 6000-6799) are excluded. The average ROE amounts to 14.68% at 2018 year end. The model company's ROE values arising from the hedging relationship range from 0.0067% to 0.0190% depending on the specific accounting method used. These numbers definitely support P4. Whether the impact of hedge accounting is economically relevant or not, as suggested in prediction *P5*, depends of course on company specific earnings numbers as well as on the specific transaction data. The differences in the model company's portfolio earnings and ROEs depending on the specific accounting method applied underline the economic importance of the specific method in use.

2.4.2 Base Case Model with a Source of Ineffectiveness Included

The base case model explained and described above is designed without any influence of ineffectiveness. However, there are sources of ineffectiveness that might affect the hedging relationship. According to IAS 39, para. AG114 and IFRS 9, para. B6.4.1, ineffectiveness arises in case fair value changes in the hedged item and in the hedging instrument differ. IAS 39, para. AG124 gives a list of possible reasons for ineffectiveness including amongst others changes in the payment dates of the hedging instrument and the hedged item. IFRS 9, para. B6.5.5 advices how to measure hedge ineffectiveness. Correspondingly, an entity should use a so-called 'hypothetical derivative' which substitutes the hedged

[22] I retrieve ROE data for HDAX companies from Thomson Reuters EIKON using datatype WC08301. According to the description, ROE is calculated with the following formula: *(Net Income - Bottom Line - Preferred Dividend Requirement) / Average of Last Year's and Current Year's Common Equity * 100.* This information is given under `product.datastream.com/Navigator/HelpFiles/DatatypeDefinitions/en/0/WC08301.htm`, retrieved on 2020-03-20.

[23] HDAX consists of companies listed in DAX, MDAX, and TecDAX.

item. The hypothetical derivative and the hedged item have perfectly matched critical terms. The ineffectiveness arising from the difference between hypothetical derivative and hedging instrument needs to be accounted for in profit or loss (IAS 39, para. 95(b) and IFRS 9, para. 6.5.11(c)).

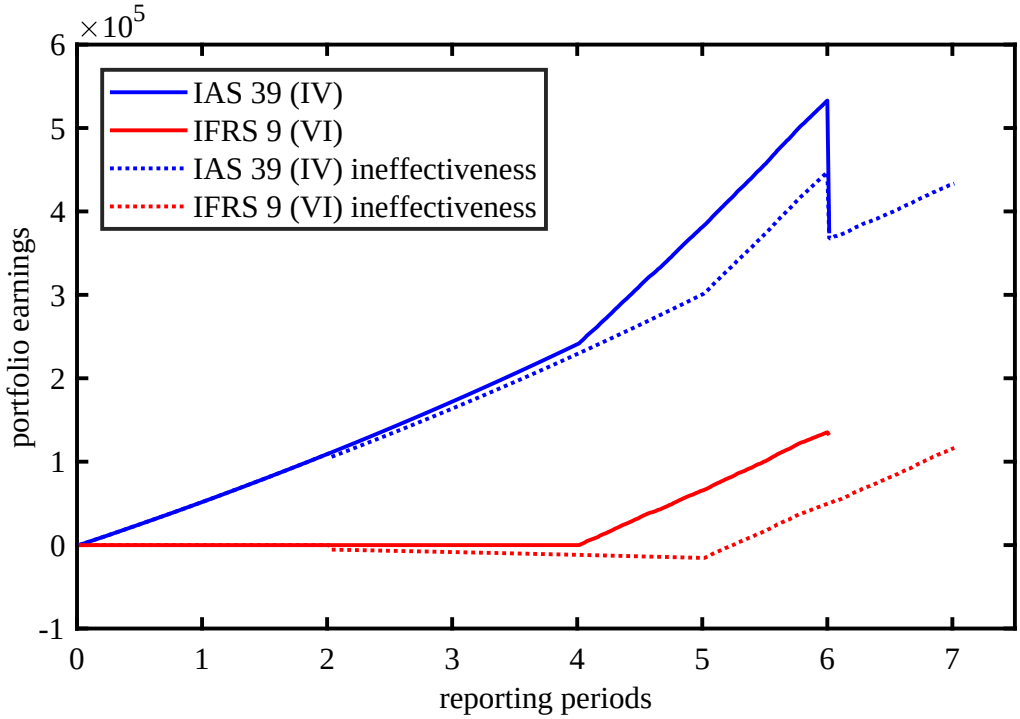


Figure 2.2: The graph shows accumulated portfolio earnings on a daily basis for accounting possibilities (IV) and (VI) of the hedging relationship according to IAS 39 and IFRS 9 excluding and including a source of ineffectiveness. The used input parameters are: $N_0 = N_{hedge} = 10{,}000{,}000$, $S_0 = 1.35$, $r_d = 0.05$, $r_f = 0.055$, $\sigma = 0.1$, $t_0 = t_{inception} = 0$, $t_{delivery} = 4$, $T = t_{payment} = 6$, or rather $t_{delivery} + 1 = 5$ and $t_{payment} + 1 = 7$ in case of ineffectiveness due to delayed delivery and payment.

Including such a source of ineffectiveness in the model decreases portfolio earnings from the point in time ineffectiveness arises, here: in $t = 2$. Ineffectiveness impacts portfolio earnings independent of the applied accounting possibility. To show the effect on the base case model, a scenario of delayed delivery and payment is added, which reflects the source of ineffectiveness in the model. Instead of delivering the raw material in $t_{delivery}$

as expected before, raw material is now expected to be delivered in $t_{delivery}+1$. Also the payment of the invoice is now expected to be transferred to time $t_{payment}+1$ instead of being paid in time $t_{payment}$. Consequently, discount rates based on r_d are calculated with respect to a different time horizon which results in value changes of the hypothetical derivative compared to the hedging instrument. Figure 2.2 shows the effect of the included source of ineffectiveness for accounting possibilities (IV) and (VI). The specific accounting entries for the model including the said ineffectiveness are presented in Tables 2.11 to 2.16. The resulting hedge ratios differ from 100%, but are still in the range required by IAS 39 of 80% to 125% as prescribed in IAS 39, para. AG105(b). The displayed source of ineffectiveness represents the ineffectiveness arising from the different discount rates, due to the different time horizons of the hedging instrument and the hedged item, as well as the effect of delayed delivery and payment of the raw material. Comparing e.g. the results in Tables 2.8 with 2.14 and 2.10 with 2.16, does not support my prediction *P3* that ineffectiveness impacts all methods in the same manner. Including the above described source of ineffectiveness in the model leads to even higher deviations between portfolio earnings of methods (IV) and (VI) at maturity of the hedging relationship. While possibility (IV) shows higher portfolio earnings compared to its fully effective counterpart, portfolio earnings of possibility (VI) depreciate due to the ineffectiveness. In Section 2.4.3, I will refer to that more detailed.

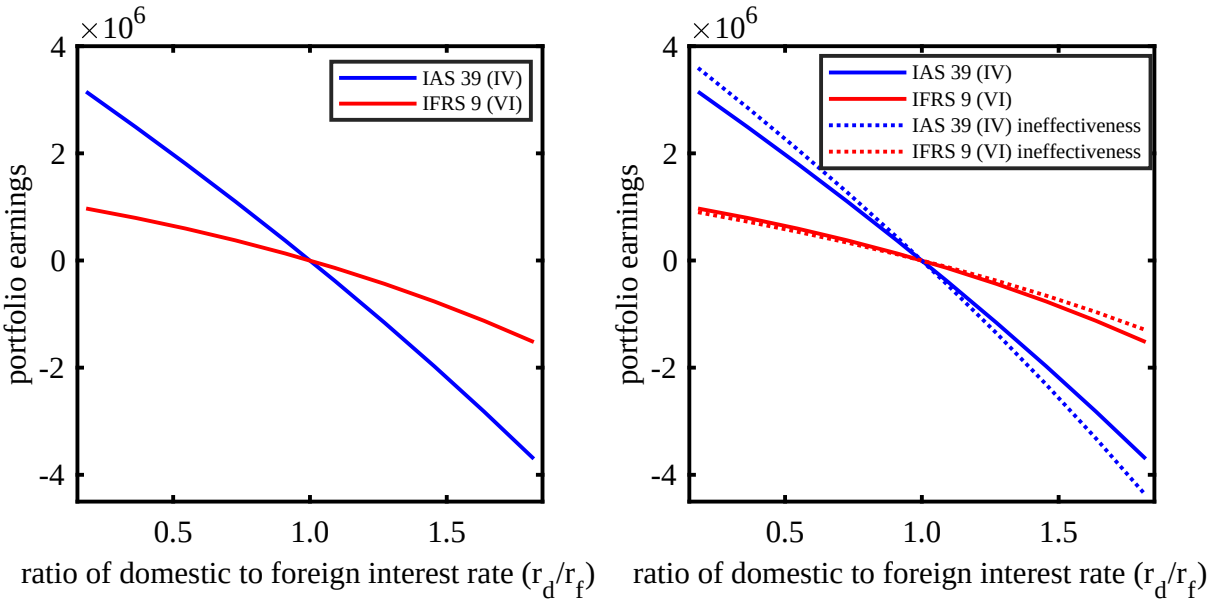
Impact on ROE

For the base case model with the specified source of ineffectiveness included, the resulting ROEs are similar or lower compared to the ones presented in Table 2.3. This is true for all methods, except for the ROE of method (IV). For possibility (IV), the ROE of 0.0220% exceeds the value of the base case model where the ROE amounts to 0.0190%. This seems obvious since portfolio earnings are less for the given input parameters for all methods, when the source of ineffectiveness is included, except for method (IV) (compare also Tables 2.5 to 2.10 with Tables 2.11 to 2.16). Again, possibilities (II), (V), and (VI) show the largest negative deviation with a $\Delta\text{ROE}_{\text{IAS 39(IV)}}$ of -69.59% for (II) and (V) and a $\Delta\text{ROE}_{\text{IAS 39(IV)}}$ of -73.16% for (VI) compared to the benchmark ROE value of method (IV).

2.4.3 Parameter Analysis of Domestic Interest Rate r_d and Volatility σ

For the described base case model, I fix specific input parameters which lead to the results presented above. In order to get an impression about the variation in portfolio earnings for varying input parameters, I conduct a parameter analysis for different domestic interest rates r_d and volatilities σ of the spot exchange rate S.

First, I vary r_d from 1% to 10% with step size 1% in order to get different ratios of domestic to foreign interest rates r_d/r_f. The resulting portfolio earnings at maturity of the hedging relationship, in time $T = 6$, for the specific ratios r_d/r_f are given in Figure 2.3 (a). The figure shows portfolio earnings without ineffectiveness of accounting possibility (IV), depicted by the blue solid line, and of possibility (VI), depicted by the red solid line. It is clearly observable, that the slope of portfolio earnings calculated by possibility (IV) is much steeper compared to portfolio earnings of method (VI). Thus, applying accounting method (IV) leads to higher earnings for increasing negative drift (μ), where $r_d/r_f \ll 1$ and to lower earnings for increasing positive drift (μ) where $r_d/r_f \gg 1$ compared to method (VI). The deviation shrinks as r_d approaches r_f, where the ratio $r_d/r_f = 1$. Ramirez (2015) observes similar results for the methods he examines and the static parameters he uses in terms of the set foreign exchange rate relation. My study however, extends his example by dynamic variation of input parameters and identifies differences between an excluded and included source of ineffectiveness. In case the previously specified source of ineffectiveness is excluded, the simulation results show in general close accordance for all accounting possibilities (I) to (VI) except for possibility (IV). At time $t = 6$, the deviations in portfolio earnings between methods (I), (II), (III), (V), and (VI) are relatively small (see also Tables 2.5, 2.6, 2.7, 2.9, 2.10). As already mentioned above when describing Figure 2.1 (b), the main driver for the difference between possibility (IV) and (VI) (or rather all others) is the influence of the accounting of the forward element. This fact is again more clearly observable in Figure 2.3 (a). For varying r_d/r_f ratios, the results do not support prediction *P2* that IFRS 9 (VI) portfolio earnings are more sensitive to changes in the macroeconomic factors than are IAS 39 (IV) portfolio earnings.



(a) (b)

Figure 2.3: (a) shows accumulated portfolio earnings of accounting possibilities (IV) and (VI) of the hedging relationship according to IAS 39 and IFRS 9 at maturity of the hedging relationship in $T = 6$ for varying ratios of domestic to foreign interest rate r_d/r_f excluding the source of ineffectiveness. (b) compares accumulated portfolio earnings excluding ineffectiveness in $T = 6$ with earnings including ineffectiveness in $t = 7$. The used input parameters are: $N_0 = N_{hedge} = 10{,}000{,}000$, $S_0 = 1.35$, $r_f = 0.055$, $\sigma = 0.1$, $t_0 = t_{inception} = 0$, $t_{delivery} = 4$, $T = t_{payment} = 6$, $t_{delivery} + 1 = 5$, and $t_{payment} + 1 = 7$.

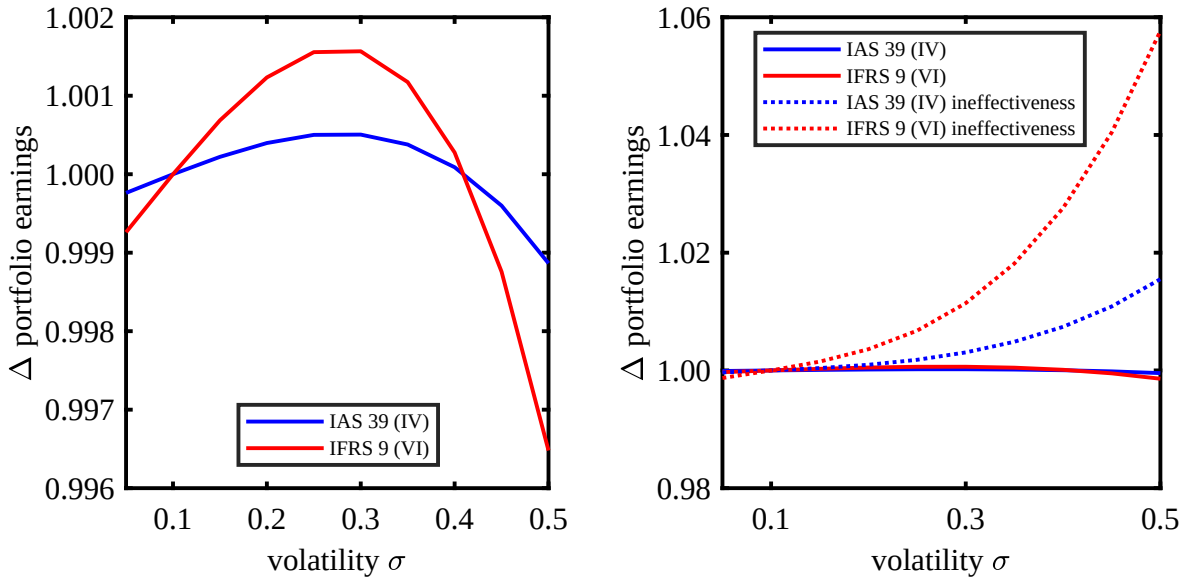
Figure 2.3 (b) compares the portfolio earnings excluding ineffectiveness at maturity of the hedging relationship with the portfolio earnings including the specified source of ineffectiveness at time $t_{payment} + 1$, thus after all accounting entries from the hedging relationship as well as the delayed accounting entries from the source of ineffectiveness are recognized. As in Figure 2.3 (a), also in Figure 2.3 (b) portfolio earnings are depicted on varying ratios of r_d/r_f. In case the above defined source of ineffectiveness is included, the blue and red dotted lines show the respective portfolio earnings for possibilities (IV) and (VI), respectively. For accounting method (IV), the graphs show higher portfolio earnings for $r_d/r_f < 1$ and lower portfolio earnings for $r_d/r_f > 1$ compared to the effective counterpart.

Analyzing the portfolio earnings of method (VI) shows a different behavior. Here, the graphs show slightly lower portfolio earnings for $r_d/r_f < 1$ and slightly higher portfolio earnings for $r_d/r_f > 1$ compared to the effective counterpart. The finding indicates that ineffectiveness may rise portfolio earnings of method (IV) while it may decrease portfolio earnings of method (VI) or vice versa for the same respective r_d/r_f ratio. The resulting portfolio earnings from the base case model in Tables 2.8, 2.10, 2.14, and 2.16 confirm the relationship of r_d/r_f and earnings shown in Figure 2.3 (b). This finding does not support my prediction *P3* that ineffectiveness affects all hedge accounting methods in the same manner, meaning that portfolio earnings uniformly increase or decrease over all methods when including a source of ineffectiveness. Generally, portfolio earnings including the specified source of ineffectiveness as well as portfolio earnings excluding this ineffectiveness approach zero as r_d/r_f approaches 1. The intersection points of the earnings including and excluding this ineffectiveness for both possibilities do not match exactly. This is due to the different time horizon I analyze in this figure, $T = 6$ for portfolio earnings without including the source of ineffectiveness and $t_{payment} + 1 = 7$ for portfolio earnings including ineffectiveness. In case the source of ineffectiveness is included, accounting methods (I), (II), (III), and (V) show close accordance to each other but differ slightly from IFRS 9 (VI) compared to the previously shown case where this source of ineffectiveness is excluded. For detailed values, see Tables 2.11, 2.12, 2.13, and 2.15. The hedge ratio varies across varying r_d/r_f, but does not exceed the limits prescribed by IAS 39 (IAS 39, para. AG105(b)).

In the following, I present the analysis of the volatility parameter σ of the spot exchange rate S. For this purpose, I vary σ from 5% to 50% with step size 5%. Figure 2.4 (a) shows the resulting changes in portfolio earnings at maturity $T = 6$ for varying volatilities σ with respect to the base case model, where $\sigma = 0.1$, excluding the specified source of ineffectiveness. The graphs are depicted by the blue and red solid lines for accounting possibilities (IV) and (VI), respectively. In relation to the base case model without including the source of ineffectiveness, Figure 2.4 (a) shows equal trends for accounting possibilities (IV) and (VI). However, it is observable that IFRS 9 (VI) is more sensitive to changes in volatility than it is IAS 39 (IV). Both methods are increasing in portfolio

earnings for $0.05 \leq \sigma \leq 0.3$ and decreasing for $0.35 \leq \sigma \leq 0.5$. At the peaks, method (IV) shows 1.0005 and method (VI) 1.0015 times higher portfolio earnings compared to the base case model with $\sigma = 0.1$. The deviation between the two methods is again due to the different accounting of the forward element. The U-shape of both graphs arises mainly due to different values of the cash flow hedge reserve and the foreign exchange difference for varying σ which influence profit or loss. The relative impact is higher for IFRS 9 (VI) compared to IAS 39 (IV), which results in the more distinct U-shape of method (VI) in the figure. That is, for varying σ, the results do support prediction *P2* that IFRS 9 (VI) portfolio earnings are more sensitive to changes in the macroeconomic factors than are IAS 39 (IV) portfolio earnings. In case the source of ineffectiveness is excluded from the model, the simulated portfolio earnings for varying volatilities of methods (II) and (V) are equal. They show close accordance to method (VI). Moreover, methods (I) and (III) result in similar portfolio earnings. Compared to all other methods, IAS 39 (I) and (III) are by far most sensitive to volatility changes with ~ 1.015 times higher portfolio earnings for $\sigma = 0.3$.

Figure 2.4 (b) compares relative portfolio earnings excluding the source of ineffectiveness at $T = 6$ with relative changes in portfolio earnings when the source of ineffectiveness is included at time $t_{payment} + 1 = 7$ for varying volatilities σ of the spot exchange rate S with respect to the base case model. The graphs are depicted by the blue and red dotted lines for method (IV) and (VI), respectively. The graphs in Figure 2.4 (b) show clearly that, with increasing volatility, portfolio earnings deviate more from their base case model results. For both accounting methods, portfolio earnings augment in a monotone manner with increasing σ. This finding supports my prediction *P3* that ineffectiveness affects all hedge accounting methods in the same manner. Again, the figure displays higher sensitivity to volatility changes for method IFRS 9 (VI) compared to method IAS 39 (IV). Moreover, as for the case where the source of ineffectiveness is excluded, the deviation between the two methods is due to the different accounting of the forward element and the shape of both graphs, here increasing with σ, arises mainly due to different values of the cash flow hedge reserve and the foreign exchange difference for varying σ. In Figure 2.4 (b) it is again observable that the resulting relative impact on profit or loss is stronger for



(a) (b)

Figure 2.4: (a) shows the relative change in accumulated portfolio earnings of accounting possibilities (IV) and (VI) with respect to the base case model at maturity of the hedging relationship in $T = 6$ according to IAS 39 and IFRS 9 for varying volatilities σ of S excluding the source of ineffectiveness. (b) compares the relative change in accumulated portfolio earnings excluding ineffectiveness in $T = 6$ with the relative change in portfolio earnings including ineffectiveness in $t = 7$. The used input parameters are: $N_0 = N_{hedge} = 10{,}000{,}000$, $S_0 = 1.35$, $r_d = 0.05$, $r_f = 0.055$, $t_0 = t_{inception} = 0$, $t_{delivery} = 4$, $T = t_{payment} = 6$, $t_{delivery} + 1 = 5$, and $t_{payment} + 1 = 7$.

IFRS 9 (VI) than for IAS 39 (IV). In case the source of ineffectiveness is included in the model, the simulated portfolio earnings for varying volatilities of the different methods differ more compared to their effective counterparts. Nevertheless, similarities occur. Accounting possibilities (I) and (III) are similar, methods (II) and (V) are alike. The hedge ratios do not change across varying σ. The limits prescribed by IAS 39 (IAS 39, para. AG105(b)) are not exceeded.

Summarizing the results, the parameter analyses show that the accounting method IAS 39 (IV), where, as defined in Section 2.2.1, only the spot element of the forward contract is designated as the hedging instrument and the cash flow hedge reserve is included in

the initial cost of the purchased raw material while the forward element is recognized in profit or loss, portfolio earnings at the end of the original hedging relationship in T are higher when $r_d/r_f < 1$, but lower when $r_d/r_f > 1$, compared to all other possible hedge accounting methods. Moreover, in case the specified source of ineffectiveness is included, portfolio earnings are higher for possibility (IV) but lower for possibility (VI) compared to their effective counterparts when $r_d/r_f < 1$. The opposite relation holds when $r_d/r_f > 1$. In terms of varying spot exchange rate volatility σ, changes in portfolio earnings are most sensitive to volatility changes for accounting methods (I) and (III) in case the source of ineffectiveness is excluded from the model. When comparing accounting methods (IV) and (VI), IAS 39 (IV) reacts less sensitive to changes in σ than does IFRS 9 (VI). This is true with and without including the specified source of ineffectiveness in the model.

2.4.4 Robustness Check

I conduct additional analyses to examine whether the above presented findings are limited to specific assumptions, either concerning model company characteristics or concerning hedging relationship specifications. I focus mainly on two aspects: Capital structure of the model company and credit risk of counterparties.

Impact of Different Capital Structures

Portfolio earnings generated through the hedging relationship do not change due to different capital structures of the company. Therefore, portfolio earnings as given in Tables 2.5 to 2.10 are still valid in this analysis. However, ROEs differ due to different D/E ratios. I repeat the investigation on the impact of specific hedge accounting methods (I) to (VI) on the model company's ROE as presented in Section 2.4.1 for D/E ratios of 0/100, 10/90, 20/80, 30/70, 40/60, 50/50, 60/40, 80/20, and 90/10. Results are given in Table 2.4. For a D/E ratio of 100/0, ROE values are not shown in the table as it represents the vertical asymptote of the function. ROE values would be infinitely high.

Table 2.4: ROE and $\Delta ROE_{IAS\ 39(IV)}$ for the different accounting methods (I) to (VI) and different D/E ratios

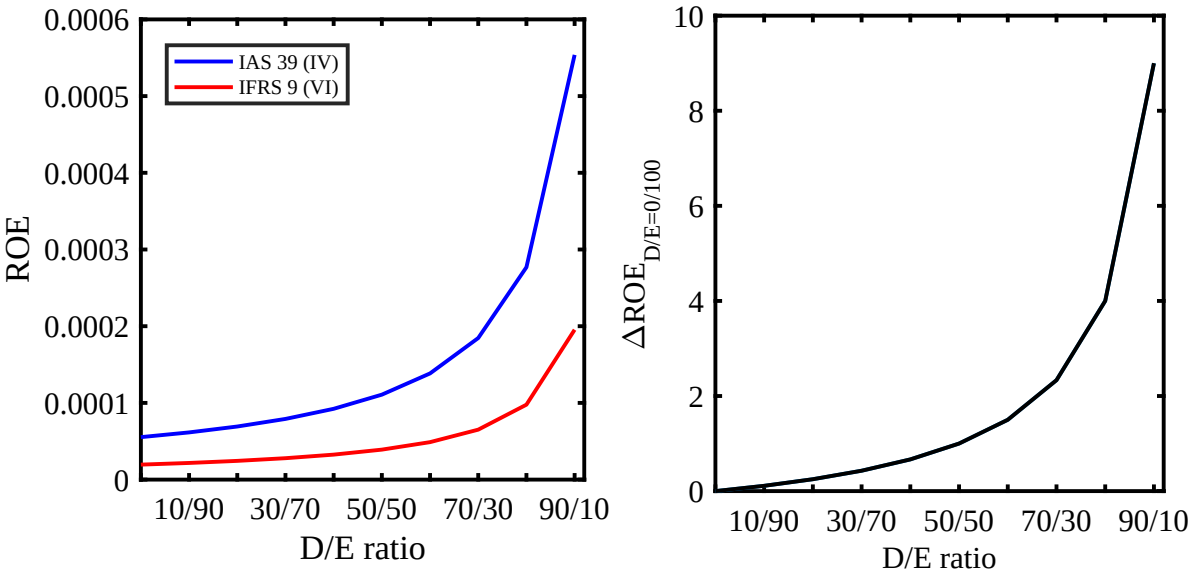
	D/E	IAS 39 (I)	IAS 39 (II)	IAS 39 (III)	IAS 39 (IV)	IFRS 9 (V)	IFRS 9 (VI)
ROE[a]	0/100	0.0020%	0.0020%	0.0020%	0.0055%	0.0020%	0.0020%
ROE	10/90	0.0022%	0.0022%	0.0022%	0.0062%	0.0022%	0.0022%
ROE	20/80	0.0025%	0.0024%	0.0025%	0.0069%	0.0024%	0.0024%
ROE	30/70	0.0028%	0.0028%	0.0028%	0.0079%	0.0028%	0.0028%
ROE	40/60	0.0033%	0.0033%	0.0033%	0.0092%	0.0033%	0.0033%
ROE	50/50	0.0040%	0.0039%	0.0040%	0.0111%	0.0039%	0.0039%
ROE	60/40	0.0049%	0.0049%	0.0049%	0.0138%	0.0049%	0.0049%
ROE	80/20	0.0099%	0.0098%	0.0099%	0.0277%	0.0098%	0.0098%
ROE	90/10	0.0198%	0.0195%	0.0198%	0.0554%	0.0195%	0.0195%
$\Delta ROE_{IAS\ 39(IV)}$[b]		-64.28%	-64.72%	-64.28%	0%	-64.72%	-64.72%

[a] ROE is calculated by relating the model company's portfolio profit or loss to its equity.
[b] $\Delta ROE_{IAS\ 39(IV)}$ is calculated referring to IAS 39(IV) as a benchmark.

As one would expect, compared to the ROEs of the highly leveraged model company as given in Table 2.3 which are based on the capital structure of 30% equity and 70% debt, the ROEs resulting for capital structures with more (less) debt proportion are higher (lower) for all accounting methods (I) to (VI), respectively. E.g., for a D/E ratio of 10/90, possibilities (II), (V), and (VI) show the smallest ROE with 0.0022% and possibility (IV) the largest with 0.0062%. For a D/E ratio of 90/10, possibilities (II), (V), and (VI) show the smallest ROE with 0.0195% and possibility (IV) the largest with 0.0554%.

Figure 2.5 (a) displays the different ROEs of accounting possibility (IV) and (VI) resulting from the various capital structures of debt and equity given in Table 2.4. ROEs of possibility (IV) are depicted by the blue solid line, ROEs of possibility (VI) by the red solid line. The graph shows that ROE values are monotonic strictly increasing with increasing leverage, independent of the applied hedge accounting method. The graph shows clearly that the difference in ROE values of possibilities (IV) and (VI) is less remarkable for less indebted capital structures and more accentuated for more indebted capital structures. Moreover, the asymptotic behavior of the function is observable. Figure 2.5 (b) depicts the change in ROE with stepwise increasing leverage by +10 debt and -10 equity points, respectively. I use the D/E ratio of 0/100 as reference value. This change is indicated

by $\Delta ROE_{D/E=0/100}$. The function of $\Delta ROE_{D/E=0/100}$ is equal for all hedge accounting possibilities (I) to (VI). Thus, relatively speaking, the stepwise shift by 10 debt / equity points leads to the same percentage increase throughout all methods.



(a) (b)

Figure 2.5: (a) shows the ROE values of accounting possibilities (IV) and (VI) for different debt-equity-combinations. (b) displays the change in ROE values ($\Delta ROE_{D/E=0/100}$) for a stepwise change of +10 debt and -10 equity points increase in leverage.

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Independent of the respective capital structure, accounting methods (II), (V), and (VI) show the lowest values, while method (IV) shows the highest values. Moreover, the values of $\Delta ROE_{IAS\ 39(IV)}$ do not differ between the specific hedge accounting methods due to changes in the capital structure, neither do the values of $\Delta ROE_{D/E=0/100}$. That is, capital structure does not impact the relation of hedge accounting methods to one another. It only influences the amount of ROE itself. Thus, the findings support predictions *P4* and *P5* independent of the company's capital structure.

Impact of Credit and Debit Value Adjustments

In this work, I so far neglect credit and debit value adjustments to the hedging instrument

and the hypothetical derivative as I assume the model company as well as its counterparties, bank and supplier, to be credit-risk free. Thus, I only include market risk in the simulation of the hedging relationship, but not idiosyncratic risk of the individual parties. In order to get an impression about whether credit and debit value adjustments (CVA/DVA) impact the results in terms of differences between the applicable hedge accounting methods, in this paragraph, I include CVAs and DVAs in the developed simulation model. From the point of view of the model company, CVA is the expected loss from a default of its counterparties and DVA is the expected loss for its counterparties from a default of the model company itself (Hull, 2015). According to Hull (2015), the book value (BV) of a derivative is the fair value of the derivative assuming neither party defaults minus CVA plus DVA:

$$BV = FV_{risk-free} - CVA + DVA \tag{2.12}$$

(Hull, 2015, p. 436). IFRS 9 does not provide a specific calculation method to define CVAs and DVAs for derivatives, nor does it instruct the user whether to calculate CVAs and DVAs for the hedging instrument only, or for both, hedging instrument and hedged item through the hypothetical derivative. In practice, various calculation methods are possible (see e.g., Ernst & Young, 2014). I make use of an expected future exposure approach and calculate the book value at time t_j of the hedging instrument by

$$\begin{aligned} BV_{t_j} = FV_{risk-free_{t_j}} + (-(PD_{bank} R_{bank} EAD + (1 - PD_{bank}) EAD) + \\ + (PD_{modelcompany} R_{modelcompany} EAD + \\ + (1 - PD_{modelcompany}) EAD)) exp(-r_d (T - t_j)) \end{aligned} \tag{2.13}$$

with PD being the respective probability of default of the model company or its counterparty, the bank, R being the respective recovery rate in case of a default and EAD being the exposure at default. Eq. (2.13) is aligned to Ramirez (2015, p. 81). I assume the forward contract to possibly default at each point in time until maturity. Moreover, I decide to include CVAs and DVAs only to adjust the value of the hedging instrument, not of the hedged item. Explicitly speaking, the supplier is still assumed to be credit risk-free.

In order to calculate CVAs and DVAs, assumptions on exposure at default, probabilities of default, as well as on recovery rates need to be made. I define the exposure at default as the amount contracted in the forward at inception of the hedging relationship. I choose the model company's probability of default to be 1.52% which equals the average default rate of the German wholesale sector in 2018.[24] I vary the model company's recovery rate between 20%, 50%, and 80%. Referring to the counterparty, I vary probabilities of default of the bank in the investment grade (S&P rating AAA to BBB-) according to an analysis of creditworthiness by *Deutsche Bundesbank*.[25] In addition, I vary the recovery rate of the bank to cover multiple scenarios. The probability of default and the recovery rate are covered by 0.05%, 0.1%, 0.25%, and 0.4% and 20%, 50%, and 80%, respectively. I run the simulation of the accounting outcomes for each combination of these parameters. The findings of this analysis show the following. Including the possibility of default in the model leads to non-identical critical terms of hedging instrument and hedged item which consequently, increases ineffectiveness and in turn affects portfolio earnings. The analysis shows clearly that it is much harder for accounting methods with the entire forward contract being designated as hedging instrument to fulfill the effectivity requirement of the hedge ratio to range between 80% and 125% (IAS 39, para. AG105(b)) compared to accounting methods where only the spot element is designated as hedging instrument. Referring to the above described default parameter combinations (PD_{bank}, $PD_{model\ company}$, R_{bank}, $R_{model\ company}$, EAD), accounting methods (I), (II), and (V) only rarely meet the effectivity requirement, methods (III), (IV), and (VI) always fulfill the prerequisite. Since CVAs and DVAs impact all methods similarly, the relation between the single accounting methods to one another, does not change. Thus, the findings of the base case model

[24]The default rate is taken from the latest default study published in May 2019 by *Creditreform*. The exact values can be found in `https://www.creditreform-rating.de/pub/media/global/page_document/Creditreform_Rating_Default_Study_2019_-_ENG.pdf`, retrieved on 2020-01-29. Please note that apart from the specific German rates, country and sector specific default rates can be applied in accordance with the company characteristics under focus. E.g., default rates of Italian non-financial companies can be found in the latest default study published in March 2019 by *Cerved Rating Agency*. Values can be found in `https://ratingagency.cerved.com/sites/ratingagency.cerved.dev/files/Cerved%20Rating%20Agency_Default%20Study%202019.pdf`, retrieved on 2020-05-13.

[25]The values for probabilities of default in an investment grade rating according to Deutsche Bundesbank can be found in `https://www.bundesbank.de/resource/blob/602050/7375022c234c5932edac071f268f78ee/mL/bonitaetsanalyse-kurzuebersicht-data.pdf`, retrieved on 2020-01-29.

analysis still hold. Varying the ratio of domestic to foreign interest rates r_d/r_f as well as of varying the spot exchange rate volatility σ shows identical behavior as presented in Section 2.4.3. Only the intersection points vary slightly from the ones defined in the base case model, dependent on the specific default parameter combination. Moreover, also the relation in terms of $\Delta\text{ROE}_{\text{IAS 39(IV)}}$ does not change. These results support *P3*. The ineffectiveness caused by CVAs and DVAs impacts all hedge accounting methods in the same manner.

Table 2.5: IAS 39 (I) Designation of entire forward contract without basis adjustment

	Derivative	CFH (OCI)	Fwd element (OCI)	Payable	Inventory	Cash	CFH (PL)	Fwd element (PL)	FX diff (PL)	PF earnings
t=0	0	0	0	0	0	0	0	0	0	0
t=1	0.59	0.59	0	0	0	0	0	0	0	0
t=2	0.10	0.10	0	0	0	0	0	0	0	0
t=3	1.29	1.29	0	0	0	0	0	0	0	0
t=4	1.63	1.63	0	13,235	13,235	0	0	0	0	0
t=5	1.51	1.51	0	13,168	13,235	0	0	0	66	66
t=6	0	0	0	0	13,235	(13,101)	(3)	0	136	133

Table 2.6: IAS 39 (II) Designation of entire forward contract with basis adjustment

	Derivative	CFH (OCI)	Fwd element (OCI)	Payable	Inventory	Cash	CFH (PL)	Fwd element (PL)	FX diff (PL)	PF earnings
t=0	0	0	0	0	0	0	0	0	0	0
t=1	0.59	0.59	0	0	0	0	0	0	0	0
t=2	0.10	0.10	0	0	0	0	0	0	0	0
t=3	1.29	1.29	0	0	0	0	0	0	0	0
t=4	1.63	0	0	13,235	13,233	0	0	0	0	0
t=5	1.51	(0.13)	0	13,168	13,233	0	0	0	66	66
t=6	0	0	0	0	13,233	(13,101)	(4)	0	136	132

Amounts in TCUD (thousand CUD). The tables show accumulated stocks, flows, and portfolio earnings at quarterly reporting dates t for accounting possibilities (I) and (II) of the hedging relationship according to IAS 39. The used input parameters are: $N_0 = N_{hedge} = 10{,}000{,}000$, $S_0 = 1.35$, $r_d = 0.05$, $r_f = 0.055$, $\sigma = 0.1$, $t_0 = t_{inception} = 0$, $t_{delivery} = 4$, $T = t_{payment} = 6$. Negative values are displayed in parentheses.

Table 2.7: IAS 39 (III) Designation of spot element without basis adjustment

	Derivative	CFH (OCI)	Fwd element (OCI)	Payable	Inventory	Cash	CFH (PL)	Fwd element (PL)	FX diff (PL)	PF earnings
t=0	0	0	0	0	0	0	0	0	0	0
t=1	0.59	(52)	0	0	0	0	0	52	0	52
t=2	0.10	(110)	0	0	0	0	0	110	0	110
t=3	1.29	(172)	0	0	0	0	0	173	0	173
t=4	1.63	(240)	0	13,235	13,235	0	0	242	0	242
t=5	1.51	(316)	0	13,168	13,235	0	0	317	66	383
t=6	0	0	0	0	13,235	(13,101)	(402)	399	136	133

Table 2.8: IAS 39 (IV) Designation of spot element with basis adjustment

	Derivative	CFH (OCI)	Fwd element (OCI)	Payable	Inventory	Cash	CFH (PL)	Fwd element (PL)	FX diff (PL)	PF earnings
t=0	0	0	0	0	0	0	0	0	0	0
t=1	0.59	(52)	0	0	0	0	0	52	0	52
t=2	0.10	(110)	0	0	0	0	0	110	0	110
t=3	1.29	(172)	0	0	0	0	0	173	0	173
t=4	1.63	0	0	13,235	13,475	0	0	242	0	242
t=5	1.51	(75)	0	13,168	13,475	0	0	317	66	383
t=6	0	0	0	0	13,475	(13,101)	(161)	399	136	374

Amounts in TCUD (thousand CUD). The tables show accumulated stocks, flows, and portfolio earnings at quarterly reporting dates t for accounting possibilities (III) and (IV) of the hedging relationship according to IAS 39. The used input parameters are: $N_0 = N_{hedge} = 10{,}000{,}000$, $S_0 = 1.35$, $r_d = 0.05$, $r_f = 0.055$, $\sigma = 0.1$, $t_0 = t_{inception} = 0$, $t_{delivery} = 4$, $T = t_{payment} = 6$. Negative values are displayed in parentheses.

Table 2.9: IFRS 9 (V) Designation of entire forward contract with basis adjustment

	Derivative	CFH (OCI)	Fwd element (OCI)	Payable	Inventory	Cash	CFH (PL)	Fwd element (PL)	FX diff (PL)	PF earnings
t=0	0	0	0	0	0	0	0	0	0	0
t=1	0.59	0.59	0	0	0	0	0	0	0	0
t=2	0.10	0.10	0	0	0	0	0	0	0	0
t=3	1.29	1.29	0	0	0	0	0	0	0	0
t=4	1.63	0	0	13,235	13,233	0	0	0	0	0
t=5	1.51	(0.13)	0	13,168	13,233	0	0	0	66	66
t=6	0	0	0	0	13,233	(13,101)	(4)	0	136	132

Table 2.10: IFRS 9 (VI) Designation of spot element with basis adjustment

	Derivative	CFH (OCI)	Fwd element (OCI)	Payable	Inventory	Cash	CFH (PL)	Fwd element (PL)	FX diff (PL)	PF earnings
t=0	0	0	0	0	0	0	0	0	0	0
t=1	0.59	(52)	52	0	0	0	0	0	0	0
t=2	0.10	(110)	110	0	0	0	0	0	0	0
t=3	1.29	(172)	173	0	0	0	0	0	0	0
t=4	1.63	0	0	13,235	13,233	0	0	0	0	0
t=5	1.51	(75)	75	13,168	13,233	0	0	0	66	66
t=6	0	0	0	0	13,233	(13,101)	(161)	157	136	132

Amounts in TCUD (thousand CUD). The tables show accumulated stocks, flows, and portfolio earnings at quarterly reporting dates t for accounting possibilities (V) and (VI) of the hedging relationship according to IFRS 9. The used input parameters are: $N_0 = N_{hedge} = 10{,}000{,}000$, $S_0 = 1.35$, $r_d = 0.05$, $r_f = 0.055$, $\sigma = 0.1$, $t_0 = t_{inception} = 0$, $t_{delivery} = 4$, $T = t_{payment} = 6$. Negative values are displayed in parentheses.

Table 2.11: IAS 39 (I) Designation of entire forward contract without basis adjustment when ineffectiveness is included

	Derivative	CFH (OCI)	Fwd element (OCI)	Payable	Inventory	Cash	CFH (PL)	Fwd element (PL)	FX diff (PL)	Ineffectiveness (PL)	PF earnings
t=0	0	0	0	0	0	0	0	0	0	0	0
t=1	0.59	0.59	0	0	0	0	0	0	0	0	0
t=2	0.10	0.10	0	0	0	0	0	0	0	0	0
t=3	1.29	1.23	0	0	0	0	0	0	0	0.06	0.06
t=4	1.63	1.56	0	0	0	0	0	0	0	0.08	0.08
t=5	1.51	1.44	0	13,168	13,168	0	0	0	0	0.07	0.07
t=6	0	0	0	13,098	13,168	(3)	(3)	0	70	(0.13)	67
t=7	0	0	0	0	13,168	(13,035)	(3)	0	136	(0.13)	133

Table 2.12: IAS 39 (II) Designation of entire forward contract with basis adjustment when ineffectiveness is included

	Derivative	CFH (OCI)	Fwd element (OCI)	Payable	Inventory	Cash	CFH (PL)	Fwd element (PL)	FX diff (PL)	Ineffectiveness (PL)	PF earnings
t=0	0	0	0	0	0	0	0	0	0	0	0
t=1	0.59	0.59	0	0	0	0	0	0	0	0	0
t=2	0.10	0.10	0	0	0	0	0	0	0	0	0
t=3	1.29	1.23	0	0	0	0	0	0	0	0.06	0.06
t=4	1.63	1.56	0	0	0	0	0	0	0	0.08	0.08
t=5	1.51	0	0	13,168	13,167	0	0	0	0	0.07	0.07
t=6	0	0	0	13,098	13,167	(3)	(4)	0	70	(0.13)	66
t=7	0	0	0	0	13,167	(13,035)	(4)	0	136	(0.13)	132

Amounts in TCUD (thousand CUD). The tables show accumulated stocks, flows, and portfolio earnings at quarterly reporting dates t for accounting possibilities (I) and (II) of the hedging relationship according to IAS 39 including the specified source of ineffectiveness arising from delayed payment. The used input parameters are: $N_0 = N_{hedge} = 10{,}000{,}000$, $S_0 = 1.35$, $r_d = 0.05$, $r_f = 0.055$, $\sigma = 0.1$, $t_0 = t_{inception} = 0$, $t_{delivery} = 4$, $T = t_{payment} = 6$, $t_{delivery} + 1 = 5$, $t_{payment} + 1 = 7$. Negative values are displayed in parentheses.

Table 2.13: IAS 39 (III) Designation of spot element without basis adjustment when ineffectiveness is included

	Derivative	CFH (OCI)	Fwd element (OCI)	Payable	Inventory	Cash	CFH (PL)	Fwd element (PL)	FX diff (PL)	Ineffectiveness (PL)	PF earnings
t=0	0	0	0	0	0	0	0	0	0	0	0
t=1	0.59	(52)	0	0	0	0	0	52	0	0	52
t=2	0.10	(110)	0	0	0	0	0	110	0	0	110
t=3	1.29	(163)	0	0	0	0	0	173	0	(8)	165
t=4	1.63	(229)	0	0	0	0	0	242	0	(12)	230
t=5	1.51	(300)	0	13,168	13,168	0	0	317	0	(15)	302
t=6	0	0	0	13,098	13,168	(3)	(382)	399	70	(20)	67
t=7	0	0	0	0	13,168	(13,035)	(382)	399	136	(20)	133

Table 2.14: IAS 39 (IV) Designation of spot element with basis adjustment when ineffectiveness is included

	Derivative	CFH (OCI)	Fwd element (OCI)	Payable	Inventory	Cash	CFH (PL)	Fwd element (PL)	FX diff (PL)	Ineffectiveness (PL)	PF earnings
t=0	0	0	0	0	0	0	0	0	0	0	0
t=1	0.59	(52)	0	0	0	0	0	52	0	0	52
t=2	0.10	(110)	0	0	0	0	0	110	0	0	110
t=3	1.29	(163)	0	0	0	0	0	173	0	(8)	165
t=4	1.63	(229)	0	0	0	0	0	242	0	(12)	230
t=5	1.51	0	0	13,168	13,468	0	0	317	0	(15)	302
t=6	0	0	0	13,098	13,468	(3)	(82)	399	70	(20)	367
t=7	0	0	0	0	13,468	(13,035)	(82)	399	136	(20)	433

Amounts in TCUD (thousand CUD). The tables show accumulated stocks, flows, and portfolio earnings at quarterly reporting dates t for accounting possibilities (III) and (IV) of the hedging relationship according to IAS 39 including the specified source of ineffectiveness arising from delayed payment. The used input parameters are: $N_0 = N_{hedge} = 10{,}000{,}000$, $S_0 = 1.35$, $r_d = 0.05$, $r_f = 0.055$, $\sigma = 0.1$, $t_0 = t_{inception} = 0$, $t_{delivery} = 4$, $T = t_{payment} = 6$, $t_{delivery} + 1 = 5$, $t_{payment} + 1 = 7$. Negative values are displayed in parentheses.

Table 2.15: IFRS 9 (V) Designation of entire forward contract with basis adjustment when ineffectiveness is included

	Derivative	CFH (OCI)	Fwd element (OCI)	Payable	Inventory	Cash	CFH (PL)	Fwd element (PL)	FX diff (PL)	Ineffectiveness (PL)	PF earnings
t=0	0	0	0	0	0	0	0	0	0	0	0
t=1	0.59	0.59	0	0	0	0	0	0	0	0	0
t=2	0.10	0.10	0	0	0	0	0	0	0	0	0
t=3	1.29	1.23	0	0	0	0	0	0	0	0.06	0.06
t=4	1.63	1.56	0	0	0	0	0	0	0	0.08	0.08
t=5	1.51	0	0	13,168	13,167	0	0	0	0	0.07	0.07
t=6	0	0	0	13,098	13,167	(3)	(4)	0	70	(0.13)	66
t=7	0	0	0	0	13,167	(13,035)	(4)	0	136	(0.13)	132

Table 2.16: IFRS 9 (VI) Designation of spot element with basis adjustment when ineffectiveness is included

	Derivative	CFH (OCI)	Fwd element (OCI)	Payable	Inventory	Cash	CFH (PL)	Fwd element (PL)	FX diff (PL)	Ineffectiveness (PL)	PF earnings
t=0	0	0	0	0	0	0	0	0	0	0	0
t=1	0.59	(52)	52	0	0	0	0	0	0	0	0
t=2	0.10	(110)	110	0	0	0	0	0	0	0	0
t=3	1.29	(163)	173	0	0	0	0	0	0	(8)	(8)
t=4	1.63	(229)	242	0	0	0	0	0	0	(12)	(12)
t=5	1.51	0	0	13,168	13,151	0	0	0	0	(15)	(15)
t=6	0	0	0	13,098	13,151	(3)	(82)	82	70	(20)	50
t=7	0	0	0	0	13,151	(13,035)	(82)	82	136	(20)	116

Amounts in TCUD (thousand CUD). The tables show accumulated stocks, flows, and portfolio earnings at quarterly reporting dates t for accounting possibilities (V) and (VI) of the hedging relationship according to IFRS 9 including the specified source of ineffectiveness arising from delayed payment. The used input parameters are: $N_0 = N_{hedge} = 10{,}000{,}000$, $S_0 = 1.35$, $r_d = 0.05$, $r_f = 0.055$, $\sigma = 0.1$, $t_0 = t_{inception} = 0$, $t_{delivery} = 4$, $T = t_{payment} = 6$, $t_{delivery} + 1 = 5$, $t_{payment} + 1 = 7$. Negative values are displayed in parentheses.

2.5 Conclusion

This simulation study analyzes the consequences on earnings of the new standard *IFRS 9 Financial Instruments* with respect to changes in hedge accounting regulation compared to the former standard *IAS 39 Financial Instruments: Recognition and Measurement*. Due to the extraordinary transition period, comparing these two hedge accounting regulations is of high interest: On a company basis, entities may choose to apply hedge accounting either under IAS 39 or IFRS 9 simultaneously. The said transition period holds until the IASB finalizes the IFRS 9 regulation on macro hedging.

To analyze and evaluate the impact of different possible cash flow hedge accounting rules on a firm's income statement, I conduct a simulation study. I use a Monte Carlo simulation approach which is less examined in the accounting literature. The simulation allows to show how dynamic variation of different input parameters affects the decision of applying specific hedge accounting methods. Within the study, I describe and examine the applicable hedge accounting methods for the hedging relationship under focus. Four of them refer to IAS 39, two of them to IFRS 9. The simulation study consists of a leveraged non-financial model company that is exposed to exchange rate risk and aims to mitigate this exposure by entering a hedging relationship with a defined forward contract as hedging instrument. The simulated hedging relationship allows to analyze the effects of cash flow hedge accounting on a transaction-based level and gives insights on the impact of different methods on the model company's portfolio profit or loss. The six alternative hedge accounting methods differ mainly in two aspects: (i) application of IAS 39 hedge accounting vs. IFRS 9 hedge accounting, and (ii) designation of the entire forward contract as hedging instrument vs. designation of the spot element of the forward contract as hedging instrument. When referring to main distinctions between IAS 39 and IFRS 9 hedge accounting, two methods differ the most: Designation of the spot element of the forward contract as hedging instrument with reclassification of the cash flow hedge reserve to initial cost of inventory and recognition of the forward element in profit or loss, according to IAS 39, and recognition of the forward element in a separate component of equity in other comprehensive income, according to IFRS 9. These methods are defined

as hedge accounting possibilities IAS 39 (IV) and IFRS 9 (VI) throughout the presented work. At maturity of the hedging relationship, portfolio earnings of method IAS 39 (IV) are higher compared to all other possible methods as long as foreign interest rate r_f exceeds domestic interest rate r_d with $r_d/r_f < 1$, but lower in case $r_d/r_f > 1$. The results of method IAS 39 (IV) show also slightly higher or lower portfolio earnings for $r_d/r_f < 1$ or $r_d/r_f > 1$ in case a source of ineffectiveness is included in the model compared to its fully effective hedging relationship counterpart. This relation, however, is not equal for all methods. Accounting possibility IFRS 9 (VI) presents slightly lower portfolio earnings for $r_d/r_f < 1$, but slightly higher results for $r_d/r_f > 1$ when the hedging relationship is partly ineffective compared to a fully effective hedge. The deviation in portfolio earnings between effective and ineffective hedging relationships is stronger for IAS 39 (IV) than it is for IFRS 9 (VI). Furthermore, the study shows that portfolio earnings of IFRS 9 hedge accounting methods vary less across changes in r_d, independent of the relationship between r_f and r_d. Moreover, I illustrate that the accounting methods differ in terms of their sensitivity to exchange rate volatility changes. I show that changes in portfolio earnings are most volatile for accounting possibilities under IAS 39 in case the cash flow hedge reserve is not included in the initial cost of inventory. However, comparing IAS 39 (IV) and IFRS 9 (VI), the results show that method IFRS 9 (VI) is more sensitive to changes in exchange rate volatility than IAS 39 (IV) is. Analyzing the impact of the different hedge accounting methods on the model company's ROE shows that accounting possibility IAS 39 (IV) has by far the highest impact compared to all other methods. In addition, I show that changing the model company's capital structure does not affect the relation of the individual hedge accounting methods to one another, neither does including default risk to the parties involved in the financial contract underlying the hedging relationship.

Overall, the analyses show that applying IAS 39 hedge accounting regulation may lead to higher portfolio earnings volatility during the time-period of the hedging relationship. Moreover, portfolio earnings may be more sensitive to changes in foreign exchange rates, but less sensitive to foreign exchange rate volatility changes. All three results depend on the specific IAS 39 method used. Applying IFRS 9 hedge accounting regulation leads to

less portfolio earnings volatility during the time-period of the hedging relationship. In addition, portfolio earnings are less sensitive to changes in foreign exchange rates. However, in terms of foreign exchange rate volatility changes, portfolio earnings are more sensitive. On the basis of these analyses and results, firms may decide whether early switching from IAS 39 to IFRS 9 hedge accounting is desirable or rather burdensome for them, according to their company specific risk management policies and objectives.

This study is subject to several limitations. These limitations are chosen on purpose to separate the effects of specific hedge accounting methods. First, the presented work is a simulation study of the impact of hedge accounting methods on a model company's portfolio earnings. Thus, the results are restricted to the specific input parameters I use. Second, the developed model is simplified as the company is exposed to exchange rate risk only. Exchange rate risk arises from a single foreign currency transaction. To hedge this risk, the model company deals with a single hedging relationship. Consequently, counterparty risk is limited, too. Third, the results from this study might lack of generalizability. This is due to the fact that I focus on an average manufacturing company. Results might differ when analyzing other industries. Especially for financial companies, the hedged business transaction is not representative. Nevertheless, the developed simulation approach is transferable to other industries. Fourth, I only analyze the consequences of cash flow hedge accounting methods on portfolio earnings. Fair value hedges or hedges of a net investment in a foreign operation are not investigated.

Future simulation studies could investigate other or a combination of business transactions that are hedged by a model company. Input parameters could be varied to be appropriate for other industries. Moreover, other hedging models could be examined. Future empirical research could analyze whether the results presented in this study under simplified circumstances hold for real world hedging relationships. In addition, it could be explored how companies really act during the ongoing transition period and what companies currently actually use IFRS 9 hedge accounting.

Chapter 3

Determinants of Hedge Accounting according to IAS 39 and IFRS 9 - Evidence from Germany

Abstract

I analyze the hedge accounting practices of German non-financial, listed firms using a hand-collected data set of hedge accounting practices. I focus on firms' decision to apply IFRS 9 or IAS 39 hedge accounting rules during IFRS 9 introduction. The transition period of IFRS 9 hedge accounting is ongoing and, thus, extraordinary because firms may choose, on a firm basis, between IFRS 9 and IAS 39 hedge accounting. Hence, two hedge accounting regulations are co-existing in the market. Therefore, the setting suits to reveal firm preferences. I show that approximately 75% of hedge accounting applicants opt for IFRS 9. IFRS 9 hedge accounting users designate significantly more hedging relationships to reduce commodity and interest rate risk exposures and designate fair value hedges on a significantly larger scale. The tremendous increase in hedge accounting for commodity risk exposures might even indicate possible real effects. Additionally, the results show that IFRS 9 users are greater in size and have lower levels of asymmetric information. This work is particularly useful to standard setters and investors, giving insights into the practical implications and consequences of providing the choice between these two standards.

Keywords: IFRS 9; IAS 39; Hedge Accounting; Derivatives; Risk Management

3.1 Introduction

Managing financial risks becomes more and more important to economic entities. The increase in derivative use for risk management activities over the last decades (Panaretou et al., 2013) makes it even more crucial to create and establish an environment in which the management provides understandable and interpretable information to stakeholders. Accounting data that is closely aligned to risk management strategies builds a fundamental basis in such an environment. The new hedge accounting requirements of the International Financial Reporting Standard (IFRS) 9 aims to create such a basis. However, adapting to changes in a firm's regulatory environment is usually associated with benefits and costs, which leads to the research questions R1 and R2 that I analyze in this work: *Which non-financial firms opt for the new IFRS 9 hedge accounting rules?* (R1) and *Do IFRS 9 hedge accounting applicants differ from IAS 39 hedge accounting applicants?* (R2). To address my research question R1, I test whether specific hedge accounting practices and firm characteristics in the period prior to the introduction of IFRS 9 in 2018 (referred to as 'pre-period') are connected to a firm's decision to opt for IFRS 9 hedge accounting. To analyze R2, I test whether specific hedge accounting practices and firm characteristics in the post IFRS 9 introduction period (referred to as 'post-period') are related to a firm's actual application of IFRS 9 hedge accounting. I investigate R1 and R2 using different sets of logistic regression models. I determine hedge accounting practices based on the designation of derivatives as hedging instruments to lower specific risk exposures for which the resulting hedging relationships get hedge accounting treatment.

With the introduction of the International Accounting Standard (IAS) 39[26] in 2005, the International Accounting Standards Board (IASB) accomplished to install a framework for standardized reporting of financial instruments. Financial instruments included in risk management activities can be accounted for at fair value through profit or loss as if they were held for trading or through hedge accounting (McConnell, 2014).[27] Hedge

[26] IAS 39 was issued in 1999 and endorsed in 2004 by the European Union (EU) (Commission Regulation (EC) 2086/2004).

[27] According to IAS 39, para. 72, firms may designate non-derivative financial instruments measured at amortized cost as hedging instruments to hedge foreign currency risk (IAS 39, para. AG95).

accounting aims to reflect a firm's risk management activities in its financial statements (IFRS 9, para. 6.1.1). It allows for simultaneous reporting of changes in the fair values of hedging instruments and hedged items and consequently shows the offsetting evolution in hedging relationships. 'Ordinary' accounting rules often do not allow for simultaneous reporting of income and expenses. The application of hedge accounting is voluntary (IFRS 9, para. 6.1.2). However, hedging instruments, hedged items, and hedging relationships themselves need to meet certain requirements to qualify for a designation as hedging relationships, which are then allowed to be accounted for using the special hedge accounting rules. IAS 39 regulates these criteria in para. 72-88, IFRS 9 in para. 6.2-4. IAS 39 hedge accounting requirements are heavily restricted and highly complex, which is why they were massively criticized (IFRS 9, para. BCE.177), and investors were dissatisfied with the provided disclosure information (McConnell, 2014). The IASB intended to address these critiques. With the issuance of *IFRS 9 Financial Instruments* in 2014, they renewed the accounting of financial instruments and replaced *IAS 39 Financial Instruments: Recognition and Measurement*.[28] The development of IFRS 9 was threefold: the first part concerned classification and measurement, the second impairment, and the third hedge accounting. In addition to the hedge accounting requirements, the IASB improved the disclosure requirements for hedge accounting defined in IFRS 7. For EU entities, IFRS 9 as well as the disclosure amendments (IFRS 7, para. 21A) became effective on 1 January 2018 and the application mandatory from this date onward (IFRS 9, para. 7.1.1-2). The obligation to apply IFRS 9 however, is limited to the parts of 'Recognition and Derecognition', 'Classification', and 'Measurement'. Related to hedge accounting, IFRS 9 defines a special transition period. According to the standard, hedge accounting applicants are allowed to choose, at the initial application of IFRS 9, whether they continue to apply hedge accounting according to the former standard IAS 39 or start applying the new IFRS 9 hedge accounting rules (IFRS 9, para. 7.2.21). Given a firm decides to continue applying IAS 39 hedge accounting at this point in time, it may modify its choice and start applying the new hedge accounting rules of IFRS 9 at the beginning of any reporting period (IFRS 9, para. BC6.104). Once a firm has decided to apply IFRS 9

[28]The EU endorsed IFRS 9 in 2016 (Commission Regulation (EU) 2016/2067).

hedge accounting for the first time, however, it is not allowed to switch back and use IAS 39 hedge accounting again. The option to apply still IAS 39 hedge accounting remains valid until the IASB finalizes its current project on macro hedge accounting (IFRS 9, para. BC6.104).[29] Thus, during the transition period, firms may choose on a firm basis between both regulations, leading to a co-existence of two hedge accounting standards in the market at the same time. Referring to IFRS 7, firms generally have to apply the new disclosure requirements when they first apply IFRS 9. Independent of what hedge accounting standard a firm applies, IFRS 7 is valid in its current version even in case IAS 39 hedge accounting rules are in place (IFRS 7, para. 21A). A transition period as given for IFRS 9 hedge accounting is extraordinary. Typically, the IASB issues a new standard, including a fixed and pre-defined effective date, after which the application of the new standard is mandatory. Potentially, the IASB also enables early adoption. For IFRS 9 hedge accounting, however, the length of the transition period is not yet defined, even though the IASB has already enforced and the EU already endorsed the standard. Firms are truly free to make their choice without any foreseeable time constraints. This unique setting reveals firm preferences concerning their individual hedge accounting practices.

The objectives of this paper are (i) to evaluate the hedge accounting practices of non-financial firms during the extraordinary IFRS 9 transition period, (ii) to define determinants that drive a firm's decision to apply a specific hedge accounting standard, and (iii) to provide insights into the consequences of changes in IFRS hedge accounting to standard setters and investors.

I analyze a hand-collected data set of German non-financial firms listed in DAX30, MDAX, SDAX, or TECDAX during a three-year period from 2017 to 2019 that apply the optional rules on hedge accounting. I choose a German sample because of Germany's economic relevance in the EU. Germany is a strong export country and has a relatively large capital market.[30] The results of my analyses show that none of the investigated firms voluntarily

[29] While micro hedge accounting mainly refers to single hedged items (IAS 39, para. 78, IFRS 9, para. 6.3.1, para. 6.6.1), macro hedge accounting can be applied for risk exposures arising from a portfolio of financial assets or liabilities, see IAS 39, para. 81A, 89A and IASB (2014).

[30] See for example Credit Suisse (2018) and Credit Suisse (2021) as well as `https://de.statista.com/statistik/daten/studie/7055/umfrage/export-von-guetern-aus-den-eu-laendern/`, retrieved on 2021-10-06.

adopted IFRS 9 hedge accounting regulation in the period prior to IFRS 9 introduction. All hedge accounting users applied IAS 39 hedge accounting rules. With the mandatory application of IFRS 9 (except hedge accounting) for reporting periods beginning on or after 1 January 2018, 75% of the firms in the sample started to apply hedge accounting according to the new standard. However, 25% stick to the former standard, IAS 39. The empirical results of this study detect differences between IFRS 9 and IAS 39 hedge accounting applicants in the pre- and post-period. IFRS 9 seems to allow for a more diversified and advantageous application of hedge accounting for non-financial firms. I find strong evidence that a firm's choice to opt for the new hedge accounting rules is associated with the extended designation possibilities given in IFRS 9 and being applied by non-financial firms, as well as with firm size and leverage. My results suggest that IFRS 9 hedge accounting applicants are able to designate particularly more hedging relationships to reduce commodity and interest rate risk exposures. Hedging against commodity risk is particularly important for non-financial firms (Eierle, Hartleib & Prinz, 2021). The results might even indicate possible real effects associated with the accounting change in the post-period. Moreover, the results show that IFRS 9 applicants use more fair value hedges, are greater in size, and have less information asymmetries. On the one hand, the results of this work give standard setters and regulators an overview of the status quo on current hedge accounting practices. On the other hand, possible real effects arising from different accounting standards might help investors and other stakeholders better interpret disclosed risk management information in annual reports. In addition, accounting numbers that are more aligned to risk management strategies allow for more conclusive interpretations and a more profound understanding, potentially providing a competitive advantage to attract more investors.

Prior empirical studies rather focus on determinants that drive firms' decision to apply hedge accounting in general (e.g., Glaum & Klöcker, 2011; Pierce, 2020) or effects that result from adopting hedge accounting rules (e.g., Panaretou et al., 2013; Köchling & Posch, 2018). There is only little research on differences between hedge accounting standards. Müller (2020) already highlights consequences of cash flow hedge accounting on portfolio earnings of firms by differentiating between IAS 39 and IFRS 9 hedge accounting. The

author uses a simulation approach. To my knowledge, no study to date empirically analyzes these differences and their consequences. The content of this work is timely and of high interest since the possibility for firms to freely choose between two hedge accounting standards holds only until the IASB finalizes the IFRS 9 macro hedging project (IFRS 9, para. BC6.104). Since firms apply both standards simultaneously, the setting promises a unique opportunity to reveal firm preferences. Revealing firm preferences would not be possible if firms had to obligatorily apply the new hedge accounting rules of IFRS 9. Thus, this study contributes to the existing literature on derivative accounting and derivative accounting policy changes and their influence on firms' risk management strategies and hedging practices. Practical implications from this study allow conclusions whether the IASB succeeded with its objective to align hedge accounting and risk management (Lloyd, 2014; McConnell, 2014; BDO IFR Advisory Limited, 2014). Moreover, it might give guidance to the standard setters regarding the upcoming regulatory change in macro hedging. Switching costs related to a change in hedge accounting rules might also be relevant for future changes in other accounting standards.

The paper is structured as follows. Section 3.2 develops predictions for the two research questions based on the institutional setting during the transition period and gives an overview of related academic research. Section 3.3 presents the research design including sample selection, variables, and used method. In Section 3.4, I present descriptive findings and empirical results. Finally, Section 3.5 concludes.

3.2 Predictions Development and Prior Literature

This work contains two main research questions: *Which non-financial firms opt for the new IFRS 9 hedge accounting rules?* (R1) and *Do IFRS 9 hedge accounting applicants differ from IAS 39 hedge accounting applicants?* (R2). R1 refers to the pre-period, the period prior to the introduction of IFRS 9 in 2018. R2 refers to the post-period, the period after the IFRS 9 introduction. To analyze these research questions, I develop predictions based on the specific institutional setting according to the hedge accounting requirements of IAS 39 and IFRS 9 and on firm characteristics. Due to the novelty of

this subject, concerning firm characteristics, I rather conduct a determinant analysis and explore predictions. Table 3.1 provides a brief summary of main differences between IAS 39 and IFRS 9 hedge accounting requirements. The section concludes with an overview of relevant prior literature.

Table 3.1: Main differences between IAS 39 and IFRS 9 hedge accounting requirements

	Requirements according to IAS 39	Requirements according to IFRS 9
Hedging instruments		
Non-derivative financial assets/liabilities	limited to hedges of foreign currency risks	not limited
Accounting of the non-designated part of the financial instrument in case of partial designation through	profit or loss (P&L)	other comprehensive income (OCI)
Hedged items		
Component of an exposure	limited to financial hedged items and non-financial hedged items for foreign currency risks	not limited
Aggregated exposures	no	yes
Effectiveness testing		
Measures	mainly quantitative	mainly qualitative
Manner	prospective and retrospective	prospective
Hedge ratio	80% - 125%	none
Rebalancing[31]	no	yes
Discontinuation of hedging relationships		
Voluntarily	yes	no
Partly	no	yes

Notes: The table summarizes the main differences between IAS 39 and IFRS 9 hedge accounting. I do not consider minor differences and identical hedge accounting requirements of the two standards. For further details, please see the main part of this work and the respective standards.

3.2.1 Predictions Development

3.2.1.1 Which non-financial firms opt for the new IFRS 9 hedge accounting rules?

Standard setters often grant accounting choices and transitional regulations with the issuance of new accounting standards (Wagenhofer & Ewert, 2015). Particularly, accounting standards that greatly impact a firm's assets, liabilities, financial position, and profit or loss are accompanied by such special treatment (Wagenhofer & Ewert, 2015). The definition of *accounting choice* can be very broad (Fields et al., 2001; Francis, 2001). To define the term more precisely, Francis (2001) distinguishes between several decision-makers, that might be managers, auditors, standard setters, etc., and the nature of choice they have. In this work, aligned to one possible definition given in Francis (2001), I determine accounting choices to be choices among equally acceptable accounting rules for which managers are responsible. Specific choices often lead to different accounting outcomes. What motivates firms to elect specific accounting choices instead of others? Morris (1987) names two basic theories in relation to accounting policy choices: the agency theory (Jensen & Meckling, 1976) and the signaling theory (Spence, 1973). In the context of this work, the conflict of interests, the principal-agent problem, arises from separating management and ownership of a firm. The crucial assumptions of the agency theory imply, and the basic assumption of the signaling theory is, information asymmetry between the parties (Morris, 1987). By choosing a particular accounting rule, managers provide information to investors (owners) through accounting numbers that are influenced by their choice (signal) and present the firm's economic situation in a way they want it to be presented. A signal can only be credible if generating the signal is associated with different costs for different entities (Wagenhofer & Ewert, 2015). With the application of voluntary but highly complex hedge accounting rules itself, the management signals that it is important to the firm to hedge their risk exposures and, in addition, to make their

[31] The concept of *rebalancing* (IFRS 9, para. 6.5.5) is initially introduced by IFRS 9. Rebalancing allows firms to remain with a hedging relationship even if it no longer meets hedge effectiveness requirements. However, the concept of rebalancing is limited to adjustments of designated quantities of the hedging instrument or the hedged item of an existing hedging relationship (IFRS 9, para. B6.5.7). For further details, please see IFRS 9, para. B6.5.8-21.

hedging activities visible to investors. The cost associated with the application of hedge accounting arises from several aspects. To name a few, firms have to invest in expertise. Firms need employees with specialist knowledge in hedge accounting and resources to adapt existing IT accounting systems (Füllbier & Scharf, 2017). Firms must disclose hedge accounting information as defined in the requirements of the respective standard (Comiskey & Mulford, 2008). The cost of hedge accounting application and the benefit of the accounting offset between hedging instrument and hedged item and/or presenting risk management strategies to investors through hedge accounting differ between firms, which is why not all firms apply these rules even if they enter derivative contracts to reduce their risk exposure ideally. The transitional regulations of IFRS 9 contain additional accounting choices. As described in Section 3.1, hedge accounting applicants can choose between the equally acceptable hedge accounting requirements of IAS 39 and IFRS 9. Either way, if firms apply hedge accounting, they are interested in the accounting offset or in making their hedging activities visible to investors. However, the given sets of rules are not equally suitable for hedging relationships of non-financial firms. IAS 39 confronts non-financial firms with highly restrictive requirements that either lead firms to refuse the application of hedge accounting at all or at least for specific risk exposures or to accept higher ineffectiveness recognized in profit or loss. One of the main reasons seems to be the unfavorable regulation of hedge accounting for non-financial items. Firms have to designate non-financial items in their entirety. IAS 39, para. 82 allows the designation of separate risk components only for foreign currency risks. When designating non-financial hedged items for commodities or interest rates, firms have to accept a compromise between the benefit of applying hedge accounting to these hedging relationships and the cost of ineffectiveness. For example:[32] A firm enters a contract to purchase aluminum cans. The main component of these cans is the metal aluminum. Their price is mainly built on the London Metal Exchange (LME) for standard aluminum. Though, several other components such as a quality premium or discount of the metal used as well as delivery costs are included in the final price of these cans. To hedge the price risk of aluminum, firms could enter LME futures or forwards. IAS 39 permits the designation of the alu-

[32]The example is taken from Pricewaterhouse Coopers (2017b, p. 19).

minum cans as hedged items only in their entirety. Designating only the separate LME component is prohibited. Thus, ineffectiveness arises from the components included in the hedged item but not incorporated in the hedging instrument. IFRS 9 advantageously extends the hedge accounting requirements, particularly useful for non-financial firms. It allows for the designation of single risk components of non-financial hedged items (IFRS 9, para. 6.3.1, 6.3.7). Referring to the example, with IFRS 9, it is possible to designate the separated LME component solely as the hedged item. Consequently, ineffectiveness should be reduced. Hence, the new hedge accounting requirements enlarge the designation possibilities especially for risk exposures arising from commodity prices and interest rates. Regarding foreign currency risk exposures, IAS 39 already provides enlarged possibilities. Based on these considerations, I expect a firm that applies the rather unsuitable rules of IAS 39 hedge accounting related to commodity price and interest rate risk exposures to opt for IFRS 9 hedge accounting. Moreover, I expect a firm that applies IAS 39 hedge accounting to a relatively high extent to benefit even more from extended designation possibilities coming with IFRS 9 and to opt for IFRS 9 hedge accounting. In addition, I expect that firms for which IAS 39 is either suitable enough related to their hedging relationships or too costly to apply, the benefits of IFRS 9 hedge accounting would probably not outweigh the costs because of limited need and interest in displaying risk management strategies through hedge accounting. Therefore, I predict the following[33]

R1-P1 Non-financial firms with more designated hedging relationships opt for IFRS 9 hedge accounting.

R1-P2 Non-financial firms with more designated hedging relationships for commodity price risk exposures opt for IFRS 9 hedge accounting.

R1-P3 Non-financial firms with more designated hedging relationships for interest rate risk exposures opt for IFRS 9 hedge accounting.

R1-P4 Non-financial firms with more designated hedging relationships for foreign exchange rate risk exposures do not opt for IFRS 9 hedge accounting.

Generally, a firm can hedge commodity price, interest rate, and foreign exchange rate risk

[33] In the following, I use the term *hedging relationship* indicating that a firm applies hedge accounting to the hedging relationship.

with either fair value hedges or cash flow hedges, dependent on what risk it is willing to hedge. With fair value hedges, a firm hedges the exposure to changes in the fair value of a recognized asset or liability or an unrecognized firm commitment (IAS 39, para. 86 (a) and IFRS 9, para. 6.5.2 (a)). With cash flow hedges, a firm hedges the exposure to variability in cash flows that is attributable to a particular risk associated with a recognized asset or liability or a highly probable forecast transaction (IAS 39, para. 86 (b) and IFRS 9, para. 6.5.2 (b)). Of course, a firm decides about the type of the hedging relationship[34] based on the hedged item itself, but more importantly on the fact whether it wants to hedge fair values or cash flows. In line with R1-P1, I predict that

R1-P5 Non-financial firms with more designated fair value hedges opt for IFRS 9 hedge accounting.

R1-P6 Non-financial firms with more designated cash flow hedges opt for IFRS 9 hedge accounting.

In addition to fair value and cash flow hedges, the third type of hedging relationships are hedges of a net investment in a foreign operation. Based on the institutional setting, I do not make any directional prediction here:

R1-P7 Non-financial firms that opt for IFRS 9 hedge accounting differ regarding designated hedges of a net investment in a foreign operation.

Besides the institutional aspects of the specific hedge accounting requirements, also firm characteristics might play an essential role in managers' decisions to opt for IFRS 9 hedge accounting or not. Firm size and financial leverage are traditional measures in the research of accounting policy choice (Skinner, 1993). The positive accounting theory[35] states that large firms are highly associated with political costs, i.e., wealth redistribution (Watts & Zimmerman, 1978). According to the political cost hypothesis of Watts & Zimmerman

[34]IAS 39 and IFRS 9 adhere to the same types of hedging relationships. Both standards distinguish between fair value hedges, cash flow hedges, and hedges of a net investment in a foreign operation. The types of hedging relationships are defined and described in IAS 39, para. 89, 95-99, 102 and IFRS 9, para. 6.5.8, 6.5.11, 6.5.13-14.

[35]The term 'positive accounting theory' originates from Watts & Zimmerman (1978). Using this term, the authors aimed to differentiate their work from traditional normative theories. According to the positive accounting theory, the objective of accounting theory is to explain and predict accounting choices (Watts & Zimmerman, 1990).

(1990), which originates from the positive accounting theory, larger firms tend to apply profit-decreasing accounting choices to avoid political attention. IAS 39 and IFRS 9 hedge accounting rules partly differ in aspects that affect profit or loss. Generally, both standards intend the designation of hedging instruments in their entirety (IAS 39, para. 74, IFRS 9, para. 6.2.4). Nevertheless, IAS 39, para. 74(a) as well as IFRS 9, para. 6.2.4(a) allow, e.g., to separate the intrinsic and the time value of an option contract and to only designate the intrinsic value as hedging instrument.[36] The crucial difference between IAS 39 and IFRS 9 in this context is the accounting of the non-designated part of the financial instrument. Given the option contract mentioned above, this refers to the time value of the option (IAS 39, para. 74(a), IFRS 9, para. 6.5.15).[37] While IAS 39, para. 95-96 determine to recognize the non-designated part in profit or loss, IFRS 9, para. 6.5.15-16 require to recognize it in other comprehensive income (OCI).[38] Since the non-designated part of a hedging instrument certainly affects profit or loss under IAS 39 but not under IFRS 9 hedge accounting, I expect that

R1-P8 Non-financial firms with greater size opt for IFRS 9 hedge accounting.

Risk management theory states that firms have incentives to reduce their risk (Guay, 1999). To reduce their risk exposure and, thus, their financial distress costs, firms use hedging strategies (Smith & Stulz, 1985). Economic hedging strategies are not directly visible in a firm's financial statements. In order to make hedging activities visible in a firm's statement of profit or loss and thus, more transparent to the public, firms apply hedge accounting. IFRS 9 hedge accounting aims to accompany corporate risk management more closely (Lloyd, 2014; McConnell, 2014; BDO IFR Advisory Limited, 2014), allows for more designation possibilities of hedging relationships and is preferable to decrease earnings volatility in terms of profit or loss. Since a reduction in earnings volatility

[36] More exceptions exist: IAS 39, para. 74(b) as well as IFRS 9, para. 6.2.4(b) allow to separate the forward and spot element of a forward contract and only designate the spot element as hedging instrument. According to IFRS 9, para. 6.2.4(b), also the currency basis spread might be separated from the financial instrument.

[37] When referring to forward contracts and foreign currency basis spreads of financial instruments, the non-designated part would be the forward element (IAS 39, para. 74(b) and IFRS 9, para. 6.5.16) or the foreign currency basis spreads (IFRS 9, para. 6.5.16).

[38] With this new idea of accounting for the non-designated part, IFRS 9 introduces the cost of hedging concept. This approach interprets the non-designated part as a premium for risk protection (IFRS 9, para. BC6.389; Ramirez, 2015).

is even more important to firms with higher levels of financial distress (Smith & Stulz, 1985), I expect that

R1-P9 Non-financial firms with more leverage opt for IFRS 9 hedge accounting.

Market imperfections make volatility costly (Guay & Kothari, 2003; Panaretou et al., 2013). A major goal of hedge accounting is to lower earnings volatility by simultaneously recording changes in the fair values of hedging instruments and hedged items in the statement of profit or loss. In the absence of hedge accounting, they need to be accounted for according to 'ordinary' accounting rules. Derivatives that do not get hedge accounting treatment are accounted for as if they were held for trading, and changes in fair values are recognized through profit or loss (McConnell, 2014). Thus, 'ordinary' accounting leads to higher earnings volatility due to the timely unmatched recognition of changes in fair values of hedging instruments and hedged items through profit or loss. Consequently, hedge accounting per se should lower earnings volatility. However, as already mentioned before, IAS 39 hedge accounting requirements often cause earnings volatility through ineffectiveness in hedging relationships. IFRS 9 addresses this downside. Therefore, I expect that

R1-P10 Non-financial firms with higher earnings volatility opt for IFRS 9 hedge accounting.

As described above, the agency theory (Jensen & Meckling, 1976), as well as the signaling theory (Spence, 1973), are highly related to information asymmetry. To reduce information asymmetries, the management should understandably provide accounting information to be correctly interpretable by investors. The framework given by the standard setter is decisive in achieving this objective. IAS 39 hedge accounting was heavily criticized due to restrictive rules (IFRS 9, para. BCE.177) resulting in misrepresentation of firms' risk management strategies (Ernst & Young, 2016; Pricewaterhouse Coopers, 2016). Therefore, the IASB sought to adjust the rules to align hedge accounting more closely to risk management activities (Lloyd, 2014; McConnell, 2014; BDO IFR Advisory Limited, 2014). Moreover, they extended the disclosure requirements of IFRS 7 regarding hedge accounting. These requirements are valid and mandatory for all hedge accounting

applicants from the time of the first IFRS 9 application (1 January 2018) onward (IFRS 9, para. BC6.104, IFRS 7, para. 21A). By doing so, information asymmetry should be decreased due to IFRS 9 specific rules on hedge accounting on the one hand and less scope for individual interpretation on the other hand. However, the latter should be of minor importance here. I use bid-ask spreads to proxy information asymmetry. It is a widely used measure, see e.g., Welker (1995), Healy et al. (1999), Leuz & Verrecchia (2000), Daske et al. (2008), Muller et al. (2011), Fu et al. (2012). I predict that

R1-P11 Non-financial firms with higher information asymmetries opt for IFRS 9 hedge accounting.

Firms with higher growth opportunities rely on funding for profitable future investments. However, growth firms often face difficulties raising external funding due to information asymmetries concerning future projects (Froot et al., 1993). To lower the cost of external financing and to prevent underinvestment, growth firms prefer less volatile earnings (Barton, 2001). Derivatives that are treated in hedge accounting support this purpose (Eierle et al., 2021). As described above, IFRS 9 aims to reduce earnings volatility. Therefore, I expect that

R1-P12 Non-financial firms with higher growth opportunities opt for IFRS 9 hedge accounting.

Ownership structure might also impact firms' financial reporting practices (Healy & Palepu, 1993) and thus their decision to opt for the new hedge accounting standard. Healy & Palepu (1993) argue that ownership concentration reduces information asymmetries between managers and shareholders. Large shareholders play an active role in a firm's corporate governance processes and are closely related to the management (Healy & Palepu, 1993). Hence, they should know the firm's risk. Therefore, managers possibly have no incentive or need to provide information via hedge accounting, which aligns the firm's financial reporting more closely to its risk management strategies because large shareholders are aware of that. Since IFRS 9 aims to align hedge accounting more closely to a firm's risk management strategy, I expect this to be mainly important to firms that have a highly dispersed ownership structure and that have to use official and publicly

accessible information and communication channels to disclose risk management relevant information to their shareholders. I expect that

R1-P13 Non-financial firms with lower ownership concentration opt for IFRS 9 hedge accounting.

3.2.1.2 Do IFRS 9 hedge accounting applicants differ from IAS 39 hedge accounting applicants?

Aligned to the predictions development of research question R1, R1-P1 to R1-P13, I evolve the predictions regarding research question R2 in this paragraph. The numbering P1 to P13 refers to the identical hedge accounting-related variables and firm characteristics described for R1. Specific firm characteristics, e.g., ownership structure, are obviously related in the pre- and post-period. These firm characteristics are not necessarily affected by a firm's decision to opt for IFRS 9 hedge accounting or not. Even though the relation of specific firm characteristics in pre- and post-period might enable an implicit formulation of the predictions, I explicitly develop and formulate them for R2. Thus, a better overview and a clearer structure are provided.

As mentioned in Section 3.2.1.1, applying hedge accounting is a costly signal for a firm to make its risk management activities visible to external stakeholders. Switching from IAS 39 to IFRS 9 hedge accounting is again associated with costs. Firms are only willing to invest resources, like money, workforce, etc., if it is worth it. The extended designation possibilities improve the alignment of hedge accounting to a firm's risk management (e.g., Lloyd, 2014; McConnell, 2014; BDO IFR Advisory Limited, 2014). IFRS 9 allows to designate a group of items as hedged items (IFRS 9, para. 6.3.1(b)), independent of the proportionality criterion which is given in IAS 39, para. 83, as well as aggregated exposures (IFRS 9, para. 6.3.4). According to the standard, an aggregated exposure combines a possible hedged item as described in IFRS 9, para. 6.3.1 and a derivative (IFRS 9, para. 6.3.4). Moreover, IFRS 9, para. 6.3.1, 6.3.7 allow designating single risk components of non-financial hedged items for all kinds of risk exposures, not only for foreign currency risks as restricted in IAS 39, para. 82. As already mentioned, the designation of single risk components of non-financial items might be especially advantageous for non-financial

firms in terms of commodity price risk and interest rate risk and lowers the recognition of undesired ineffectiveness in profit or loss. Moreover, less restrictive rules on effectiveness testing and the possibility of rebalancing might make the application of hedge accounting even more advantageous.[39] However, a potential burden of IFRS 9 hedge accounting might be that firms are no longer allowed to voluntarily discontinue hedging relationships (IFRS 9, para. 6.5.6). Nevertheless, I expect the potential advantages to outweigh this burden. Based on the development of the predictions R1-P1 to R1-P4 and the new designation possibilities in IFRS 9, I predict the following for the post IFRS 9 introduction period

R2-P1 IFRS 9 hedge accounting applicants designate more hedging relationships compared to IAS 39 hedge accounting applicants.[40]

R2-P2 IFRS 9 hedge accounting applicants designate more hedging relationships for commodity price risk exposures.

R2-P3 IFRS 9 hedge accounting applicants designate more hedging relationships for interest rate risk exposures.

R2-P4 IFRS 9 hedge accounting applicants differ regarding designated hedging relationships for foreign exchange rate risk exposures.

Concerning the types of hedging relationships, IFRS 9, para. 6.6.1(a)-(b) allow groups of items as hedged items in fair value hedges. Especially the possibility of designating a group of hedged items constituting net positions (IFRS 9, para. B6.6.7) widens the application of fair value hedges. In terms of cash flow hedges, IFRS 9, para. 6.6.1(c) restricts the hedge of a net position to foreign currency risk (IFRS 9, para. B6.6.7).

[39] IFRS 9 emphasizes the economic relationship between the hedging instrument and the hedged item (IFRS 9, para. 6.4.1(c)(i)) and neglects quantitative effectiveness testing. While IAS 39 requires hedge accounting applicants to assess effectiveness testing prospectively and retrospectively and the hedge ratio to lie within the range of 80% and 125% (IAS 39, para. AG105), IFRS 9 demands only prospective testing (IFRS 9, para. B6.4.12) and does not require the hedge ratio to meet a specific range. The hedge ratio is "the relationship between the quantity of the hedging instrument and the quantity of the hedged item in terms of their relative weighting", see the Appendix of IFRS 9. Rebalancing allows firms to adjust quantities of hedging instruments or hedged items of existing hedging relationships. This concept allows firms to remain with a hedging relationship even if it no longer meets hedge effectiveness requirements (IFRS 9, para. 6.5.5).

[40] All the predictions R2-P1 to R2-P13 refer to the relation with IAS 39 hedge accounting applicants. For the sake of brevity, I do not explicitly formulate the comparison in all predictions but only exemplary in R2-P1.

Under IAS 39, net positions do not qualify for hedge accounting (IAS 39, para. 84). In line with R2-P1, I predict

R2-P5 IFRS 9 hedge accounting applicants designate more fair value hedges.

R2-P6 IFRS 9 hedge accounting applicants designate more cash flow hedges.

I again refrain from making any directional prediction regarding hedges of a net investment in a foreign operation:

R2-P7 IFRS 9 hedge accounting applicants differ regarding designated hedges of a net investment in a foreign operation.

The following predictions refer again to specific firm characteristics. The positive accounting theory states that large firms are highly associated with political costs (Watts & Zimmerman, 1978). According to the political cost hypothesis of Watts & Zimmerman (1990), larger firms tend to apply profit-decreasing accounting choices. IFRS 9 hedge accounting rules tend to affect profit or loss less likely. The cost of hedging approach (IFRS 9, para. 6.5.15-16) on the one hand and the extended designation possibilities for non-financial items (IFRS 9, para. 6.3.7) on the other hand are the main drivers to reduce earnings volatility. Thus, applying IFRS 9 hedge accounting rules implies less impact on profits. I expect that

R2-P8 IFRS 9 hedge accounting applicants are greater in size.

Risk management theory states that firms have incentives to reduce their risk (Guay, 1999). Hedging helps to reduce risk and, thus, financial distress costs (Smith & Stulz, 1985). Economic hedging strategies are not directly visible in a firm's financial statements. Hedge accounting, per se, aims to present risk management strategies in financial reporting. As described above, compared to IAS 39, IFRS 9 might be more suitable to align hedge accounting more closely to a firm's risk management and to reduce earnings volatility further. Especially for firms with higher levels of financial distress, reducing earnings volatility is important (Smith & Stulz, 1985). Therefore, I expect that

R2-P9 IFRS 9 hedge accounting applicants are more levered.

According to corporate risk management theory, in imperfect markets, volatility is costly

(Guay & Kothari, 2003; Panaretou et al., 2013). Generally, hedge accounting aims to reduce earnings volatility by simultaneously recording changes in the fair values of hedging instruments and hedged items in the income statement. Nevertheless, hedging relationships still affect profit or loss and make earnings volatile, even though to a much lesser extent than under 'ordinary' accounting rules. Under IAS 39, hedging relationships often affect profit or loss because restricted designation possibilities lead to increased ineffectiveness recognized in profit or loss. With IFRS 9, the IASB developed hedge accounting rules which influence profit or loss less likely. The new opportunities of designating separate components of non-financial items as hedged items (IFRS 9, para. 6.3.7) diminish ineffectiveness arising from components that could be included in the hedged item but are not included in the hedging instrument. Moreover, with the new cost of hedging concept, IFRS 9, para. 6.5.15-16 recognize the non-designated part of hedging instruments (e.g., the time value of an option contract of which only the intrinsic value is designated as hedging instrument) in OCI and not in profit or loss as determined in IAS 39, para. 95-96. Therefore, I expect that

R2-P10 IFRS 9 hedge accounting applicants have less volatile earnings.

Agency theory (Jensen & Meckling, 1976) and signaling theory (Spence, 1973) are highly related to information asymmetry. With IAS 39 hedge accounting rules, asymmetric information between managers and investors exists because of restrictive (IFRS 9, para. BCE.177) and unfavorable rules, especially for non-financial firms. On the one hand, IAS 39 leaves room for individual interpretation due to misrepresented risk management strategies in the accounting outcome. On the other hand, non-financial firms with exposures to commodity price and interest rate risk suffer from undesired ineffectiveness recognized in profit or loss. The new possibility to designate non-financial items in hedging relationships (IFRS 9, para. 6.3.7) aligns financial reporting more closely to a firm's risk management. Thus, IFRS 9 hedge accounting should decrease information asymmetries between the management and the investors. Since credible signaling is costly (Wagenhofer & Ewert, 2015), firms would only have opted for the new accounting policy if information asymmetries were relatively high prior to the accounting change due to unfavorable accounting rules. When analyzing information asymmetries, also IFRS 7 is

not negligible. IFRS 7 is valid for all hedge accounting applicants from the time of the first IFRS 9 application (1 January 2018) onward. Hence, differences in the reduction in information asymmetry should not be primarily driven by the extended disclosure requirements of IFRS 7. Thus, the analysis should show whether the IASB succeeded with its objective to reduce information asymmetry by introducing new IFRS 9 hedge accounting requirements. Therefore, I expect that

R2-P11 IFRS 9 hedge accounting applicants have less information asymmetries.

Firms with growth opportunities prefer lower earnings volatility. This is mainly due to high asymmetric information among managers of growth firms and investors. Future projects of growth firms are likely to be less assessable, making external financing costly (Froot et al., 1993). Derivatives treated in hedge accounting (Eierle et al., 2021) and less volatile earnings help to reduce the cost of external financing and to prevent underinvestment (Barton, 2001). As described above, IFRS 9 hedge accounting rules are even more beneficial in reducing earnings volatility than are the rules of IAS 39. Therefore, I expect that

R2-P12 IFRS 9 hedge accounting applicants have higher growth opportunities.

The ownership structure is related to firms' financial reporting practices (Healy & Palepu, 1993). Ownership concentration reduces information asymmetries between managers and shareholders because large shareholders play an active role in a firm's corporate governance processes and are closely related to the management (Healy & Palepu, 1993) and to the risk the firm is facing. Thus, aligning hedge accounting more closely to risk management strategies, as IFRS 9 aims to do, should be mainly important to firms with a highly dispersed ownership structure. I expect that

R2-P13 IFRS 9 hedge accounting applicants have lower ownership concentration.

3.2.2 Prior Literature

My research questions include two main aspects: First, how do hedge accounting standards influence firms' hedging activities, and second, what firm characteristics determine

the application of a new hedge accounting standard. I base my empirical analyses on the designation of derivatives as hedging instruments in hedging relationships. Hence, relevant academic literature to the first aspect includes research on financial derivative accounting, primarily related to changes in derivative accounting and its influence on firms' risk management activities. The second aspect addresses a broader range of literature. It combines research on hedging and hedge accounting and voluntary disclosure since applying the new hedge accounting rules of IFRS 9 is not obligatory.

Specific requirements that are defined in the accounting standards on fair value reporting of derivatives as well as on hedge accounting influence firms' risk management strategies and hedging activities (e.g., Glaum & Klöcker, 2011; Lins et al., 2011). Especially theoretical studies often conclude that the underlying accounting regime leads to suboptimal hedging (e.g., DeMarzo & Duffie, 1995; Melumad et al., 1999; Chen et al., 2013) and potentially misleads investors' interpretation of derivative use in firms (Campbell et al., 2019). Melumad et al. (1999) investigate in their theoretical study the impact of different hedge accounting methods, i.e., fair value and cash flow hedge accounting, and the alternative of no hedge accounting on managers' hedging decisions. The authors show that the accounting regulation impacts managers' hedging decisions. The underlying accounting standard for this work is the Statement of Financial Accounting Standards (SFAS) 133.[41] The results illustrate that managers' hedging decisions are not optimal economic decisions if they do not apply hedge accounting. In contrast, the theoretical work of DeMarzo & Duffie (1995) implies that managers reduce risk through hedging activities more efficiently if they do not have to disclose this information according to the accounting standard. Besides the theoretical work in this field of research, there is also empirical evidence on the influence of financial reporting on managers' hedging behavior. Lins et al. (2011) conducted a survey study using data from 2005. They examine the responses of CFOs of international public and private firms concerning changes in their risk management policies after the introduction of fair value reporting for financial derivatives according to IAS 39 and SFAS 133 (ASC 815). The study results indicate that fair value report-

[41] SFAS 133 'Accounting for Derivative Instruments and Hedging Activities' is issued by the Financial Accounting Standards Board (FASB) and is applied by firms using United States Generally Accepted Accounting Principles (US GAAP). The original standard FAS 133 refers to FASB's accounting standard codification (ASC) 815.

ing influences firms' hedging behavior in a way that economic hedging is compromised. However, Panaretou et al. (2013) emphasize in their empirical work that the advantage of applying hedge accounting overrules the alleged disadvantage arising from suboptimal hedging strategies (Panaretou et al., 2013). Another survey study is performed by Glaum & Klöcker (2011). The authors analyze whether non-financial firms apply IAS 39 hedge accounting and, if so, how the application influences a firm's hedging behavior. They conducted the study in 2007/08 with German and Swiss stock-listed firms. The results show that most firms (72%) hedge financial risks using derivatives they treat in hedge accounting. Moreover, the authors find evidence of the impact of hedge accounting on the hedging behavior of surveyed firms. Their results indicate that firms are willing to accept higher financial risk exposures if it ensures them the possibility to apply the specific hedge accounting rules. In addition, Glaum & Klöcker (2011) assume that less complex rules on hedge accounting might encourage the application of hedge accounting in non-financial corporations more. In line with that, Pierce (2020) highlights in his study that compliance costs and limitations related to SFAS 133 (ASC 815) particularly influence the use of hedge accounting. In his paper, Pierce (2020) examines the determinants of hedge accounting usage through SFAS 161[42] disclosure data. His sample consists of non-financial firms listed in the S&P 500 during a five-year period, from 2008 to 2012. He uses an ordinary least squares (OLS) regression to model the extent to which firms designate derivatives they hedge account for. In contrast to my study, he models the use of hedge accounting per se using variables on firm characteristics and derivative contract specifics. In a simulation study conducted by Müller (2020), the author examines and compares portfolio earnings of cash flow hedges under IAS 39 and IFRS 9 hedge accounting rules, respectively. Her results show that diverse accounting rules lead to different earnings and that IFRS 9 hedge accounting might lead to less earnings volatility. I contribute to this first stream of literature by analyzing two hedge accounting standards co-existent in the market. In doing so, I try to expose how different hedge accounting requirements might affect firms' risk management activities and possibly lead to real effects. My work differs

[42]SFAS 161 regulates 'Disclosures about Derivative Instruments and Hedging Activities' and represents an amendment to SFAS 133 'Accounting for Derivative Instruments and Hedging Activities'. Both standards are issued by the FASB and are applied by firms using US GAAP. As for FAS 133, ASC 815 also refers to FAS 161.

from the studies mentioned above as it analyzes the voluntary application of a specific set of accounting requirements, i.e., IFRS 9 hedge accounting, that are equally acceptable and have the same purpose as IAS 39 hedge accounting requirements with empirical data. The ongoing transition period suits to reveal firm preferences regarding hedge accounting practices.

Prior research on firm characteristics influencing a firm's decision to apply a new hedge accounting standard comprises several research streams. Prior studies on voluntary disclosure find a positive relation to firm size (e.g., Leuz & Verrecchia, 2000). Studies on IFRS reporting in Germany also show that firm size is positively associated with voluntary IFRS adoption (e.g., Gassen & Sellhorn, 2006; Kim & Shi, 2012) and hedge accounting application (Glaum & Klöcker, 2011). Voluntary disclosure is also associated with financial distress (Leuz & Verrecchia, 2000). Geyer-Klingeberg et al. (2019) analyze leverage as a hedging determinant in their meta-regression analysis as it is a widely used proxy for financial distress. They find a positive association between a firm's leverage and its level of risk exposure and financial distress costs. In their empirical study of firms from the United Kingdom (UK), Panaretou et al. (2013) find evidence that hedge accounting reduces asymmetric information and makes earnings more predictable. Ranasinghe et al. (2022) underline this finding for a US sample with firms of the oil-and-gas and airlines industries. Pierce (2020) provides evidence that hedge accounting actually decreases earnings volatility and Müller (2020) even shows that IFRS 9 might lead to less earnings volatility compared to IAS 39 hedge accounting. Moreover, firms with growth opportunities are more likely to apply hedging (Geczy et al., 1997; Choi et al., 2013) and hedge accounting (Glaum & Klöcker, 2011). Referring to the ownership structure of a firm, academic literature finds a positive association between voluntary disclosure and the level of institutional ownership (Healy et al., 1999). However, Lins et al. (2011) show that ownership sophistication is not necessarily associated with the application of hedge accounting. In line with that, Marshall & Weetman (2007) argue that a higher degree of insider ownership is associated with lower levels of disclosure. In addition, prior research finds a positive relation between voluntary early IFRS adoption and ownership concentration (Muller et al., 2011). Glaum & Klöcker (2011) find no significant differences

in ownership concentration between hedge accounting applicants and non-applicants. I contribute to this second stream of literature by determining factors that might influence firms' decision to opt for the new hedge accounting requirements of IFRS 9 or not. Besides hedging and hedge accounting-related aspects, these factors include firm characteristics. Compared to the above-mentioned studies, I compare two specific hedge accounting requirements, i.e., IFRS 9 and IAS 39. Hence, firm preferences regarding hedge accounting practices are revealed, given the individual firm characteristics.

To my knowledge, empirical academic work on IFRS derivative accounting changes is scarce. So far, I am not aware of any empirical study employing statistical analyses to investigate the application of IFRS hedge accounting during the transition from IAS 39 to IFRS 9 using the respective IFRS 7 disclosure requirements to measure derivative use of non-financial firms quantitatively. The study of Pierce (2020) is one of the few that uses a US setting with data from SFAS 161 (ASC 815) in which enlarged and reinforced disclosure requirements are defined (Campbell et al., 2019) in order to measure derivative use more precisely. Concerning IFRS hedge accounting, descriptive studies concerning IFRS 9 hedge accounting exist. The authors von Keitz & Grote (2019) analyze 2018 semi-annual reports of German SDAX firms in a content-based analysis regarding IFRS 9. They do not find qualitative information indicating that firms under focus designate more hedging relationships under IFRS 9 compared to IAS 39. Kreß (2019) and Eierle, Hartleib & Prinz (2021) do exploratory research and present descriptive findings. They investigate the hedge accounting practices of German non-financial firms. Kreß (2019) calls attention to restrictions of IAS 39 hedge accounting requirements, Eierle, Hartleib & Prinz (2021) examine whether IFRS 9 succeeds in reducing these restrictions. They base all of their results on descriptive analyses.

3.3 Research Design

3.3.1 Sample

My study is based on the analysis of German non-financial firms listed in DAX30, MDAX, SDAX, or TECDAX. I choose a German sample because of Germany's economic relevance in the EU. Germany is by far the strongest EU export country[43] and has one of the largest capital markets[44] in Europe after UK and France (Credit Suisse, 2018). Therefore, I assume German firms to represent a suitable sample to analyze hedge accounting practices in the EU. I include firm-years from firms that are listed in the indices mentioned above in 2017 and/or 2018 and/or 2019. To examine firms' hedge accounting practices, I hand-collect data from annual IFRS reports to identify hedge accounting applicants and non-applicants as well as to distinguish between applicants following IAS 39 and IFRS 9 hedge accounting requirements. Annual reports are mostly available for download in pdf format on firms' websites. In order to locate the specific paragraphs in which firms inform users of financial statements about their hedge accounting practices, I employ a keyword-based search in the pdf-files using general terms related to hedge accounting like *'hedg'*, *'IAS 39'*, and *'IFRS 9'*. For annual reports published in German language, I add *'risiko'* and *'sicherungs'* to the keywords list. For annual reports published in English language, I add *'risk'* to the keywords list in my search. Based on the paragraphs found through the keyword search, I analyze the defined disclosure sections one by one and extract the individual firm-specific hedge accounting-related information. Firms disclose such information in the notes of annual reports, mostly in a subsection called 'Finanzinstrumente'/ 'Financial Instruments' or similar. Firms inform whether they use hedge accounting or not and, if so, which reporting standard they apply.

Table 3.2 shows the sample composition. Originally, the sample consisted of 540 firm-year observations. Eliminating duplicates originating from TECDAX listings in 2018 and 2019

[43] Detailed information on exports of goods from EU countries can be found on `https://de.statista.com/statistik/daten/studie/7055/umfrage/export-von-guetern-aus-den-eu-laendern/`, retrieved on 2021-10-06.

[44] The ranking is referring to the sizes of stock markets of European countries in 2017. With a share of 3.2%, Germany is third in Europe after UK (6.1%) and France (3.3%) (Credit Suisse, 2018). In 2021, Germany and Switzerland are tied in third place with a share of 2.6% (Credit Suisse, 2021).

leads to 480 firm-year observations.[45] In addition, I exclude observations from financial firms.[46] Financial firms differ substantially from industrial corporations: Their balance sheets are not comparable; they have to comply with special regulations; they have different business activities. Furthermore, financial firms often hedge dynamically (Deutsche Bundesbank, 2019). As described above, the IASB did not yet finalize the IFRS 9 macro hedging project. Therefore, financial firms might stick to IAS 39 hedge accounting also for micro hedges. Moreover, for insurance companies, the obligation to apply IFRS 9 is postponed to 2023-01-01 (Commission Regulation (EU) 2020/2097). In doing so, I last with a first sample of 395 non-financial firm-year observations.[47] This sample serves to analyze the application of hedge accounting among German non-financial firms, see Section 3.4.1. To examine my research questions R1 and R2, I refer to a smaller sample containing only hedge accounting applicants. This sample contains 264 firm-year observations, 90 originate from the pre- and 174 from the post-period. It contains firms with fiscal years equal and unequal to calendar years. In order to make firms' hedging practices comparable even if fiscal years' start and end points differ, I strictly assign fiscal years to the calendar year in which they start.

3.3.2 Variables

Dependent variable

I use a binary variable as the dependent variable for the empirical analyses. Addressing research question R1, the binary variable *IFRS 9 HA* indicates whether hedge accounting applicants in the pre-period decide to opt for IFRS 9 or stay with IAS 39 hedge accounting requirements after the introduction of IFRS 9 in 2018.[48] Thus, the binary variable *IFRS 9 HA* is based on firms' hedge accounting decisions in the post-period. I code *IFRS 9 HA*

[45] In September 2018, Deutsche Börse enabled technology companies listed in TECDAX to access also MDAX and SDAX, leading to an enlargement of the number of firms listed in MDAX from 50 to 60 and in SDAX from 50 to 70 constituents (`https://www.handelsblatt.com/finanzen/maerkte/aktien/aktienindizes-so-sehen-mdax-sdax-und-tecdax-kuenftig-aus/23002476.html?ticket=ST-5821207-TfQrOYcKwzaDVpscc5kI-cas01.example.org`, retrieved on 2021-12-23).

[46] I identify financial firms with their four-digit SIC codes (6000 - 6799) extracted from Datastream (Worldscope) via parameter 'WC19506'.

[47] In the following, I refer to the term 'firm' indicating only non-financial firms.

[48] Table 3.5 shows that there are no firms that early adopted IFRS 9 hedge accounting.

Table 3.2: Sample composition and hedge accounting practices

	Firm-year observations		
	Pre-period (2017)	Post-period (2018-2019)	Total
All	160	380	540
- TECDAX duplicates in 2018 and 2019		-60	-60
- Financial firms	-27	-58	-85
Subtotal	133	262	395
- Non-hedge accounting applicants	-43	-88	-131
Sample	**90**	**174**	**264**
IAS 39 hedge accounting applicants	90	40	130
IFRS 9 hedge accounting applicants	0	134	134

Notes: The table shows the sample composition in the upper part and the hedge accounting practices in the lower part for the pre and post IFRS 9 introduction period from 2017 to 2019 of German listed firms in DAX30, MDAX, SDAX, or TECDAX. The adjusted sample contains 264 firm-year observations.

by 1 if a firm opts for IFRS 9 in 2018 or 2019 and by 0 if it sticks to IAS 39. Whether a firm applies hedge accounting in the post-period for the first time or switches from IAS 39 to IFRS 9 is not taken into account here. Addressing research question R2, the binary variable *IFRS 9 HA* indicates whether hedge accounting applicants actually use the IFRS 9 or IAS 39 hedge accounting requirements in the post-period. If firms apply IFRS 9 hedge accounting, I code *IFRS 9 HA* by 1 and by 0 otherwise.

Independent variables

To test my hypotheses, I use hedge accounting-related variables and firm characteristics. I retrieve static and time series data of the sample firms via Datastream.[49] Measuring derivative use is quite challenging (Campbell et al., 2019). Prior studies use indicator variables (e.g., Allayannis & Weston, 2001; Guay, 1999; Zhang, 2009), notional amounts (e.g., Barton, 2001; Venkatachalam, 1996) or fair values (e.g., Kreß, 2019; Pierce, 2020; Eierle, Hartleib & Prinz, 2021). Based on the detailed disclosure given in the oil-and-gas and airlines industries, Ranasinghe et al. (2022) use specific derivative contract information (e.g., quantity, maturity) to construct their measures. Certainly, measuring hedge

[49] A detailed variable description is appended to this work, see the Appendix A.1.

accounting-related variables depends mainly on the information firms make available in financial reports due to given disclosure requirements. I follow the approach of using fair values.[50] I use the fair values of hedging instruments' gross positions, i.e., the sum of the absolute amounts of assets and liabilities, gathered from manual data collection to construct the hedge accounting-related variables. I collect the data from annual reports. Thus, the amounts are the fair values at fiscal year-end, i.e., at the balance sheet date. I use the term 'hedging instrument' only for derivatives designated as hedging instruments in hedging relationships, for which firms apply hedge accounting. To make the extent of hedge accounting comparable between firms, I deflate the gross positions of hedging instruments by the sum of total assets.[51] Hence,

- *HA Derivatives*$_i$ determines the share of derivative financial instruments that firm i designates as hedging instruments for which it applies hedge accounting relative to firm i's total assets.

I further separate hedging instruments according to the risk category they are designated for to reduce the respective risk exposure:

- *Commodity*$_i$ determines the relative share of designated hedging instruments used to reduce commodity price risk exposure.
- *Interest rate*$_i$ determines the relative share of designated hedging instruments used to reduce interest rate risk exposure.
- *Foreign exchange*$_i$ determines the relative share of designated hedging instruments used to reduce foreign currency risk exposure.

Besides the risk categories mentioned above, I define a residual category *Other*. *Other* contains different risk exposures firms hedge and hedge account for. However, these risk exposures cannot be assigned to the above-mentioned categories.[52] I exclude the residual

[50] The introduction of IFRS 9 was accompanied by extended disclosure requirements regarding hedge accounting determined in IFRS 7, para. 21A-24H. Before the introduction of IFRS 9, the disclosure requirements for hedge accounting were relatively sparse and not very detailed. They also were imprecise in requesting disclosure concerning specific amounts, see IFRS 7 (2017, para. 22-24). However, they explicitly requested the fair values of hedging instruments, see IFRS 7 (2017, para. 22(b)).

[51] A similar approach is used in Kreß (2019) and Eierle et al. (2021).

[52] For example, Bayer AG hedges its employee share program with stock options and stock forwards, see Bayer Annual Report 2019 on p. 210 (`https://www.bayer.com/sites/default/files/2020-11/geschaeftsbericht-2019-der-bayer-ag.pdf`), retrieved on 2020-04-14.

variable *Other* from empirical analyses. For completeness, I include the residual variable though in the descriptive statistics, see Table 3.3.
In addition to the separation by risk category, I separate hedging instruments according to the different types of designated hedging relationships:

- FVH_i determines the relative share of hedging instruments designated by firm i in fair value hedges.
- CFH_i determines the relative share of hedging instruments designated by firm i in cash flow hedges.
- HNI_i determines the relative share of hedging instruments designated by firm i in hedges of net investments in foreign operations.

Unfortunately, firms provide relatively less standardized quantitative information with strongly varying levels of detail. Notably, in 2017, before the IASB included amendments to disclosures of financial instruments used in hedge accounting, annual reports often contain insufficient quantitative information. For empirical analyses, I restrict my sample to observations with sufficient and unequivocal quantitative information concerning the hedge accounting-related variables. Therefore, I include the variables concerning the different risk categories only if the published information contains data on all risk categories individually. I follow the same procedure regarding the variables reflecting the type of designated hedging relationships.
Table 3.3 shows the descriptive statistics of the sample firms. It includes firm characteristics and derivative financial instruments used in hedge accounting in the pre- and post-period, see Panel A and B, respectively. N denotes the number of firm-year observations. St. Dev. is the standard deviation. The data referring to the variables defining the firms' hedge accounting practices shows that, on average, sample firms use 0.56% in the pre-period, see Panel A, and 0.67% in the post-period, see Panel B, of their total assets in designated hedging relationships. Mostly, they hedge account for foreign exchange risk exposures. However, the increase in designated hedging instruments more than triples for commodity risk exposures and more than doubles for interest rate risk exposure, respectively, from pre- to post-period. Moreover, the table shows that sample firms designate

the highest portion of their hedging relationships as cash flow hedges.

Table 3.4 represents the coefficients of the independent variables and their respective significance levels (*p<0.1; **p<0.05; ***p<0.01) of the Pearson correlation at the lower left and the Spearman rank correlation at the upper right. As already expected, most hedge accounting-related variables are highly correlated. Moreover, I find significantly high negative bivariate Pearson and Spearman rank correlations between *Size* and *Bid-ask spread* with values of -0.655 and -0.684 in the pre- and -0.695 and -0.829 in the post-period. Other variables on firm characteristics show modest correlations, even though partially significant.

Table 3.3: Descriptive statistics

	N	Mean	Median	St. Dev.	Min	Max
Panel A: Pre-period						
HA Derivatives	80	0.0056	0.0025	0.0090	0.0000	0.0501
Commodity	64	0.0005	0.0000	0.0021	0.0000	0.0139
Interest rate	64	0.0006	0.0000	0.0017	0.0000	0.0106
Foreign exchange	64	0.0036	0.0007	0.0081	0.0000	0.0482
Other	64	0.0002	0.0000	0.0017	0.0000	0.0134
FVH	59	0.0002	0.0000	0.0007	0.0000	0.0045
CFH	59	0.0048	0.0015	0.0092	0.0000	0.0487
HNI	59	0.0000	0.0000	0.0000	0.0000	0.0001
Size	86	22.4583	22.3803	1.4816	19.6514	25.4675
Leverage	87	0.2273	0.1923	0.1653	0.0000	0.8120
Earnings volatility	80	0.0080	0.0054	0.0077	0.0003	0.0398
Bid-ask spread	88	0.0017	0.0016	0.0010	0.0000	0.0042
MTB	86	3.0604	2.6719	2.1834	-0.8652	11.7198
Free float	87	0.6631	0.6800	0.2366	0.1400	1.0000
Panel B: Post-period						
HA Derivatives	156	0.0067	0.0019	0.0138	0.0000	0.0805
Commodity	147	0.0016	0.0000	0.0079	0.0000	0.0619
Interest rate	147	0.0013	0.0000	0.0043	0.0000	0.0419
Foreign exchange	147	0.0041	0.0008	0.0099	0.0000	0.0796
Other	147	0.0001	0.0000	0.0003	0.0000	0.0025
FVH	132	0.0003	0.0000	0.0011	0.0000	0.0067
CFH	132	0.0060	0.0017	0.0114	0.0000	0.0639
HNI	132	0.0010	0.0000	0.0082	0.0000	0.0793
Size	172	22.4399	22.3800	1.5416	19.2563	25.7192
Leverage	173	0.2607	0.2355	0.1698	0.0000	0.8269
Earnings volatility	155	0.0096	0.0056	0.0153	0.0003	0.1475
Bid-ask spread	172	0.0016	0.0012	0.0014	0.0000	0.0086
MTB	172	3.0606	2.0043	5.6765	-0.0973	69.3874
Free float	173	0.6773	0.7300	0.2445	0.1000	1.0000

(Table 3.3 continued)

(Table 3.3 continued)

Notes: The table shows the descriptive statistics of the independent variables in the pre and post IFRS 9 introduction period of the hedge accounting applicants sample. N denotes the number of firm-year observations. St. Dev. depicts the standard deviation. *HA Derivatives* is the sum of the fair values of derivative hedging instruments' gross positions deflated by total assets. *Commodity* is the sum of the fair values of derivative hedging instruments' gross positions, designated to hedge commodity price risk, deflated by total assets. *Interest rate* is the sum of the fair values of derivative hedging instruments' gross positions, designated to hedge interest rate risk, deflated by total assets. *Foreign exchange* is the sum of the fair values of derivative hedging instruments' gross positions, designated to hedge foreign exchange rate risk, deflated by total assets. *Other* is the sum of the fair values of derivative hedging instruments' gross positions, designated to hedge other risk, deflated by total assets. *FVH* is the sum of the fair values of derivative hedging instruments' gross positions, designated in fair value hedges, deflated by total assets. *CFH* is the sum of the fair values of derivative hedging instruments' gross positions, designated in cash flow hedges, deflated by total assets. *HNI* is the sum of the fair values of derivative hedging instruments' gross positions, designated in hedges of net investments in foreign operations, deflated by total assets. *Size* is the natural logarithm of the market value of equity. *Leverage* is the ratio of total debt to total assets. *Earnings volatility* is the standard deviation of income before extraordinary items and preferred and common dividends scaled by total assets. *Bid-ask spread* is the median of the yearly quoted spread (i.e., difference between daily closing bid and ask prices divided by the midpoint). *Market-to-book (MTB)* ratio is the consolidated market value of equity securities to the book value of common equity. *Free float* is the total amount of shares in issue available to ordinary investors. For more detailed variable definitions, please see the Appendix A.1.

Table 3.4: Correlation matrix

	HA Derivatives	Commodity	Interest rate	Foreign exchange	FVH	CFH	HNI	Size	Leverage	Earnings volatility	Bid-ask spread	MTB	Free float
Panel A: Pre-period													
HA Derivatives		0.259**	0.270**	0.761***	0.226*	0.978***	-0.193	0.246**	0.022	-0.091	-0.086	-0.039	0.178
Commodity	0.434***		0.098	0.126	0.135	0.230*	-0.055	0.338***	0.032	-0.082	-0.181	-0.230*	0.168
Interest rate	0.244*	0.096		0.035	0.445***	0.163	-0.110	0.094	0.383***	-0.098	0.127	-0.335***	0.128
Foreign exchange	0.938***	0.215*	0.053		0.231*	0.744***	-0.139	0.201	-0.138	0.081	0.004	-0.035	0.330***
FVH	0.374***	0.350***	0.183	0.301**		0.088	-0.052	0.391***	0.071	0.083	-0.230*	-0.017	0.080
CFH	0.998***	0.400***	0.234*	0.942***	0.308**		-0.212	0.071	-0.099	0.004	0.102	-0.121	0.249*
HNI	-0.070	-0.030	-0.047	-0.057	-0.034	-0.070		-0.162	-0.162	-0.100	0.224*	0.225*	0.019
Size	0.301***	0.148	-0.051	0.238*	0.345***	0.184	-0.142		0.108	-0.184	-0.684***	0.190*	0.092
Leverage	-0.026	-0.038	0.481***	-0.189	0.071	-0.134	-0.119	0.043		-0.390***	-0.191*	-0.211*	0.099
Earnings volatility	-0.044	0.007	-0.107	0.018	-0.057	-0.003	-0.073	-0.122	-0.298***		0.136	0.046	0.084
Bid-ask spread	-0.060	-0.173	0.201	0.117	-0.196	0.116	0.308**	-0.655***	-0.106	0.085		-0.004	-0.298***
MTB	0.017	-0.183	-0.158	0.050	-0.068	-0.004	0.514***	0.062	-0.184*	-0.009	0.132		0.041
Free float	0.027	0.193	-0.027	-0.035	0.072	-0.011	0.025	0.103	0.067	0.044	-0.314***	0.045	
Panel B: Post-period													
HA Derivatives		0.429***	0.418***	0.758***	0.193**	0.964***	0.165*	0.170**	-0.056	-0.031	-0.129	-0.019	0.230***
Commodity	0.655***		0.312***	0.194**	0.410***	0.444***	0.141	0.276***	0.024	0.004	-0.247***	-0.240***	0.158*
Interest rate	0.316***	0.035		0.027	0.456***	0.302***	0.165*	0.156*	0.480***	-0.165*	-0.116	-0.277***	0.191**
Foreign exchange	0.769***	0.128	-0.012		0.125	0.707***	0.170*	0.222***	-0.217***	0.044	-0.174**	0.024	0.215***
FVH	0.300***	0.188**	0.200**	0.195**		0.111	0.114	0.396***	0.107	-0.094	-0.438***	-0.308***	0.119
CFH	0.829***	0.724***	0.396***	0.438***	0.255***		-0.007	0.065	-0.124	0.029	-0.013	-0.013	0.242***
HNI	0.614***	0.156*	-0.014	0.756***	0.058	0.073		0.158*	-0.092	-0.051	-0.172**	-0.031	0.166*
Size	0.127	-0.034	-0.064	0.225***	0.303***	0.041	0.099		0.090	-0.165**	-0.829***	0.252***	0.062
Leverage	-0.019	0.016	0.201**	-0.149*	0.126	-0.045	-0.044	0.024		-0.267***	-0.130*	-0.051	0.094
Earnings volatility	0.057	0.124	-0.057	0.031	-0.019	0.084	0.023	-0.060	-0.146*		0.091	-0.054	-0.053
Bid-ask spread	0.059	0.100	0.321***	-0.122	-0.240***	0.193**	-0.091	-0.695***	-0.012	0.012		-0.066	-0.230***
MTB	0.011	-0.026	-0.050	0.054	-0.090	0.029	-0.020	0.107	0.121	-0.021	-0.035		-0.045
Free float	0.111	0.105	0.073	0.022	0.091	0.188**	-0.074	0.061	0.064	-0.053	-0.145*	-0.068	

Notes: The table shows the Pearson correlation coefficients at the lower left and the Spearman rank correlation coefficients at the upper right with the corresponding significance levels, where *p<0.1; **p<0.05; ***p<0.01. For the definition of the independent variables, please see Table 3.3.

3.3.3 Method

I use three different sets of logistic regression models to address whether hedge accounting practices and specific firm characteristics might be connected to a firm's decision to opt for IFRS 9 in the pre-period (R1) and a firm's actual application of IFRS 9 hedge accounting in the post-period (R2):

$$IFRS\ 9\ HA_i = \alpha + \beta \times HA\ Derivatives_i + \sum_{j=1}^{J} \gamma_{ji} \times C_{ji} + \epsilon_i, \tag{3.1}$$

$$IFRS\ 9\ HA_i = \alpha + \beta_1 \times COM_i + \beta_2 \times INT_i + \beta_3 \times FX_i + \sum_{j=1}^{J} \gamma_{ji} \times C_{ji} + \epsilon_i, \tag{3.2}$$

$$IFRS\ 9\ HA_i = \alpha + \beta_1 \times FVH_i + \beta_2 \times CFH_i + \beta_3 \times HNI_i + \sum_{j=1}^{J} \gamma_{ji} \times C_{ji} + \epsilon_i, \tag{3.3}$$

with index i indicating firm i and C_j being the different firm characteristics: *Size*, *Leverage*, *Bid-ask spread*, *Earnings volatility*, *MTB*, and *Free float*. Due to the small sample size in this study, I refrain from including industry or firm fixed effects in the regressions. Appendix A.1 provides detailed definitions of these variables. For notation simplicity in the equations, I use *COM*, *INT*, and *FX* as abbreviations for derivatives designated as hedging instruments to reduce risk exposures from commodity prices, interest rates, and foreign exchange rates, respectively. *FVH*, *CFH*, and *HNI* are short for fair value hedges, cash flow hedges, and hedges of net investments in foreign operations, respectively. To define Eq. (3.1), (3.2), and (3.3), I firstly explore univariate analyses. I use Mann-Whitney-U tests to ascertain statistically significant differences between IAS 39 and (future) IFRS 9 applicants in the pre- and the post-period, separately.[53] Based on these results, I determine secondly the vector C of univariate relevant firm characteristics that is then included in multivariate logistic regressions.

[53]The Mann-Whitney-U test is the non-parametric equivalent to the unpaired t-test. Based on the Shapiro-Wilk test, the majority of the independent variables are not normally distributed. Therefore, I refrain from using the t-test, which compares group means, and make use of the Mann-Whitney-U test instead to analyze differences in medians (Bortz & Schuster, 2010, pp. 130-134, 145).

3.4 Results

3.4.1 Descriptive Findings

I present the descriptive findings of hedge accounting practices among the sample firms in Table 3.5. For the analyzed period from 2017 to 2019, approximately two-thirds of German listed non-financial firms in the sample apply the optional hedge accounting rules. The relation of hedge accounting applicants to non-applicants remains constant over the years. Despite the new designation possibilities, I find little variation in a firm's choice to apply hedge accounting. The sample rather represents firms that either apply hedge accounting throughout the whole period or do not apply hedge accounting throughout the whole period. Among the firms that were listed in all three years, only two change from not applying hedge accounting in 2017 to applying hedge accounting in 2018 and 2019 using IFRS 9 requirements. I also find two firms that stop applying hedge accounting in 2018 and 2019 after having applied the rules of IAS 39 in 2017. Referring to the differences between the indices as shown in Table 3.5, I can state that the highest portion of hedge accounting applicants can be found in DAX30, followed by MDAX and SDAX. Comparing pre- and post-period, the portion of hedge accounting applicants decreases after the introduction of IFRS 9 for all indices. The decrease could imply that fewer firms apply hedge accounting after the change in the reporting standard. However, a closer look into the data gives rise to other interpretations. The drop in DAX30 hedge accounting applicants from 100% to 96% originates from a firm previously listed in MDAX that ascended to DAX30 in 2018. This firm applies hedge accounting, neither in 2017 nor in 2018 and 2019. From 2018 onward, MDAX and SDAX indices also contain TECDAX companies. The table shows that TECDAX has the lowest portion of hedge accounting applicants in the index comparison in the pre-period with only 41%. Including them in MDAX and SDAX in the post-period might be the reason for the respective lower portions of hedge accounting applicants in these indices compared to the pre-period. Nonetheless, the total absolute number of hedge accounting applicants also shrinks from 90 in 2017 to 88 and 86 in 2018 and 2019. Thus, it seems that the new reporting standard does not necessarily attract non-applicants to start applying hedge accounting. Referring to the respective

standards hedge accounting applicants have selected, Table 3.5 illustrates that none of the firms listed on 31-12-2017 early adopted IFRS 9 hedge accounting. Thus, before 2018-01-01, hedge accounting applicants solely used IAS 39 hedge accounting requirements. Only after the official IFRS 9 introduction in January 2018 this behavior changes.[54] Sample observations from 2018 and 2019 annual reports demonstrate a slightly increasing trend towards IFRS 9 hedge accounting application as time goes by. Approximately 75% and 79% of hedge accounting applicants included in the sample use the new hedge accounting standard in 2018 and 2019, respectively. This trend mainly holds among the indices. The higher the index a firm is listed in, the higher the switching rate from the old to the new hedge accounting standard.[55] Table A1 shows the application of hedge accounting of sample firms separated by the Fama & French 10 industries classifications.

From descriptive statistics, I derive that sample firms apply hedge accounting in the pre-period primarily to foreign exchange risk exposures, followed by interest rate and commodity price risk exposures. This finding is consistent with what Glaum & Klöcker (2011) present in their survey study concerning the importance of different types of financial risks for non-financial firms. Figure 3.1 illustrates the extent to which the sample firms apply hedge accounting for specific risk exposures in the pre- and post-period. I calculate the proportions as the respective percentage of all derivative hedging instruments treated in hedge accounting for which a concrete risk exposure is specified. The proportion of foreign exchange derivatives amounts to 72% in the pre- and 58% in the post-period. While this proportion shrinks after the introduction of IFRS 9, the figure shows a considerable increase in the hedge accounting of hedging instruments used to lower interest rate risk, from 13% to 19%, and mainly to lower commodity price risk, from 11% to 22%. These observations might indicate that IFRS 9 hedge accounting requirements serve better for non-financial firms to reflect their risk management activities in their financial reporting. Whether these results might be aligned to IFRS 9 hedge accounting application, I will

[54] According to the expectation of the IASB, this attitude might imply that firms are mainly affected by IFRS 9 classification and measurement and impairment of financial instruments and not primary by financial instruments used for managing risks and hedge account for them. Therefore, they instead choose to postpone the adoption of the new standard, independent of the ameliorated hedge accounting rules and the related advantages (McConnell, 2014).

[55] Assumed underlying index ranking starting with the highest index: DAX30, MDAX, SDAX.

analyze empirically in the following.

Table 3.5: Hedge accounting practices among non-financial firms separated by indices

		Hedge accounting				Hedge accounting applicants			
		non-applicants		applicants		IAS 39		IFRS 9	
		# firms	(%)	# firms	(%)	# firms	(%)	# firms	(%)
2017	DAX30	0	(0%)	24	(100%)	24	(100%)	0	(0%)
	MDAX	7	(17%)	33	(83%)	33	(100%)	0	(0%)
	SDAX	19	(47%)	21	(53%)	21	(100%)	0	(0%)
	TECDAX	17	(59%)	12	(41%)	12	(100%)	0	(0%)
	Total	43	(32%)	90	(68%)	90	(100%)	0	(0%)
2018	DAX30	1	(4%)	23	(96%)	1	(4%)	22	(96%)
	MDAX	14	(29%)	35	(71%)	9	(26%)	26	(74%)
	SDAX	29	(49%)	30	(51%)	12	(40%)	18	(60%)
	Total	44	(34%)	88	(66%)	22	(25%)	66	(75%)
2019	DAX30	1	(4%)	23	(96%)	1	(4%)	22	(96%)
	MDAX	15	(30%)	35	(70%)	7	(20%)	28	(80%)
	SDAX	28	(50%)	28	(50%)	10	(36%)	18	(64%)
	Total	44	(34%)	86	(66%)	18	(21%)	68	(79%)

Notes: The table shows the hedge accounting practices of German non-financial firms listed in DAX30, MADX, SDAX, or TECDAX throughout the observation period from 2017 to 2019. For each year, this table presents the hedge accounting practices separated by index.

3.4.2 Opting for the New IFRS 9 Hedge Accounting Rules

3.4.2.1 Univariate analysis

I analyze the previously developed hypotheses based on the pre-period data to identify possible drivers for firms that opt for the new hedge accounting standard. I separate hedge accounting applicants in 2017 according to whether they stay with IAS 39 hedge accounting, referred to as Group 1 in Table 3.6, or opt for the new standard, referred to as Group 2 in Table 3.6, in the post-period. Table 3.6, Panel A illustrates univariate results from the pre-period analysis. The table contains the mean and standard deviation (St.

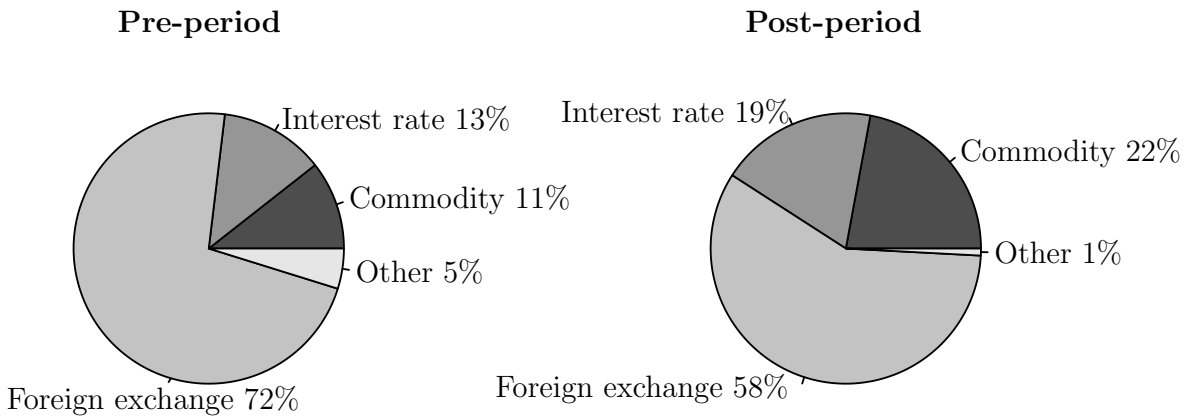

Figure 3.1: The figure depicts the extent to which sample firms apply hedge accounting for specific risk exposures in the pre and post IFRS 9 introduction period. The proportions are calculated as the respective percentage of all derivative hedging instruments used in hedge accounting for which a concrete risk exposure is specified.

Dev.) of the independent variables in the respective sub-samples, Group 1 and Group 2. P denotes the directional prediction made, N is the number of firm-year observations. P-values of medians result from non-parametric Mann-Whitney-U tests for independent samples. All analyses are based on a significance level of at least 10%. Result interpretations are based on one-tailed p-values whenever a directional prediction is made and on two-tailed p-values otherwise.

The analysis shows that IAS 39 hedge accounting users that opt for IFRS 9 hedge accounting are greater in size, more levered, have higher exposures to commodity price risk which they hedge account for, apply more fair value hedges, and fewer hedges of net investments in foreign operations. These differences are highly significant. Moreover, firms that opt for IFRS 9 do not generally seem to have higher exposures to risk that they hedge account for. Hedge accounting users that opt for IFRS 9 do not apply hedge accounting significantly more for exposures to interest rate risks or less for exposures to foreign exchange rate risks. Differences in the types of hedging relationships regarding cash flow hedges are insignificant, too. In addition, the results do not show significant differences between the two sub-samples concerning the firm's earnings volatility, market-to-book ratio, and

ownership structure.

In Panel A, quasi-separation occurs. *Commodity* predicts the outcome variable perfectly for $Commodity_i > 0$. Only firms that opt for IFRS 9 use derivative financial instruments to hedge and hedge account for commodity risk exposures. *FVH* predicts the outcome variable perfectly for $FVH_i > 0$. Only firms that opt for IFRS 9 designate fair value hedges. *HNI* occurs only within firms that stay with IAS 39 hedge accounting and therefore also quasi-separates Panel A. However, the data contains only one observation where $HNI_i > 0$. Thus, its power to separate is relatively low. I explain how I deal with quasi-separation in multivariate analyses in Section 3.4.2.2.

Univariate results from the pre-period seem to support R1-P2, R1-P5, R1-P7, R1-P8, and R1-P9. Non-financial firms with hedging relationships for commodity price risk exposures they hedge account for opt for IFRS 9 hedge accounting, one-tailed p-value: 0.044. The possibility to designate single risk components of non-financial items (IFRS 9, para. 6.3.7) seems to be especially advantageous to firms that already apply hedge accounting to commodity price risk exposures in the pre-period under IAS 39. Hedge accounting requirements per se are probably some of the most complex rules in IFRS accounting. Experience and routines of the accounting of specific hedging relationships (Glaum & Klöcker, 2011), here: commodity price risk, might help firms to adapt more easily to the new standard. Benefiting from existing experiences and knowledge might also be important regarding the designation of fair value hedges. The designation possibility of groups of items as hedged items constituting net positions in fair value hedges given in IFRS 9, para. 6.6.1(a)-(b) extends the existing requirements under IAS 39. Firms that already designate fair value hedges in the pre-period under the old standard seem to gain particularly. Moreover, adapting to changes in the accounting environment seems to be less complicated and associated with lower compliance costs for firms with greater size. To successfully implement a new accounting standard, a firm needs expertise in specific departments, system-wise, and personnel. Accounting experts need to analyze the advantages and disadvantages of the eligible standards. IT departments must implement rapidly new or adapt existing accounting systems (Füllbier & Scharf, 2017). Furthermore, departments might need to collaborate more intensively to align hedge accounting closely to

a firm's risk management. In addition, highly levered firms seem to take advantage when opting for IFRS 9 hedge accounting. Increased visibility of risk management strategies to investors and expected decreased earnings volatility might be possible drivers. Univariate results do not seem to support predictions R1-P1, R1-P3, R1-P4, R1-P6, R1-P10, R1-P12, and R1-P13. According to univariate results, neither R1-P11 can be supported. Contrary to my prediction, firms that opt for IFRS 9 hedge accounting have significantly lower levels of asymmetric information, two-tailed p-value: 0.005. However, *Bid-ask spread* is negatively correlated to *Size*. Thus, this result based on the univariate analysis should be interpreted cautiously. I investigate whether univariate results from the pre-period also hold when interacting the variables in multivariate analyses in the following section.

3.4.2.2 Multivariate analysis

My first research question *Which non-financial firms opt for the new IFRS 9 hedge accounting rules?* leads to the binary dependent variable *IFRS 9 HA* as described in Section 3.3.2. I use the three logistic regression models from Eq. (3.1), (3.2), and (3.3) to analyze the significance of the independent variables in the pre-period. R1 (1), R1 (2), and R1 (3) denote the main models for research question R1 resulting from Eq. (3.1), (3.2), and (3.3), see Table 3.7. In multivariate analyses, I include only variables with two-tailed p-values < 0.25 from univariate analyses and those of importance (Hosmer et al., 2013, p. 91). I determine hedge accounting-related variables as variables of importance. Therefore, I do not exclude these variables, even though some p-values exceed 0.25. However, I exclude the variables representing a firm's earnings volatility and ownership structure. The remaining firm characteristics used are firm size, leverage, and MTB. Moreover, to avoid overfitting, I follow Harrell et al. (1996, p. 364)'s rule of thumb, suggesting using at most one predictor variable for every ten observations. *Bid-ask spread* and *Size* have both two-tailed p-values < 0.25, but show negative correlations with highly significant Pearson (-0.655) and Spearman (-0.684) correlation coefficients, see Table 3.4. Therefore, I use only *Size* in the main models. I conduct a robustness check (a) to show whether the results also hold when using *Bid-ask spread* instead of *Size*, see Table 3.8 Models R1 (1a), R1 (2a), and R1 (3a). To make my results more reliable and robust to possible outliers, I

Table 3.6: Univariate analyses in the pre and post IFRS 9 introduction period

Panel A: **Pre-period** (R1)		Group 1: IAS 39 hedge accounting users staying with IAS 39 hedge accounting			Group 2: IAS 39 hedge accounting users opting for IFRS 9 hedge accounting			Mann-Whitney-U test p-value	
	P	N	Mean	St. Dev.	N	Mean	St. Dev.	one-tailed	two-tailed
P1: HA Derivatives	+	19	0.0051	0.0093	61	0.0058	0.0089	0.1110	0.2221
P2: Commodity	+	13	0.0000	0.0000	51	0.0007	0.0024	0.0443	0.0885
P3: Interest rate	+	13	0.0002	0.0003	51	0.0007	0.0018	0.1857	0.3713
P4: Foreign exchange	-	13	0.0053	0.0105	51	0.0032	0.0075	0.5233	0.9667
P5: FVH	+	11	0.0000	0.0000	48	0.0002	0.0008	0.0774	0.1549
P6: CFH	+	11	0.0061	0.0113	48	0.0046	0.0088	0.3667	0.7334
P7: HNI	?	11	0.0000	0.0000	48	0.0000	0.0000	-	0.0408
P8: Size	+	20	21.7854	1.0205	66	22.6622	1.5442	0.0078	0.0156
P9: Leverage	+	20	0.1669	0.1889	67	0.2453	0.1546	0.0042	0.0083
P10: Earnings volatility	+	18	0.0093	0.0090	62	0.0076	0.0074	0.8567	0.2918
P11: Bid-ask spread	+	21	0.0022	0.0010	67	0.0015	0.0010	0.9978	0.0045
P12: MTB	+	20	3.5882	2.4157	66	2.9005	2.1016	0.9417	0.1190
P13: Free float	+	20	0.6265	0.2376	67	0.6740	0.2370	0.2126	0.4252
Panel B: **Post-period** (R2)		IAS 39 hedge accounting users			IFRS 9 hedge accounting users			Mann-Whitney-U test p-value	
	P	N	Mean	St. Dev.	N	Mean	St. Dev.	one-tailed	two-tailed
P1: HA Derivatives	+	39	0.0035	0.0065	117	0.0078	0.0153	0.0293	0.0587
P2: Commodity	+	34	0.0000	0.0000	113	0.0020	0.0089	0.0001	0.0002
P3: Interest rate	+	34	0.0002	0.0004	113	0.0017	0.0049	0.0341	0.0682
P4: Foreign exchange	?	34	0.0036	0.0068	113	0.0042	0.0107	-	0.8263
P5: FVH	+	29	0.0000	0.0000	103	0.0004	0.0012	0.0011	0.0022
P6: CFH	+	29	0.0043	0.0074	103	0.0064	0.0123	0.1466	0.2933
P7: HNI	?	29	0.0000	0.0000	103	0.0013	0.0093	-	0.0619
P8: Size	+	39	21.5284	1.0250	133	22.7071	1.5681	0.0001	0.0003
P9: Leverage	+	39	0.2498	0.1947	134	0.2639	0.1625	0.2104	0.4208
P10: Earnings volatility	-	37	0.0085	0.0098	118	0.0100	0.0166	0.2510	0.5020
P11: Bid-ask spread	-	40	0.0020	0.0010	132	0.0015	0.0014	0.0006	0.0012
P12: MTB	+	39	2.1902	1.3235	133	3.3158	6.3992	0.2984	0.5968
P13: Free float	+	39	0.6759	0.2023	134	0.6777	0.2561	0.4907	0.9813

Notes: The table shows the differences between IAS 39 and IFRS 9 hedge accounting applicants in the pre- and post-period. Panel A displays differences in the pre-period between hedge accounting applicants that will stay with IAS 39 (Group 1) and those that will opt for IFRS 9 (Group 2). Panel B displays differences in the post-period between IAS 39 and IFRS 9 hedge accounting applicants. The column titled P reflects the directional prediction made, the column titled N depicts the number of observations. The last two columns depict the p-values of Mann-Whitney-U tests. I use one-tailed p-values of medians according to what I hypothesized and two-tailed p-values if no directional prediction is made (P). Moreover, two-tailed p-values are used to specify regression parameters in multivariate analyses. For the definitions of the independent variables, please see Table 3.3.

winsorize the hedge accounting-related independent variables included in the regressions at the 95th percentile.[56]

Table 3.7 presents estimation results of the main Models R1 (1), R1 (2), and R1 (3). In the upper part, the table presents the regression coefficients of the explanatory variables and the respective robust standard errors in parentheses. †, *, **, and *** depict the conventional significance levels at 0.1, 0.05, 0.01, and 0.001, respectively. Reported p-values are one-tailed whenever a directional prediction is made and two-tailed otherwise. In the lower part, the table presents the number of firm-year observations. In Model R1 (1), I find no significant association between a firm's general risk exposure it hedge accounts for and its decision to opt for IFRS 9 hedge accounting. The coefficient of *HA Derivatives* is insignificant. Hence, the results do not support R1-P1. I find a significant association between *Size* and a firm's decision to opt for IFRS 9 hedge accounting. In line with univariate analyses, the positive coefficient indicates that firms with greater size are more likely to opt for the new hedge accounting requirements. This result also holds for Model R1 (2) but not for Model R1 (3). Model R1 (2) underlines the univariate findings concerning commodity price risk exposures firm hedge account for and supports R1-P2. In line with my prediction R1-P4, I find a negative and significant association between the hedge accounting of foreign exchange rate risk exposure and the decision not to opt for IFRS 9. I do not find an association between interest rate risk exposures a firm hedge accounts for and its decision to opt for IFRS 9. Like in univariate analyses, R1-P3 is not supported by the results of Model R1 (2). Model R1 (3) presents the regression results regarding the types of hedging relationships a firm designates. The model contains the hedge accounting-related variables *FVH* and *CFH*. *HNI* drops out due to the winsorizing criterion. Model R1 (3) shows a positive and significant estimate of the variable *FVH* indicating an association between a firm's designation of fair value hedges and its decision to opt for IFRS 9 hedge accounting. Thus, firms that opt for the new standard designate significantly more hedging relationships in fair value hedges, which provides evidence to support R1-P5. *CFH* does not depict a significant coefficient. Like in the univariate analysis, R1-P6 cannot be supported. As already mentioned in Section 3.4.2.1, separation

[56]Due to very limited sample size and possible outliers, pre-period regression results are affected when hedge accounting-related variables are not winsorized.

occurs within the data. The concerned variables are *Commodity* and *FVH*. Separation appears mainly in small samples (Heinze & Schemper, 2002). Small samples often lead to biased maximum likelihood estimators (Hosmer et al., 2013). The bias reduction method developed by Firth (1993) helps to overcome the separation problem in logistic regression (Heinze & Schemper, 2002). Therefore, I estimate Models R1 (2) and R1 (3) with Firth (1993)'s method.

To make my results more reliable, I investigate the regression Models R1 (1), R1 (2), and R1 (3) concerning multicollinearity and outliers (Glaum & Klöcker, 2011). Besides the inspection of correlation coefficients, see Section 3.4.2.3, I inspect variance inflation factors (VIF), Cook's distance, and standardized residuals. Models R1 (1), R1 (2), and R1 (3) present VIFs < 2.[57] Cook's distance measures are considerably below the critical value of 1 (Cook & Weisberg, 1982, p. 345) and standardized residuals do not show noticeable values (Backhaus et al., 2021, pp. 127-129). Less than 3% of standardized residuals show values slightly lower than -2.

[57] According to Backhaus et al. (2021, p. 123), general thresholds do not exist. However, the authors denote VIF values of 5 and 10 to be critical.

Table 3.7: Multivariate analyses - pre-period

		Dependent variable:		
		IFRS 9 HA		
		Logit model	*Bias reduced logit models*	
	Pred.	R1 (1)	R1 (2)	R1 (3)
HA Derivatives	+	-9.207		
		(58.718)		
Commodity	+		277.857*	
			(164.596)	
Interest rate	+		301.779	
			(348.442)	
Foreign exchange	-		-92.241†	
			(65.292)	
FVH	+			1,790.468*
				(975.771)
CFH	+			-60.578
				(55.530)
Size	+	0.438*	0.263†	0.192
		(0.219)	(0.191)	(0.232)
Leverage	+	2.908	0.901	1.190
		(2.837)	(2.730)	(2.509)
MTB	+	-0.115	-0.152	-0.170
		(0.125)	(0.120)	(0.128)
Constant		-8.742†	-4.251	-2.537
		(4.725)	(4.356)	(5.399)
Observations		79	63	58

†p<0.1; *p<0.05; **p<0.01; ***p<0.001

Notes: The table shows the regression results of my main models R1 (1), R1 (2), and R1 (3) in the pre-period. The results present the regression coefficients and the corresponding robust standard errors in parentheses. Reported p-values are one-tailed whenever a directional prediction is made and two-tailed otherwise. *IFRS 9 HA* represents the binary dependent variable that equals 1 if a firm opts for IFRS 9 hedge accounting and 0 otherwise. For the definitions of the independent variables, please see Table 3.3.

3.4.2.3 Robustness tests

I run two robustness checks (a) and (b) to investigate whether the results from the main pre-period regressions are robust. Due to the highly correlated variables *Size* and *Bid-ask spread*, I replace *Size* by *Bid-ask spread* in a first robustness test (a). Table 3.8 shows the regression results, see Models R1 (1a), R1 (2a), R1 (3a). Model R1 (3a) presents a highly positive and significant estimate of the designation of fair value hedges. The results also show a significant coefficient of commodity price risk exposures in Model R1 (2a). These results confirm my findings in Section 3.4.2.2. In robustness test (a) however, the coefficient of *Interest rate* becomes positive and significant, as predicted, while *Foreign exchange* does not reflect a significant coefficient anymore.

In my main logistic regressions, I follow the approach suggested by Hosmer et al. (2013) to include independent variables only if they have two-tailed p-values < 0.25 in univariate analyses. However, the formulated hypotheses are rather directive. Therefore, I run another robustness check (b) where I additionally include *Free float* in the regression because of its one-tailed p-value < 0.25 from univariate analysis. Table 3.8 shows that the results are consistent with the results from the main regressions, see Models R1 (1b), R1 (2b), and R1 (3b). Models R1 (1b) and R1 (2b) present significant, positive estimates for *Size*, supporting R1-P8. Models R1 (2b) and R1 (3b) depict significant, positive estimates for *Commodity* and *FVH*, respectively, underpinning the results from univariate analyses and the main Models R1 (2) and R1 (3), supporting R1-P2 and R1-P5, also when controlling for the ownership structure. Firms that already hedge account for commodity price risk exposures and designate fair value hedges in the pre-period under IAS 39 seem to benefit from the new hedge accounting standard, which might be why they opt for IFRS 9. Moreover, Model R1 (2b) reflects a significant negative coefficient of *Foreign exchange* and confirms the finding in the main Model R1 (2). However, this finding is not robust through all specifications.

Table 3.8: Multivariate analyses: Robustness tests (a) and (b) - pre-period

		Dependent variable:					
		IFRS 9 HA					
		(a)			(b)		
		Logit model	*Bias reduced logit models*		*Logit model*	*Bias reduced logit models*	
	Pred.	R1 (1a)	R1 (2a)	R1 (3a)	R1 (1b)	R1 (2b)	R1 (3b)
HA Derivatives	+	13.387			-9.423		
		(57.210)			(58.101)		
Commodity	+		261.112†			282.712*	
			(169.880)			(171.612)	
Interest rate	+		475.773†			300.431	
			(359.622)			(339.327)	
Foreign exchange	-		-62.421			-90.222†	
			(65.991)			(63.829)	
FVH	+			2,140.795**			1,788.093*
				(739.480)			(985.846)
CFH	+			-48.728			-60.496
				(56.015)			(54.987)
Size	+				0.443*	0.256†	0.189
					(0.226)	(0.188)	(0.224)
Leverage	+	2.902	1.010	1.511	2.852	0.904	1.179
		(2.849)	(2.540)	(2.445)	(2.821)	(2.699)	(2.499)
Bid-ask spread	+	-587.168	-395.589	-451.965			
		(271.937)	(261.333)	(278.789)			
MTB	+	-0.061	-0.091	-0.118	-0.117	-0.149	-0.168
		(0.133)	(0.121)	(0.135)	(0.127)	(0.120)	(0.128)
Free float	+				0.478	-0.061	-0.187
					(1.204)	(1.101)	(1.223)
Constant		1.815†	1.987*	2.344*	-9.153†	-4.098	-2.358
		(1.021)	(0.970)	(0.970)	(5.014)	(4.411)	(5.352)
Observations		79	63	58	79	63	58

†p<0.1; *p<0.05; **p<0.01; ***p<0.001

Notes: The table shows the regression results of the robustness checks (a) and (b) in the pre-period for the models of research question R1. In (a), I include *Bid-ask spread* instead of *Size* due to high correlation. In (b), I additionally include *Free float*, due to its one-tailed p-value < 0.25. The results present the regression coefficients and the corresponding robust standard errors in parentheses. Reported p-values are one-tailed whenever a directional prediction is made and two-tailed otherwise. *IFRS 9 HA* represents the binary dependent variable that equals 1 if a firm opts for IFRS 9 hedge accounting and 0 otherwise. For the definitions of the independent variables, please see Table 3.3.

3.4.3 Differences between IFRS 9 and IAS 39 Hedge Accounting Applicants

3.4.3.1 Univariate analysis

Focusing now on the post-period, I again evolve univariate analyses. I split the post-period sample into two sub-samples to show differences between IAS 39 and IFRS 9 hedge accounting applicants.[58] Table 3.6, Panel B contains the mean and standard deviation (St. Dev.) of each independent variable in the respective sub-sample. P denotes the directional prediction made, N is the number of firm-year observations. P-values of medians result from non-parametric Mann-Whitney-U tests for independent samples. Result interpretations are based on one-tailed p-values whenever a directional prediction is made and on two-tailed p-values otherwise. In the post-period, I use robust standard errors clustered at the firm-level.

The univariate results indicate that compared to IAS 39 users, IFRS 9 hedge accounting applicants use significantly more derivative financial instruments in hedging relationships they hedge account for. Consistent with my expectation stated in R2-P1, the expanded designation possibilities make it easier for firms to reflect their risk management within their accounting numbers. More specifically, IFRS 9 applicants use significantly more hedging relationships to reduce commodity price and interest rate risk. These results are in line with R2-P2 and R2-P3. Concerning foreign exchange rate risk exposures accounted for in hedging relationships, users of IAS 39 and IFRS 9 do not differ significantly. Moreover, IFRS 9 applicants designate significantly more fair value hedges and hedges of a net investment in a foreign operation, supporting R2-P5 and R2-P7. In addition, IFRS 9 users are significantly greater in size and have to deal with lower information asymmetries, providing evidence for R2-P8 and R2-P11. Regarding asymmetric information, one should consider that with the introduction of IFRS 9, the IASB also introduced IFRS 7 with extended disclosure requirements for hedge accounting. But, the enlarged

[58] Please note that the other parts of IFRS 9 except hedge accounting, i.e., classification and measurement and impairment are indeed mandatory for all firms from 2018 onward. I do not expect that these parts affect IFRS 9 hedge accounting applicants differently compared to IAS 39 hedge accounting applicants.

disclosure statements are obligatory in the post IFRS 9 introduction period, independent of whether firms apply IAS 39 or IFRS 9 hedge accounting (IFRS 7, para. 21A). Thus, IFRS 7 should not cause the difference in *Bid-ask spread* among the two sub-samples in the first place. However, the significant difference might indicate that IFRS 9 applicants can align hedge accounting more closely to risk management strategies. Since *Bid-ask spread* is negatively correlated to *Size*, this result should be interpreted cautiously based on the univariate analysis. Univariate results in the post-period do not seem to support predictions R2-P4, R2-P6, R2-P9, R2-P10, R2-P12, and R2-P13.

In Panel B, again, quasi-separation occurs. Like in the pre-period, *Commodity*, *FVH*, and *HNI* are the concerned variables. *Commodity* and *FVH* predict the outcome variable perfectly. Only IFRS 9 applicants use derivative financial instruments to hedge account for commodity risk exposures and designate fair value hedges. Also, *HNI* occurs only for IFRS 9 applicants and therefore also quasi-separates Panel B for $HNI_i > 0$. To overcome quasi-separation issues in multivariate analyses, I again apply Firth (1993)'s bias reduction method whenever necessary.

3.4.3.2 Multivariate analysis

My second research question *Do IFRS 9 hedge accounting applicants differ from IAS 39 hedge accounting applicants?* again leads to the binary dependent variable *IFRS 9 HA* as described in Section 3.3.2. I use once more the three logistic regression models from Eq. (3.1), (3.2), and (3.3), now for the data of the post-period to examine my research question R2. I analyze whether univariate results also hold when interacting explanatory variables in multivariate analyses. I stick to the approach presented in Section 3.4.2.2 and include only variables with two-tailed p-values < 0.25 from univariate analyses and those of importance (Hosmer et al., 2013, p. 91), the hedge accounting-related variables. Thus, I exclude the variables representing a firm's leverage, earnings volatility, growth opportunities, and ownership structure. *Bid-ask spread* and *Size* show two-tailed p-values < 0.01. Like in the pre-period, Pearson and Spearman correlation coefficients of *Bid-ask spread* and *Size* are highly and significantly negatively correlated with correlation coefficients of -0.695 and -0.829, respectively. Therefore, I show in the robustness tests (a) and (b) that

results hold when correlated variables are included only separately in the regressions, see Section 3.4.3.3 and Table 3.11, Models R2 (1a), R2 (2a), R2 (3a) and R2 (1b), R2 (2b), R2 (3b). Like for the multivariate analyses in the pre-period, I winsorize the hedge accounting-related independent variables at the 95th percentile.[59] Table 3.9 presents the estimation results of Models R2 (1), R2 (2), and R2 (3). In the upper part, the table presents the regression coefficients of the explanatory variables and the respective robust standard errors clustered at the firm-level in parentheses. †, *, **, and *** depict the significance levels at 0.1, 0.05, 0.01, and 0.001, respectively. Reported p-values are one-tailed whenever a directional prediction is made and two-tailed otherwise. In the lower part, the table presents the number of firm-year observations. All three models show positive coefficients of *Size*, at least significant at the 5%-level. The univariate result holds. As expected and predicted in R2-P8, IFRS 9 hedge accounting applicants are significantly greater in size compared to IAS 39 users. Model R2 (1) does not reflect a significant association between a firm's general risk exposure it hedge accounts for and the application of IFRS 9 hedge accounting requirements. Thus, the multivariate result does not underline the univariate significance of the variable *HA Derivatives*. Prediction R2-P1 cannot be supported. Model R2 (2), however, strengthens the univariate findings concerning specific risk exposures firms hedge and hedge account for. The regression results show large positive estimates for hedging relationships including commodity and interest rate derivatives. As predicted in R2-P2 and R2-P3, IFRS 9 hedge accounting applicants designate significantly more interest rate and particularly more commodity derivatives as hedging instruments in their hedging relationships. Thus, there seems to be evidence that the extended designation possibilities concerning single risk components of non-financial items (IFRS 9, para. 6.3.7) allow IFRS 9 applicants to apply hedge accounting to these specific hedged items additionally and consequently, to make their risk management strategy visible to external stakeholders. The amount of derivatives to reduce foreign exchange rate risk exposures firms hedge account for is significantly lower for IFRS 9 users. This result does not reflect the insignificant difference in *Foreign exchange* from the univariate analysis. Following my prediction and the univariate results concerning the types of des-

[59] Regression results are not unduly affected when hedge accounting-related variables are not winsorized.

ignated hedging relationships, Model R2 (3) supports R2-P5. The regression results show that a firm's application of IFRS 9 hedge accounting is related to the designation of more fair value hedges. There might be evidence that the designation possibility of groups of items as hedged items constituting net positions in fair value hedges given in IFRS 9, para. 6.6.1(a)-(b) seems to allow IFRS 9 hedge accounting applicants to designate more fair value hedges. The data set comprises only a few observations of firms designating hedges in net investments of foreign operations. Due to winsorizing, the variable *HNI* drops out. As already mentioned in Section 3.4.3.1, separation occurs also within the post-period data. The concerned variables are again *Commodity* and *FVH*, like in the pre-period. Therefore, I estimate Models R2 (2) and R2 (3) with Firth (1993)'s method. Like in Section 3.4.2.2, I also investigate the regression Models R2 (1), R2 (2), and R2 (3) concerning multicollinearity and outliers. The models present VIFs < 2, Cook's distance measures are considerably below the critical value of 1, and standardized residuals do not show noticeable values.[60]

In logistic regression, coefficients of the independent variables represent the changes in the logits, that is, the logs of the odds, related to one-unit changes in the independent variables themselves (Hosmer et al., 2013, pp. 48). Since the interpretation of coefficients resulting from logistic regressions might not be intuitive, I follow the approach given in Glaum & Klöcker (2011, pp. 476-478) and document the economic significance in a separate table. Lins et al. (2011, pp. 539, 545) use a comparable illustration of economic significance for their probit models. I choose my main Model R2 (2) to demonstrate economic significance. Results are given in Table 3.10. Like Glaum & Klöcker (2011), I set all independent variables to their mean values and show how the probability of firms applying IFRS 9 hedge accounting changes if the value of the respective explanatory variable increases by one standard deviation, all else being equal. Table 3.10 documents an accuracy of 83.62% for Model R2 (2). The results show that the highly significant explanatory variables of *Size*, *Interest rate*, and *Commodity* also have substantial economic power. An increase by one standard deviation in firm size increases the likelihood of a firm to apply IFRS 9 hedge accounting by 10.01%. An increase by one standard deviation in a

[60] See Backhaus et al. (2021, pp. 123, 127-129) and Cook & Weisberg (1982, p. 345).

firm's use of commodity and interest rate derivatives in hedging relationships which they hedge account for increases the probability of a firm applying IFRS 9 hedge accounting by 7.36% and 8.52%, respectively.

Table 3.9: Multivariate analyses - post-period

		Dependent variable:		
		IFRS 9 HA		
		Logit model	*Bias reduced logit models*	
	Pred.	R2 (1)	R2 (2)	R2 (3)
HA Derivatives	+	32.369		
		(39.834)		
Commodity	+		620.932***	
			(153.617)	
Interest rate	+		510.588**	
			(202.511)	
Foreign exchange	?		-93.931†	
			(55.505)	
FVH	+			752.921*
				(456.565)
CFH	+			-5.757
				(40.109)
Size	+	0.648**	0.686**	0.511*
		(0.255)	(0.281)	(0.241)
Bid-ask spread	-	124.584	65.258	103.529
		(246.611)	(235.500)	(227.530)
Constant		-13.604*	-14.216*	-10.340†
		(5.884)	(6.325)	(5.508)
Observations		153	145	130

†p<0.1; *p<0.05; **p<0.01; ***p<0.001

Notes: The table shows the regression results of my main models R2 (1), R2 (2), and R2 (3) in the post-period. The results present the regression coefficients and the corresponding robust standard errors clustered at firm-level in parentheses. Reported p-values are one-tailed whenever a directional prediction is made and two-tailed otherwise. *IFRS 9 HA* represents the binary dependent variable that equals 1 if a firm applies IFRS 9 hedge accounting and 0 otherwise. For the definitions of the independent variables, please see Table 3.3.

Table 3.10: Hedge accounting application: Economic significance of logistic regression results based on Model R2 (2)

	Change in likelihood of IFRS 9 hedge accounting application if the individual explanatory variable is increased by one standard deviation, all else being equal				
Probability of applying IFRS 9 hedge accounting Model R2 (2)	Commodity	Interest rate	Foreign exchange	Size	Bid-ask spread
83.6222%	+7.3600%	+8.5194%	-7.1876%	+10.0052%	+1.1794%

Notes: The percentage amount of Model R2 (2) in the first column represents the likelihood that a firm applies IFRS 9 hedge accounting when the independent variables are set to their mean values. The following columns illustrate the percentage change (increase (+) or decrease (-)) in the probability that a firm applies IFRS 9 hedge accounting when the specific individual explanatory variable is increased by one standard deviation, all other independent variables held constant. For the definition of the independent variables, please see Table 3.3.

3.4.3.3 Robustness tests

I run four robustness checks to ensure that my main results are consistent. To dispel doubts that correlated variables drive the main results, Table 3.11 illustrates the robustness tests (a) and (b), including the correlated variables *Size* and *Bid-ask spread* only separately in the regressions. I use robust standard errors clustered at firm-level. For Models R2 (1a), R2 (2a), and R2 (3a), *Size* depicts a positive sign and remains highly significant. In Model R2 (2a), variables of specific risk exposures firms hedge account for are again highly significant and support R2-P2, R2-P3, and R2-P4. Moreover, the coefficient of *FVH* is positive supporting R2-P5. For Models R2 (1b), R2 (2b), and R2 (3b), the coefficients of *Bid-ask spread* become significantly negative. The result provides evidence that IFRS 9 hedge accounting applicants have lower information asymmetries, as predicted in R2-P11. Model R2 (1b) even shows a positive and significant coefficient of *HA Derivatives*, indicating that IFRS 9 applicants designate more hedging relationships. Model R2 (2b) supports R2-P2 and R2-P3. Model R2 (3b) supports R2-P5.

Table 3.12 illustrates the robustness tests (c) and (d). In the robustness test (c), I include variables with one-tailed p-values < 0.25 from univariate analyses according to the predicted direction. In the multivariate analyses, I follow the approach suggested by Hosmer et al. (2013) to include independent variables only if they have two-tailed p-values < 0.25 from univariate analyses. Since the formulated hypotheses are rather directive, I include in this robustness check variables with one-tailed p-values < 0.25. Thus, I incorporate *Leverage* as an additional explanatory variable in my logistic regressions. Table 3.12 Models R2 (1c), R2 (2c), and R2 (3c) depict the results, standard errors are robust and clustered at the firm-level. Still, *Size* is significant at least at the 5%-level throughout all model specifications. Moreover, Model R2 (2c) and R2 (3c) present significant coefficients for the variables of specific risk exposures firms hedge account for, *Commodity*, *Interest rate*, and *Foreign exchange*, and for the variable *FVH*. Hence, like in the main models, R2-P2, R2-P3, R2-P4, and R2-P5 also hold in the robustness check (c).

The robustness test (d) in Table 3.12 uses the explanatory variables of the main models as presented in Table 3.9, but with a reduced sample. In this robustness check, the post-period sample consists of observations from 2018 only. Models R2 (1d), R2 (2d), and

R2 (3d) depict the results. I use robust standard errors. *Size* is significant throughout all models, supporting R2-P8. Model R2 (2d) shows significant coefficients for the variables *Commodity*, *Interest rate*, and *Foreign exchange*, supporting R2-P2, R2-P3, and R2-P4. For *FVH*, the regression does not depict a significant coefficient. R2-P5 cannot be supported.

To sum up, all robustness checks underline the importance of *Size* in relation to a firm's application of the new hedge accounting requirements of IFRS 9. Moreover, all robustness tests support the findings of Model R2 (2) with respect to *Commodity* and *Interest rate*. The application of IFRS 9 is strongly associated with the commodity price and interest rate risk exposures firms hedge account for. The main finding regarding *Foreign exchange* is not robust. In addition, the hypotheses concerning the types of designated hedging relationships cannot be supported throughout all robustness specifications. Therefore, the result of the main Model R2 (3) and the univariate analysis regarding R2-P5, showing that the application of IFRS 9 hedge accounting is associated with the designation of more fair value hedges, is not robust.

3.4.4 Do Hedge Accounting Applicants that Opt for IFRS 9 Differ in the Pre- and Post-Period?

To investigate whether firms that opt for IFRS 9 hedge accounting differ between pre- and post-period and thus really change their hedge accounting practices after the introduction of IFRS 9, I additionally check univariate differences in time using the Mann-Whitney-U test. Table 3.13 presents the results. Reported p-values one-tailed for all hedge accounting-related variables and two-tailed for the variables on firm characteristics. For the hedge accounting-related variables, I test whether the respective values increase from the pre- to the post-period. In Panel B, the table shows that interest rate and commodity derivatives in hedging relationships firms hedge account for increase significantly for IFRS 9 users in the post-period compared to the pre-period, with p-values of medians of 0.053 and 0.014, respectively. For IAS 39 applicants in Panel A, the univariate analyses do not show significant differences in the hedge accounting-related variables. My findings

Table 3.11: Multivariate analyses: Robustness tests (a) and (b) - post-period (I)

		Dependent variable:					
		IFRS 9 HA					
		(a)			(b)		
		Logit model	*Bias reduced logit models*		*Logit model*	*Bias reduced logit models*	
	Pred.	R2 (1a)	R2 (2a)	R2 (3a)	R2 (1b)	R2 (2b)	R2 (3b)
HA Derivatives	+	36.225			54.921†		
		(38.105)			(42.400)		
Commodity	+		619.846***			16,735.120***	
			(157.928)			(3,101.386)	
Interest rate	+		536.841**			618.858**	
			(197.438)			(243.571)	
Foreign exchange	?		-95.948†			-78.723	
			(54.714)			(53.817)	
FVH	+			674.566†			918.832**
				(416.812)			(385.652)
CFH	+			-0.379			12.880
				(36.571)			(37.592)
Size	+	0.573***	0.667**	0.454*			
		(0.185)	(0.238)	(0.200)			
Bid-ask spread	-				-359.491*	-447.173*	-234.600†
					(165.711)	(206.427)	(172.306)
Constant		-11.734**	-13.669**	-8.896*	1.450***	1.566***	1.457***
		(4.081)	(5.134)	(4.397)	(0.353)	(0.435)	(0.386)
Observations		155	147	132	154	145	130

†p<0.1; *p<0.05; **p<0.01; ***p<0.001

Notes: The table shows the regression results of robustness checks (a) and (b) in the post-period for the models of research question R2, including the highly correlated variables *Size* and *Bid-ask spread* only separately. The results present the regression coefficients and the corresponding robust standard errors clustered at firm-level in parentheses. Reported p-values are one-tailed whenever a directional prediction is made and two-tailed otherwise. *IFRS 9 HA* represents the binary dependent variable that equals 1 if a firm applies IFRS 9 hedge accounting and 0 otherwise. For the definitions of the independent variables, please see Table 3.3.

could provide evidence that the new standard affects firms' hedge accounting practices. After the introduction of IFRS 9, compared to the pre-period, IFRS 9 hedge accounting applicants designate on average ∼125% more interest rate and ∼210% more commodity derivatives in hedging relationships relative to their balance sheet sum. The results might indicate possible real effects. The new standard does not provide important changes in the

Table 3.12: Multivariate analyses: Robustness tests (c) and (d) - post-period (II)

		Dependent variable:					
		IFRS 9 HA					
		(c)			(d)		
		Logit model	*Bias reduced logit models*		*Logit model*	*Bias reduced logit models*	
	Pred.	R2 (1c)	R2 (2c)	R2 (3c)	R2 (1d)	R2 (2d)	R2 (3d)
HA Derivatives	+	31.956			38.945		
		(40.123)			(44.773)		
Commodity	+		589.418***			411.897***	
			(159.127)			(109.595)	
Interest rate	+		678.478**			740.092***	
			(232.617)			(224.819)	
Foreign exchange	?		-107.852†			-65.571*	
			(56.940)			(32.966)	
FVH	+			727.532†			331.322
				(444.389)			(407.089)
CFH	+			-4.412			-2.813
				(40.670)			(41.845)
Size	+	0.647**	0.717*	0.501*	0.630*	0.690**	0.473*
		(0.252)	(0.334)	(0.243)	(0.283)	(0.294)	(0.244)
Bid-ask spread	-	124.283	46.884	95.508	-7.005	-156.315	49.701
		(243.783)	(264.465)	(225.286)	(269.373)	(231.955)	(234.517)
Leverage	+	0.209	-2.016	-0.356			
		(1.739)	(1.880)	(1.655)			
Constant		-13.626*	-14.387†	-10.034†	-12.965*	-13.941*	-9.402†
		(5.799)	(7.435)	(5.624)	(6.569)	(6.593)	(5.626)
Observations		153	145	130	81	76	68

†p<0.1; *p<0.05; **p<0.01; ***p<0.001

Notes: The table shows the regression results of robustness checks (c) and (d) in the post-period. In (c), I additionally include *Leverage* due to its one-tailed p-value < 0.25. In (d), I use a reduced sample with data from 2018 only. The results present the regression coefficients and the corresponding robust standard errors in parentheses. Standard errors are clustered at the firm-level for Models R2 (1c)-(3c). Reported p-values are one-tailed whenever a directional prediction is made and two-tailed otherwise. *IFRS 9 HA* represents the binary dependent variable that equals 1 if a firm applies IFRS 9 hedge accounting and 0 otherwise. For the definitions of the independent variables, please see Table 3.3.

institutional setting concerning the hedge accounting of foreign exchange rate risk. Nevertheless, on average, foreign exchange rate derivatives in hedging relationships increase for IFRS 9 hedge accounting applicants after the introduction of IFRS 9. Based on the quasi-unchanging accounting regulation regarding foreign exchange rate risk, I would not expect that firms would have had much more currency derivatives to lower foreign exchange rate risk exposures for which they did not apply hedge accounting but applied 'ordinary' accounting rules in the pre-period. That given, the significant increases in the post-period in commodity and interest rate derivatives firms designate in hedging relationships might indicate at least some possibility for real effects. Firms might enter more derivative contracts to lower interest rate and commodity price risk exposures only because IFRS 9 is accompanied by new and simplified designation possibilities. Possibly, they even have more risk exposures due to new business transactions they enter. With IFRS 9, managers can provide risk management information to investors more transparently, which might allow them to enter more risky transactions they would not have entered before due to less or no representation in the accounting numbers leading to misrepresentation in the financial statements. As described in Section 3.2, the offsetting effects of hedging instruments and hedged items are not visible when 'ordinary' accounting is applied. In line with that, Glaum & Klöcker (2011) find evidence that firms are willing to accept higher financial risk exposure if it ensures them the possibility to apply the specific set of hedge accounting requirements. However, one should have in mind that there is still the possibility that firms might have had already much higher portions of interest rate and commodity derivatives to reduce their risk exposures also in the pre-period they did not hedge account for, possibly due to the restricted regulation of IAS 39.

Table 3.13: Univariate analyses between IAS 39 and IFRS 9 users in the pre and post IFRS 9 introduction period

Panel A	**Pre-period**			**Post-period**			
IAS 39	IAS 39 hedge accounting users staying with IAS 39 hedge accounting			IAS 39 hedge accounting users			Mann-Whitney-U test p-value
	N	Mean	St. Dev.	N	Mean	St. Dev.	one-tailed (pre<post)
HA Derivatives	19	0.0051	0.0093	35	0.0036	0.0068	0.2076
Commodity	13	0.0000	0.0000	30	0.0000	0.0000	N/A
Interest rate	13	0.0002	0.0003	30	0.0002	0.0005	0.2231
Foreign exchange	13	0.0053	0.0105	30	0.0038	0.0072	0.2653
FVH	11	0.0000	0.0000	25	0.0000	0.0000	N/A
CFH	11	0.0061	0.0113	25	0.0047	0.0079	0.2544
HNI	11	0.0000	0.0000	25	0.0000	0.0000	0.8481
							two-tailed
Size	20	21.7854	1.0205	35	21.6317	1.0180	0.4830
Leverage	20	0.1669	0.1889	35	0.2517	0.2009	0.0065
Bid-ask spread	21	0.0022	0.0010	36	0.0019	0.0008	0.0353
Earnings volatility	18	0.0093	0.0090	33	0.0084	0.0099	0.6306
MTB	20	3.5882	2.4157	35	2.2766	1.3592	0.0226
Free float	20	0.6265	0.2376	35	0.6677	0.2051	0.4120
Panel B	**Pre-period**			**Post-period**			
IFRS 9 HA	IAS 39 hedge accounting users opting for IFRS 9 hedge accounting			IFRS 9 hedge accounting users post-period			Mann-Whitney-U test p-value
	N	Mean	St. Dev.	N	Mean	St. Dev.	one-tailed (pre<post)
HA Derivatives	61	0.0058	0.0089	116	0.0079	0.0154	0.2541
Commodity	51	0.0007	0.0024	112	0.0020	0.0090	0.0138
Interest rate	51	0.0007	0.0018	112	0.0017	0.0049	0.0530
Foreign exchange	51	0.0032	0.0075	112	0.0043	0.0108	0.1225
FVH	48	0.0002	0.0008	102	0.0004	0.0012	0.4474
CFH	48	0.0046	0.0088	102	0.0065	0.0124	0.0320
HNI	48	0.0000	0.0000	102	0.0014	0.0093	0.0273
							two-tailed
Size	66	22.6622	1.5442	132	22.7081	1.5740	0.1626
Leverage	67	0.2453	0.1546	133	0.2610	0.1596	0.8873
Bid-ask spread	67	0.0015	0.0010	132	0.0015	0.0014	0.0362
Earnings volatility	62	0.0076	0.0074	117	0.0099	0.0167	0.4074
MTB	66	2.9005	2.1016	132	2.8153	2.7723	0.1571
Free float	67	0.6740	0.2370	133	0.6796	0.2561	0.5373

Notes: The table shows the differences between IAS 39 and IFRS 9 hedge accounting applicants in the pre- and post-period, respectively. The upper part of the table refers to IAS 39. It shows the differences in time between IAS 39 users in the pre-period staying

(Table 3.13 continued)

(Table 3.13 continued)

with IAS 39 also in the post-period. The lower part of the table refers to IFRS 9. It shows IAS 39 users in the pre-period opting for IFRS 9 and IFRS 9 users in the post-period. The last column depicts the p-values of Mann-Whitney-U tests. For hedge accounting-related variables, I show one-tailed p-values of medians with the alternative hypothesis: hedge accounting application (in general, per risk category, and per type of hedging relationship) in the post-period is higher compared to the pre-period. For firm characteristics, I show two-tailed p-values of medians. For the definitions of the independent variables, please see Table 3.3.

3.5 Conclusion

This study analyzes hedge accounting practices among German non-financial firms listed in DAX30, MDAX, SDAX, or TECDAX, using a hand-collected data set. Generally, hedge accounting is optional for firms. In this study, I focus only on firms that apply hedge accounting. Under IFRS reporting, hedge accounting applicants may currently choose between IAS 39 and IFRS 9 hedge accounting requirements. Thus, two hedge accounting standards are co-existing in the market. This extraordinary choice arises due to an ongoing transition period defined by the IASB. The setting allows revealing firm preferences by investigating whether and how differences in the requirements affect firms' hedge accounting practices. I analyze what firms opt for IFRS 9 hedge accounting in the period prior to IFRS 9 introduction in 2018 and whether IFRS 9 hedge accounting applicants differ from IAS 39 applicants in the post IFRS 9 introduction period. The results show that sample firms do not early adopt IFRS 9 hedge accounting. All hedge accounting users apply IAS 39 in the period prior to IFRS 9 introduction. Only after the IFRS 9 introduction, firms start applying IFRS 9 hedge accounting. In 2018 and 2019, 75% and 79% of the sample firms make use of the new requirements, respectively. Nevertheless, a minority of IAS 39 users remains. The adoption rate is highest for DAX30 constituents and lowest for firms listed in the SDAX or TECDAX. Empirical analyses of the pre-period indicate differences between hedge accounting applicants staying with IAS 39 and those opting for IFRS 9. Univariate results provide evidence that firms opting for IFRS 9 are significantly greater in size, more levered, use more commodity derivatives in hedging relationships they hedge account for, and designate more fair value hedges. The significant positive association of designated commodity derivatives and fair value hedges on firms' decision to opt for IFRS 9 also holds in multivariate logistic regressions when controlling for firm size, leverage, and the market-to-book ratio of equity. Referring to the period post IFRS 9 introduction, univariate analyses indicate that, compared to IAS 39 users, IFRS 9 hedge accounting applicants generally designate significantly more hedging relationships for which they apply hedge accounting. This is especially true for hedging relationships designated to reduce commodity and interest rate risk exposures

and for the designation of fair value hedges. Moreover, they are greater in size and have lower levels of information asymmetries. Multivariate analyses support the main univariate findings. Logistic regressions depict significant positive estimates of commodity and interest rate derivatives in hedging relationships. In addition, I find a significant negative association between foreign currency risk exposures firms hedge account for and their application of IFRS 9 hedge accounting. Moreover, the analysis shows a significant positive association of designating fair value hedges. The results show also a significant positive relation to firm size. My findings might provide evidence for possible real effects due to changes in the hedge accounting standard. Especially, the increase in derivative contracts to lower interest rate and commodity price risk exposures might imply that sample firms are willing to enter new business transactions. IFRS 9 allows more adequately representing these hedged transactions in a firm's financial statements, which IAS 39 does not. Hence, firms might enter such business transactions when reporting under IFRS 9 hedge accounting, but they would not have entered them under the regime of IAS 39. My analyses contribute to academic literature on accounting policy changes and hedge accounting practices of non-financial firms and their influence on their risk management strategies. Since most sample firms opt for the new standard, firms seem to prefer, among others, the extended designation possibilities aligned to this change. The results suggest that IFRS 9 hedge accounting allows for a more diversified and advantageous hedge accounting application and offers more suitable requirements for non-financial firms. Firms seem to be able to treat particularly more commodity risk exposures in hedge accounting, which are especially important to non-financial firms. Potentially, these findings help regulators to better assess whether the implementation of the new standard actually matches their original intention to align hedge accounting more closely to risk management activities. Moreover, these findings might be helpful to the IASB in the post-implementation review and for the work in progress on macro hedge accounting.

My study is subject to several limitations. First, the sample size is relatively small. Two main aspects need to be considered here: The observation period is relatively short for empirical analyses. Nevertheless, it focuses precisely on the introduction and transition period of IFRS 9 and thus should suit best for the given research questions. Second,

the setting of revealed preferences implies that firms decide by themselves to opt for the new hedge accounting standard due to firm-specific characteristics and hedging practices, which could lead to endogeneity concerns. Third, the number of observations in the different sets of logistic regressions depends on the detail of the quantitative information provided in the annual reports. Annual reports of firms for which hedge accounting is relatively important might contain more specific disclosure on hedge accounting. Hence, the composition of hedge accounting-related variables might distort the results. Fourth, given the setting in the post IFRS 9 introduction period, I analyze my research question R2 partially based on accounting numbers already influenced by the new hedge accounting requirements. Fifth, I solely focus on changes in IFRS 9 hedge accounting. In case the mandatorily applicable parts of IFRS 9 or any other accounting regulation affect IFRS 9 and IAS 39 hedge accounting applicants differently, my results might be distorted.

Future research related to this topic could enlarge the observation period. A longer time horizon might further enhance the findings in this study. However, due to the COVID-19 pandemic, adding more observation points to the post IFRS 9 introduction period, as already included here, might distort the results. Moreover, future research could extend and broaden the sample size by including other countries reporting under IFRS in the analyses. By doing so, country-specific differences, if any, could be examined. In addition, future studies might specifically analyze real effects arising from changes in the hedge accounting standard.

Chapter 4

IAS 39 vs IFRS 9 Hedge Accounting - Evidence on Analysts' Earnings Forecast Quality from Germany

Abstract

With the introduction of IFRS 9, hedge accounting applicants can choose between IFRS 9 and IAS 39 hedge accounting regulations. This paper analyzes whether the voluntary adoption of IFRS 9 hedge accounting and the mandatory application of the related disclosure requirements of IFRS 7 impact sell-side analysts' earnings forecast quality. I measure forecast quality through forecast dispersion and error. The measures serve as proxies for information asymmetry. Using a German sample of non-financial firms, I find no statistically significant differences in forecast quality between IAS 39 and IFRS 9 hedge accounting applicants. Also, the economic differences are relatively small. A further analysis on bid-ask spreads confirms my results. Based on these findings, hedge accounting, according to IAS 39 and IFRS 9, seems to have similar informational effects on external stakeholders. The study is particularly interesting for standard setters since the objective of IFRS 9 hedge accounting is to better align hedge accounting regulation to firms' risk management strategies.

Keywords: IFRS 9, IAS 39, hedge accounting, risk management, information asymmetry

4.1 Introduction

This work is motivated by the extraordinary transition period towards hedge accounting according to the International Financial Reporting Standard (IFRS) 9, which allows a co-existence of two IFRS hedge accounting regimes in the market. Firms reporting under IFRS may choose between the 'old' International Accounting Standard (IAS) 39 and the 'new' IFRS 9 hedge accounting rules. With IFRS 9, the International Accounting Standards Board (IASB) aims to align hedge accounting more closely with firms' risk management strategies (McConnell, 2014). However, since IFRS 9 lacks so far the regulation concerning macro hedge accounting (IASB, 2014), the IASB decided to grant firms the possibility to further apply IAS 39 until the regulation of IFRS 9 hedge accounting is completely finalized (IFRS 9, para. 7.2.21). In addition to the new rules on IFRS 9 hedge accounting, the IASB enlarged the disclosure requirements in terms of hedge accounting defined in IFRS 7. Through hedge accounting, firms can mitigate the effects of asymmetric information arising from their risk management activities. The major goal of hedge accounting is to mirror firms' risk management activities in the financial statements by concurrently recording changes in the fair values of hedging instruments and hedged items of a hedging relationship. This simultaneity aspect aims to reduce the volatility in earnings. Survey evidence (Graham et al., 2005) and empirical research (Dichev & Tang, 2009) indicate that earnings volatility is negatively associated with earnings predictability. IAS 39 and IFRS 9 hedge accounting regulations differ in certain aspects such that hedging relationships affect earnings differently, leading to distinctive volatility in earnings (Müller, 2020).

I investigate whether the application of IFRS 9 hedge accounting and the related disclosure requirements of IFRS 7 impact information asymmetry. I use earnings forecast quality to proxy for information asymmetry between firms' managers and the sell-side analysts following the firms. Sell-side analysts are important intermediaries of financial information. They provide amongst others buy, sell, and hold recommendations to capital market participants (e.g., Lang & Lundholm, 1996; Groysberg et al., 2008) and make their recommendations publicly available to their clients (Groysberg et al., 2008) and on

websites (Ciccone, 2005).[61] In this study, I examine the forecast quality of sell-side analysts on earnings per share (EPS). I focus on earnings forecasts estimated one month prior to firms' EPS announcement dates. My sample consists of German non-financial firms that apply hedge accounting. It contains 378 self-collected firm-year observations. I measure forecast quality through analysts' earnings forecast dispersion and error.[62] I employ a cross-sectional ordinary least squares (OLS) regression to investigate the impact of applying IFRS 9 hedge accounting combined with IFRS 7 disclosure amendments and a difference-in-differences regression to examine the exclusive impact of applying IFRS 9 hedge accounting. I find no statistically significant differences in forecast quality between IAS 39 and IFRS 9 hedge accounting applicants, indicating that analysts' earnings forecast quality remains stable, independent of the applied hedge accounting regulation. Moreover, differences are also economically small. To overcome possible endogeneity concerns, I conduct an analysis that corrects for self-selection bias. Additionally, I run several robustness tests. The findings mainly confirm my results. Furthermore, I use bid-ask spreads as an alternative proxy for information asymmetry. Unlike forecast quality, bid-ask spreads incorporate, in addition to earnings information, more general information on financial reporting, such as disclosure (Leuz, 2003). Nevertheless, my results are not affected by this alternative proxy.

Prior literature on analysts' earnings forecast quality focuses mainly on differences between accounting standards in general (e.g., Elliott & Philbrick, 1990; Ashbaugh & Pincus, 2001; Hope, 2004; Ernstberger et al., 2008) or on the impact of hedging (e.g., Dadalt et al., 2002) and hedge accounting (e.g., Panaretou et al., 2013; Lemke & Möller, 2019) per se. Panaretou et al. (2013) examine whether hedge accounting under IFRS affects forecast quality using a sample from the United Kingdom (UK). Lemke & Möller (2019) analyzes whether IAS 39 (cash flow) hedge accounting leads to differences in forecast error between applicants and non-applicants for a German sample during the years 2009 to 2015.

[61] Financial analysts are divided into sell-side and buy-side analysts. Buy-side analysts also give buy, sell, and hold recommendations. In contrast to sell-side analysts, who are employed by financial institutions, buy-side analysts work in the research departments of investment firms and report directly to their portfolio managers (Groysberg et al., 2008).

[62] In this study, the terms forecast error and forecast accuracy are interchangeable. They express how good/accurate forecasts are, but they do not reveal the forecasts' bias (optimism/pessimism).

My study contributes to prior academic research by analyzing the differences in analysts' earnings forecast quality between two equally acceptable hedge accounting regimes of IFRS. To my knowledge, no other study to date analyzes the effect of IFRS 9 hedge accounting in comparison to IAS 39 hedge accounting on information asymmetry. Like in other studies with a single country setting (e.g., Ernstberger et al., 2008; Panaretou et al., 2013), heterogeneous markets and institutional differences do not influence my results (Leuz, 2003; Ernstberger et al., 2008). Moreover, this work might be of particular importance to standard setters since the objective of the IASB is to better align risk management and hedge accounting via the new hedge accounting rules. The results of my analyses do not provide evidence that information asymmetry differs after the introduction of IFRS 9 hedge accounting.

The remainder of this paper is structured as follows. Section 4.2 provides an overview of the related literature. In Section 4.3, I summarize the relevant facts of the institutional framework and develop my hypotheses. Section 4.4 explains my sample and data, defines my forecast dispersion and error measures, and describes my models. It also provides descriptive statistics and correlations. Section 4.5 presents and discusses my univariate and multivariate results and finally, Section 4.6 concludes.

4.2 Related Literature

Two basic strands of literature are fundamental to this study: the effect of hedging on asymmetric information and the effect of financial reporting on asymmetric information. First, I refer to prior research on the effect of hedging on asymmetric information. DeMarzo & Duffie (1995) examine this effect theoretically. According to their theory, hedging reveals managerial quality by eliminating risk factors that are beyond the control of the firm's management. Thus, earnings are less noisy and more informative when firms hedge their financial risks. Brown (2001) uses a field study to analyze hedging activities. He uses 14 consecutive quarters of complete historical transaction data from 1995 to 1998 of a multinational manufacturing firm. His results suggest that reducing asymmetric information between managers and other stakeholders is one of the motivating factors for

hedging. In their empirical work, Dadalt et al. (2002) explicitly examine the effect of hedging on asymmetric information. They proxy for hedging with a firm's derivative use and its extent of derivative use. Their sample consists of non-financial firms from the United States (US) included in the Swaps Monitor database with information regarding derivatives use from 1992 to 1996. The authors provide evidence that derivative usage, especially the use of currency derivatives, is negatively associated with information asymmetry. To measure information asymmetry, Dadalt et al. (2002) use analysts' earnings forecast accuracy and dispersion.

Second, I refer to the relation between financial reporting and asymmetric information. Lang & Lundholm (1996) investigate how corporate disclosure policy affects analyst following and analysts' earnings forecasts. The authors use data provided by the Report of the Financial Analysts Federation Corporate Information Committee (FAF Report) from 1985 to 1989. They find evidence that more informative disclosure policies are positively associated with the number of analysts following a firm and earnings forecast accuracy and negatively related to forecasting dispersion. Irani & Karamanou (2003) examine analysts' behavior in the context of Regulation Fair Disclosure. Regulation Fair Disclosure arguably implies a reduction in the quantity and quality of information disclosed to the public. They use analyst followings and forecast dispersion among analysts to proxy asymmetric information. The authors find that analyst followings decrease and forecast dispersion increases with less disclosed information.

Based on these two primary literature streams, further research strands can be identified to which my study directly contributes. I add to the literature that specifically focuses on how accounting changes are associated with information asymmetry by explicitly analyzing the transition from IAS 39 towards IFRS 9 hedge accounting. Elliott & Philbrick (1990) examine how accounting changes influence earnings predictability. For diverse mandatory and voluntary accounting changes in large US firms from 1976 to 1984, they document that forecast accuracy suffers in years with accounting changes compared to years without accounting changes. Investigating 80 non-US firms, Ashbaugh & Pincus (2001) distinguish between firms reporting under IFRS and those using domestic accounting rules. Due to similarity aspects across countries, they specify that IFRS reporters have

fewer accounting choices than their domestic counterparts. The authors find evidence that the more the domestic accounting choices differ from IFRS, the worse the related analysts' forecast accuracy. Similar results are provided by Ernstberger et al. (2008) for a German sample. They analyze forecast accuracy using forecast estimates depending on IFRS and US Generally Accepted Accounting Principles (GAAP) data compared to German GAAP data. In a cross-country analysis, Hope (2004) shows that the degree of accounting choices is negatively associated with forecast accuracy. His study covers the fiscal years of the first half of the 1990s. My study differs from the just mentioned in that it examines the voluntary change of a relatively small aspect of IFRS accounting instead of a change in the whole accounting regime. Doing so sheds light on whether the specific accounting rules themselves, here hedge accounting, can influence a firm's reporting quality such that analysts' earnings forecast quality changes. The results of my study show that IAS 39 and IFRS 9 hedge accounting are comparable in terms of forecast quality.

Studies on hedge accounting combine the two literature streams on hedging and financial reporting. While some studies rather focus on the determinants of hedge accounting (e.g., Glaum & Klöcker, 2011; Pierce, 2020; see also Chapter 3 of this doctoral thesis), others explicitly investigate the impact of hedge accounting on earnings predictability and information asymmetries (e.g., Panaretou et al., 2013; Lemke & Möller, 2019; Ranasinghe et al., 2022). Ranasinghe et al. (2022) analyze the impact of hedge accounting on earnings predictability in industries that are highly exposed to commodity price risks. They focus on the applicability of hedge accounting for hedges using derivative contracts. The authors find that analysts' forecast quality increases for firms that can apply hedge accounting. However, they also point out that hedges that do not qualify for hedge accounting decrease earnings predictability. In a conference proceeding, Lemke & Möller (2019) analyze the effects of IAS 39 (cash flow) hedge accounting on information asymmetry for a German sample of non-financial firms within a seven-year period from 2009 to 2015. They compare hedge accounting applicants and non-applicants. Their results indicate that IAS 39 cash flow hedge accounting increases the level of asymmetric information between managers and analysts, measured by forecast error, for hedge accounting applicants compared to non-applicants. Panaretou et al. (2013) examine the predictabil-

ity of earnings under IFRS hedge accounting. They investigate a sample of FTSE 350 non-financial firms around the period of IFRS adoption in the UK, from 2003 to 2008. The authors find evidence that IFRS hedge accounting decreases information asymmetry. Their results suggest that analysts' earnings forecasts are more accurate to actual earnings and less dispersed. Campbell et al. (2020) and Steffen (2021) focus on the Statement of Financial Accounting Standards (SFAS) 161[63] disclosure requirements concerning hedge accounting. Campbell et al. (2020) find that SFAS 161 improves analysts' earnings forecast quality. Steffen (2021) investigates information asymmetry using bid-ask spreads. The author confirms the reduction in information asymmetry when firms disclose following SFAS 161. I contribute to this strand of literature in the sense that I analyze the differences in analysts' earnings forecast quality when comparing the co-existing regulations of IFRS hedge accounting, IAS 39 and IFRS 9 and the related IFRS 7 disclosure requirements. I find no evidence that the application of the latter impacts forecast quality.

4.3 Background and Hypotheses Development

4.3.1 Institutional Background

Hedge accounting combines a particular set of accounting rules with the objective of reflecting a firm's risk management strategies in the financial statements. More specifically, it allows to simultaneously record changes in the fair values of hedging instruments and hedged items in the accounts and thereby displays the offsetting structure of the hedging relationship. However, applying hedge accounting is not obligatory, and firms might use 'ordinary' accounting rules to display their hedging relationships forgoing the offsetting effect in the accounts.

In the IFRSs, hedge accounting is regulated as part of the financial instruments. For

[63] SFAS 161 regulates 'Disclosures about Derivative Instruments and Hedging Activities' and represents amendment to SFAS 133 'Accounting for Derivative Instruments and Hedging Activities'. Both standards are issued by the Financial Accounting Standards Board (FASB) and are applied by firms using US GAAP. The original standard FAS 161 refers to FASB's accounting standard codification (ASC) 815.

the accounting of financial instruments, the IASB distinguishes between regulations concerning technical application and disclosure. Since 2005, *IAS 39 Financial Instruments: Recognition and Measurement* and since 2007 *IFRS 7 Financial Instruments: Disclosures* determined the reporting of financial instruments. IAS 39 however, was always accompanied by high complexity and burdensome restrictions (IFRS 9, para. BCE.177), resulting in misrepresentation of risk management activities and investor dissatisfaction (McConnell, 2014). Therefore, the IASB ultimately replaced IAS 39 by IFRS 9 after a long development process and extended the disclosure requirements defined in IFRS 7. For clarity, I utilize IFRS 7 in its former version (f.v.) 'IFRS 7 (f.v.)' when I refer to the version of IFRS 7 prior to the disclosure amendments introduced with IFRS 9, and I utilize 'IFRS 7' when I refer to the version with the new disclosure amendments.[64] With IFRS 9, the IASB aims to better synchronize a firm's risk management strategy and its hedge accounting (Lloyd, 2014; McConnell, 2014; BDO IFR Advisory Limited, 2014).

The IASB developed *IFRS 9 Financial Instruments* in three main projects: 1) classification and measurement, 2) impairment, and 3) hedge accounting. The standard was issued by the IASB in 2014, endorsed by the EU in 2016, and became effective for EU entities on 1 January 2018 (Commission Regulation (EU) 2016/2067). The application of IFRS 9 is hence compulsory from this date onward (IFRS 9, para. 7.1.1). The obligatory application, however, refers only to the parts of classification, measurement, and impairment but does not include the regulation of hedge accounting. This procedure is mainly based on the fact that currently, *Chapter 6: Hedge Accounting* of IFRS 9 determines only the rules on micro hedge accounting. The new project on macro hedge accounting[65] is still a work in progress. Entities that are interested in macro hedge accounting have to rely on IAS 39 (IFRS 9, para. 6.1.3, BC6.103-104).[66] Given the circumstances, the IASB grants

[64] In addition to the aforementioned standards, *IAS 32 Financial Instruments: Presentation* complements the regulation for financial instruments (IAS 32, para. 3).

[65] Macro hedge accounting refers to hedging activities of risk exposures arising from a portfolio of financial assets or liabilities, see IAS 39, para. 81A, 89A and IASB (2014). In contrast to that, micro hedge accounting includes a hedged item being either a single item or a group of items (IAS 39, para. 78, IFRS 9, para. 6.3.1). A group of items, among others, needs to consist of individually eligible hedged items (IFRS 9, para. 6.6.1).

[66] IAS 39 contains a specific model for the accounting of macro hedging. Details are given in IAS 39, para. AG114-AG132. However, the model applies only to fair value hedge accounting for a portfolio hedge of interest rate risk. The IASB seeks to develop a new approach concerning the accounting of dynamic risk management of open portfolios (IASB, 2014).

hedge accounting users, at the initial application of IFRS 9 in 2018, the opportunity to continue applying IAS 39 hedge accounting for all their hedging relationships (IFRS 9, para. 7.2.21). In case they stay with IAS 39 hedge accounting, firms are allowed to modify their choice towards IFRS 9 hedge accounting at the beginning of every reporting period (IFRS 9, para. BC6.104). Once switched to IFRS 9 hedge accounting, a reversion is no longer possible. The option to apply IAS 39 hedge accounting remains valid until the project on macro hedge accounting is finalized (IFRS 9, para. BC6.104). With this extraordinary transition period, the IASB paved the way for the co-existence of two hedge accounting regulations in the market. Independent of whether firms apply IAS 39 or IFRS 9 hedge accounting, the new disclosure rules of IFRS 7 are binding in terms of financial instruments anyway, but also in terms of hedge accounting (IFRS 7, para. 21A). Figure 4.1 illustrates the institutional setting of this work.

Prior research on analysts' earnings forecasts suggests that firms' information environment is an essential indicator of how accurate analyst estimates are (Bhushan, 1989). Information provided through annual reports is a crucial part of it (Acker et al., 2002). Currently, the information environment in terms of hedge accounting provided through financial statements is mainly defined by two critical aspects: the accounting choice between IAS 39 and IFRS 9 and the extended disclosure requirements of IFRS 7.

4.3.2 Hypotheses Development

4.3.2.1 The accounting choice between IAS 39 and IFRS 9

According to academic literature, choices in accounting are related to uniformity and consistency in accounting methods (Nobes & Parker, 2020; Hope, 2004), flexibility of managers (Basu et al., 1998; Hope, 2003b, 2004), as well as task complexity for analysts (Basu et al., 1998; Ashbaugh & Pincus, 2001; Hope, 2004). In this study, the main focus lies principally on the interacting elements of uniformity, consistency, and task complexity and their impact on analysts' earnings forecast quality. Uniform accounting rules simplify the comparability of accounting numbers and disclosure across firms. An accounting choice itself, given that different choices are actually applied by different firms, makes

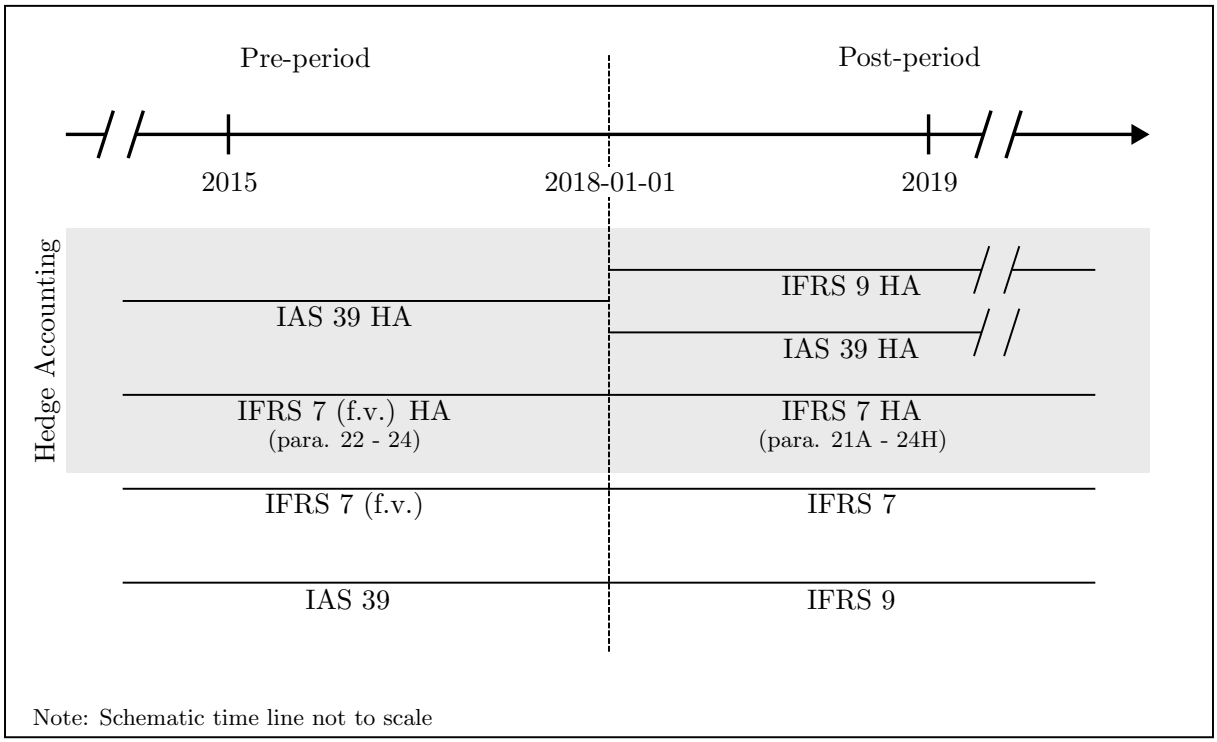

Figure 4.1: The figure illustrates the institutional setting underlying this study. It outlines the temporal validity of the hedge accounting (HA) regulations of IAS 39 and IFRS 9 as well as the corresponding disclosure amendments of IFRS 7 (f.v.) and IFRS 7 during a five year period from 2015 to 2019.

the valuation tasks of analysts more complicated. Consistent accounting rules simplify the comparability within firms over time. Changing the accounting method within a firm influences the comparability of that single firm's financial statements over the years. Such transformations that impact uniformity and consistency of the accounting might increase the complexity of estimating earnings, dependent on how important and influential these transformations are. As a consequence, analysts' earnings forecast errors and dispersion might increase. For clarification issues, I use the term 'earnings' for income and expenses included in profit or loss. If I refer to income and expenses included in other comprehensive income (OCI), I use the term OCI.[67] IAS 39 and IFRS 9 hedge accounting differ in certain aspects that might affect the quality of analysts to forecast earnings per share:

Hedged items

[67]In IAS 1, para. 7, the IASB provides the definitions of *profit or loss* and *OCI*.

Under IAS 39, especially non-financial firms experience difficulties in aligning the hedge accounting adequately to their risk management strategies. A major obstacle is a restriction when designating non-financial hedged items. Compared to financial firms, non-financial firms' business transactions demand a relatively high extent of hedging activities that include non-financial items. Generally, IAS 39 requires firms to designate non-financial items in their entirety. Designating only a single risk component of a hedged item is solely permitted when hedging foreign currency risks (IAS 39, para. 82(a)), but not concerning interest rate and commodity price risks. For example, commodity prices might also comprise delivery costs in addition to the specific commodity price itself (Pricewaterhouse Coopers, 2017b, p. 19). A hedging relationship can realize the offsetting effect between the hedging instrument and the hedged item only to the extent to which the diverse components of the hedged item are incorporated in the hedging instrument. Financial instruments, often derivatives designated as hedging instruments, offset by construction only these specific components of the hedged item, e.g., the specific commodity price itself, but not the delivery costs. Thus, the 'designation in its entirety' restriction of non-financial hedged items in IAS 39 might lead to a suboptimal match of the hedging instrument and the hedged item, leading to elevated hedge ineffectiveness. IAS 39, para. 89, 95(b), 102(b) require firms to recognize the ineffective portion of a hedging relationship in profit or loss, which consequently leads to more volatile earnings. To overcome this restriction, IFRS 9 provides firms the opportunity to generally designate single components of non-financial items as hedged items, independent of the underlying risk exposure (IFRS 9, para. 6.3.7). Therefore, hedging relationships that include non-financial hedged items should result in less undesired hedge ineffectiveness recognized in profit or loss (IFRS 9, para. 6.5.8, 6.5.11(c), 6.5.13(b)) and thus, in less volatile earnings.

Hedging instruments

Concerning hedging instruments, IAS 39, para. 74 requires the designation in their entirety. For specific derivatives, however, exceptions exist: firms might separate the time value and the intrinsic value of an option contract and designate only the intrinsic value as a hedging instrument (IAS 39, para. 74(a)), or to separate the forward and spot elements of a forward contract and designate only the spot element as a hedging instrument (IAS

39, para. 74(b)). IAS 39, para. 95-96 determine to recognize the non-designated parts (i.e., time value of an option contract or forward element of a forward contract) in profit or loss. Thus, earnings volatility increases. IFRS 9 introduces the new cost of hedging approach.[68] According to this approach, firms are able to recognize non-designated parts of hedging instruments (IFRS 9, para. 6.2.4(a)-(b)) in other comprehensive income (IFRS 9, para. 6.5.15-16) instead of recognizing them in profit or loss as defined in IAS 39. Hence, earnings volatility is not affected by non-designated parts of hedging instruments. Consequently, the offsetting effect of hedging instruments and hedged items should be more transparent to external stakeholders.

Effectiveness testing

IAS 39 requires firms to test the effectiveness of their hedging relationships prospectively and retrospectively, focusing mainly on quantitative measures. The hedge ratio[69] needs to meet a range of 80-125% (IAS 39, AG105). On the contrary, IFRS 9, para. 6.4.1(c)(i) emphasizes the economic relationship between hedging instruments and hedged items. Thus, mainly qualitative measures are used. Moreover, IFRS 9 demands effectiveness testing only in a prospective manner (IFRS 9, para. B6.4.12).

Given the institutional framework of IAS 39 and notwithstanding the opportunistic behavior of managers, managers of firms that, e.g., have a relatively high extent of commodity and interest rate risk exposures they want to hedge, might face more difficulties in providing realistic information of their risk management through hedge accounting. Consequently, information asymmetry between managers and external stakeholders might be elevated. With the new hedge accounting regulation of IFRS 9, managers of those firms might be able to better align hedge accounting with their risk management strategies leading to less information asymmetry (Bartov & Bodnar, 1996) and analysts might have a more profound and informative idea of a firm's performance. Furthermore, less volatility in profit or loss should make earnings more predictable (Graham et al., 2005; Dichev & Tang, 2009). Hence, forecast quality should increase. However, one might also think

[68] The new cost of hedging approach interprets the non-designated part as a premium for risk protection (IFRS 9, para. BC6.389; Ramirez, 2015).

[69] IFRS 9 defines the term *hedge ratio* in the Appendix A Defined terms. It is defined as "the relationship between the quantity of the hedging instrument and the quantity of the hedged item in terms of their relative weighting".

of contradicting arguments leading to decreased forecast quality. First, the possibility of choosing between two hedge accounting standards makes the comparability across firms more difficult. For example, Ashbaugh & Pincus (2001) find evidence that accounting choices are associated with lower forecast accuracy. Tan et al. (2011) emphasize the benefits of comparability when using the same accounting standards. In contrast to other transition rules, IFRS 9, para. 7.2.22 does not ask for retrospective application. Firms that newly adopt IFRS 9 hedge accounting are required only to apply the rules prospectively.[70] Hence, even if the provided information through IFRS 9 itself might be more useful to analysts, the lack of comparability and the complexity of new accounting rules might reduce forecast quality.[71] Chang et al. (2016) emphasize the difficulties analysts face in forecasting the financial reporting of new derivative users. A new hedge accounting regulation might have a similar impact. Second, quantitative measures might be more useful and uniformly interpretable than qualitative ones. Hence, forecast accuracy and dispersion might suffer from the more principle-based approach in IFRS 9. Wong (2000) finds quantitative disclosure of SFAS 119[72] to be useful for financial statement users, at least to assess firms' currency risk exposures. Third, analysts certainly lack experience with IFRS 9 hedge accounting. Prior research finds opposing evidence on whether analysts learn from experiences and whether experience actually matters in forecasting earnings (Jacob et al., 1999).

So far, I solely shed light on the differences in the regulation of IAS 39 and IFRS 9 hedge accounting per se and thus, on the information which is directly reflected in the accounting numbers, especially in earnings, through technical accounting effects. Besides this information effect which might ameliorate analysts' earnings quality, voluntary disclosure is also associated with a signaling effect (Ewert, 1999). The adoption and application of IFRS 9 hedge accounting might signal firms' willingness to publish transparent and more

[70] Exceptions exist (IFRS 9, para. 7.2.26) amongst others when firms adopt IFRS 9 hedge accounting while having designated only the intrinsic value of an option contract as hedging instrument. The non-designated time value of the option is accounted for in profit or loss according to IAS 39, para. 95-96 and in other comprehensive income in IFRS 9, para. 6.5.15.

[71] Daske et al. (2008) uses a similar argument in favor of uniform IFRS reporting across countries and its potential positive impact on investors.

[72] SFAS 119 'Disclosure about Derivative Financial Instruments and Fair Value of Financial Instruments' is issued by the FASB and is applied by firms using US GAAP. Disclosure requirements are now part of FASB's ASC 815.

precise information concerning hedging relationships to improve the understanding of risk management strategies for external stakeholders by more closely aligning the accounting with risk management. Since passing from the old to the new hedge accounting regime is costly, firms will go for it only if it is worth it. That is, adopting IFRS 9 hedge accounting should generate a credible signal (Wagenhofer & Ewert, 2015) and opportunistic behavior of the management should be less likely. Nevertheless, discretion and judgment on the side of the management still exist. Whether managers base their decision to opt for IFRS 9 hedge accounting mainly on the informational aspect or the signaling aspect is difficult to disentangle (Ewert, 1999). The decision to adopt IFRS 9 hedge accounting, however, is a relatively small commitment compared to the decision to adopt a whole new accounting regime, as was the case, e.g., in the late 1990s and early 2000s with IAS/IFRS for capital market-oriented entities in Germany and other countries. Thus, the signaling effect might be of minor importance here. Moreover, also the application of the extended IFRS 7 disclosure amendments in terms of hedge accounting, which is compulsory for all hedge accounting applicants (IFRS 9, para. BC6.104, IFRS 7, para. 21A), might diminish the signaling effect.

In summary, the differentiated considerations mentioned above do not permit clear reasoning and a likely direction of effects. While the purely technical accounting aspects might rather suggest a negative relation between the application of IFRS 9 hedge accounting and information asymmetry, the understandability and interpretability of a new hedge accounting regime might be opposing terms. Therefore, I do not predict the direction of the impact of IFRS 9 hedge accounting application on information asymmetry between managers and analysts. I hypothesize:

H1 The application of IFRS 9 hedge accounting impacts information asymmetries.

4.3.2.2 The extension of IFRS 7 disclosure requirements

This section aims to evaluate whether the disclosure amendments of IFRS 7 impact information asymmetry. Until the introduction of IFRS 9, the IASB was very vague in its demands on what entities must disclose regarding their risk management. The specifications on hedge accounting were relatively short and imprecise. All disclosure requirements

concerning hedge accounting were described on one page of the IFRS red and blue book Part A. Hence, the standard gave rather much scope for individual elaborations by firms. According to IFRS 7 (f.v.), para. 22, entities should generally provide disclosure with descriptions of each type of hedge (fair value hedge, cash flow hedge, hedge of a net investment in a foreign operation). For each type of hedge, firms have to separately disclose the hedging instrument and its fair values at the end of the reporting period and the kind of risk that is hedged. Moreover, firms should disclose ineffectiveness in profit or loss from cash flow hedges and hedges of a net investment in a foreign operation (IFRS 7 (f.v.), para. 24(b)-(c)). Most of the disclosure requirements given in IFRS 7 (f.v.) refer to cash flow hedges (IFRS 7 (f.v.), para. 23). Here, the standard requires information about the timing and uncertainty of future cash flows as well as about the amounts recognized in other comprehensive income (IFRS 7 (f.v.), para. 23(c)), reclassified from equity to profit or loss (IFRS 7 (f.v.), para. 23(d)) or removed from equity and included as a basis adjustment in the non-financial asset or non-financial liability (IFRS 7 (f.v.), para. 23(e)). For fair value hedges, the standard asks firms to separately disclose gains and losses on the hedging instrument and the hedged item (IFRS 7 (f.v.), para. 24(a)). Moreover, the standard does not explicitly indicate how to provide hedge accounting disclosure. The blue book Part B generally describes the presentation of financial instruments' disclosure in a table but allows other forms in case they seem more appropriate (IFRS 7 (f.v.), para. BC24Z). Given the mentioned requirements, firms provided only limited and unstandardized information about their risk management strategies and hedge accounting. Consequently, users of financial reports were confronted with unstandardized disclosure and room for individual interpretations of them by themselves.

The new disclosure requirements on hedge accounting are more extensive and detailed. IFRS 7 fills almost six pages of the red and blue book Part A compared to only one page in the former version. It seems that the IASB is trying to establish a framework that allows a more standardized presentation of hedge accounting disclosure and a more uniform choice of what firms should disclose and how they should disclose it. For example, IFRS 7 relates to the bundling of disclosure in a single note[73] or a separate section of the

[73]IAS 1, para. 7 defines the term. *Notes* consist of information in addition to the information presented in the financial statements.

financial statements (IFRS 7, para. 21B), the exposition of specific amounts in a lucid tabular format (IFRS 7, para. 24A, 24C), and the proposition of information per risk category an entity faces (IFRS 7, para. 22A, 23A, 23D, 24A-C) and partly also per type of hedge it designates, i.e., fair value hedge, cash flow hedge, hedge of a net investment in a foreign operation. By doing so, the IASB leaves less scope for individual interpretation of what is required by the standard compared to the former version. Consequently, managers should be able to provide disclosure on hedge accounting in a more standardized and uniform manner, and users of financial reports should be able to better understand and interpret the available information. The IASB structured the standard in three main parts: the firm's risk management strategy (IFRS 7, para. 22), the amount, timing, and uncertainty of future cash flows (IFRS 7, para. 23), and the effects of hedge accounting on financial position and performance (IFRS 7, para. 24). Nevertheless, the IASB still leaves freedom of interpretation. IFRS 7, para. 21D explicitly states that the degree of detail in disclosing hedge accounting information is with the firm. Moreover, IFRS 7, para. B3, IN4 point to the challenge of balancing the amount of disclosure (Lüdenbach, 2019). On the one hand, the provided information shall be sufficient to make the disclosed matters understandable and interpretable for external stakeholders. On the other hand, the provided information shall be reduced as much as possible to avoid overloading the reporting. Firms have to comply with the principle of materiality (Lüdenbach, 2019).
In terms of empirical evidence, prior research finds that higher levels of disclosure are associated with higher forecast accuracy (e.g., Irani & Karamanou, 2003; Ernstberger et al., 2008; Campbell et al., 2020). Steffen (2021) even finds evidence that qualitative disclosure and less aggregated quantitative data are more important to reducing information asymmetry than the form of disclosure presentation, e.g., tabular formats. With the setting of my study, I cannot disentangle the impact of IFRS 7 hedge accounting disclosure on information asymmetry from the application of IFRS 9 classification, measurement, and impairment and their impact on information asymmetry. I focus on whether or not firms apply the respective standards. The application of both standards is compulsory for fiscal years beginning in 2018, see Figure 4.1. Nevertheless, I can measure whether the hedge accounting regulations of IFRS 7 together with IFRS 9 hedge accounting have an im-

pact on asymmetric information. I expect that the new designation possibilities given in IFRS 9 combined with the enlarged quantitative and qualitative disclosure amendments of IFRS 7 influence firms' presentation of their risk management strategies which in turn influences analysts' ability to forecast earnings.

Given the empirical evidence regarding disclosure requirements, the amendments of IFRS 7 in terms of hedge accounting might help enhance the standardization process of information published in annual reports and hence, might facilitate comparability across firms. As a consequence, forecast quality might increase. On the contrary, disclosure changes might hamper the comparability within a firm over time which possibly results in lower forecast quality. In addition, IFRS 7 still leaves room for interpretation. Since I do not make a directional prediction concerning the impact of IFRS 9 hedge accounting per se, see H1, and the presented aspects regarding IFRS 7 also do not necessarily point towards a specific direction, I abstain from predicting a direction of the influence of the new hedge accounting rules, consisting of the combined requirements of IFRS 9 and IFRS 7, on information asymmetry between managers and analysts. Therefore, I hypothesize:

H2 The application of the new hedge accounting rules impacts information asymmetries.

4.4 Research Design

4.4.1 Sample and Data

I use a hand-collected German data set to investigate the effect of IFRS 9 hedge accounting and IFRS 7 amendments on asymmetric information. Like in Ernstberger et al. (2008), I restrict my sample to a single country in order to eliminate country-specific differences that might impact analysts' forecast accuracy as stated in several cross-country studies (e.g., Hope, 2004). Being a strong export country[74] and having a relatively large capital market compared to other European countries[75] (Credit Suisse, 2018), the Ger-

[74]Detailed information on exports of goods from EU countries can be found on `https://de.statista.com/statistik/daten/studie/7055/umfrage/export-von-guetern-aus-den-eu-laendern/`, retrieved on 2021-10-06.

[75]Comparing the sizes of stock markets of European countries, Germany is third in 2017 (3.2%), after UK (6.1%) and France (3.3%) (Credit Suisse, 2018).

man case is an interesting one to study in the context of hedging. My study investigates non-financial firms listed in the German indices DAX30, MDAX, SDAX, or TECDAX during a five-year observation period from 2015 to 2019. Thus, I cover three fiscal years prior to IFRS 9 introduction and IFRS 7 amendments (2015-2017) and two fiscal years after (2018-2019). Before any data manipulations, the sample consists of 860 firm-year observations, corresponding to 195 single firms. The sample comprises fiscal years equal and unequal to calendar years. To ensure comparability across observations from first-time adoptions of IFRS 9 hedge accounting and IFRS 7 amendments, I strictly assign each fiscal year to the calendar year in which it started. I employ data from different sources. Hedge accounting-related data is hand-collected from annual IFRS reports available at firms' websites. I use hedge accounting-related data to identify hedge accounting applicants and, among the applicants, to distinguish between IAS 39 and IFRS 9 users. The Institutional Brokers Estimate System (I/B/E/S) provides data on analysts' earnings forecasts. The Worldscope database provides additional data on firm characteristics. I access I/B/E/S as well as Worldscope data through Datastream. Financial data is provided by Datastream. The sample is subject to some data manipulations. First, I remove duplicate observations from TECDAX listings in 2018 and 2019.[76] Moreover, I restrict the sample to non-financial hedge accounting applicants. I exclude financial firms identified based on their four-digit SIC codes (6000 - 6799).[77] There are several reasons for this. First, financial firms and industrial corporations generally differ in their balance sheets and business activities. Second, financial firms and industrial corporations specifically differ in their hedging activities. Dynamic portfolio risk management, also referred to as macro hedging, is especially important to financial firms (Deutsche Bundesbank, 2019). Since the IASB is still working on the IFRS 9 macro hedging project, financial firms might have strong incentives to stick to IAS 39 hedge accounting for the time being. Third, specific institutional regulations exist for financial firms (e.g., bank regulation). Especially

[76] In September 2018, Deutsche Börse enlarged MDAX and SDAX compositions from 50 to 60 and 50 to 70 constituents, respectively, by enabling technology companies listed in TECDAX to access also MDAX or SDAX (`https://www.handelsblatt.com/finanzen/maerkte/aktien/aktienindizes-so-sehen-mdax-sdax-und-tecdax-kuenftig-aus/23002476.html?ticket=ST-5821207-TfQrOYcKwzaDVpscc5kI-cas01.example.org`, retrieved on 2021-12-23).

[77] SIC codes are extracted from Datastream (Worldscope) using the item 'WC19506'.

for insurance companies, also the obligation to apply IFRS 9 differs. It is postponed to 2023-01-01 (Commission Regulation (EU) 2020/2097, 2020). In addition, I adjust the sample further due to firm-year observations with short fiscal years and missing values. The final sample contains 378 firm-year observations, including 91 single firms. Table 4.1, Panel A presents the data manipulations and Panel B the sample composition regarding hedge accounting application. It shows that sample firms do not choose to apply IFRS 9 hedge accounting early. However, with the introduction of IFRS 9 in 2018, most of the firms in my sample opt for IFRS 9 hedge accounting. Only three firms decide to start applying IFRS 9 hedge accounting in 2019.

4.4.2 Measuring Information Asymmetry

In this study, I apply two measures to estimate analysts' earnings forecast quality: earnings forecast dispersion among analysts and analysts' forecast error. I use these measures to proxy for information asymmetry. Forecast dispersion measures the spread of analysts' earnings estimates. As defined in Lang & Lundholm (1996) and adopted in Dadalt et al. (2002), forecast dispersion is calculated as the ratio of the standard deviation of the estimates to the stock price[78] at the beginning of the fiscal year:

$$Dispersion_{i,t} = \frac{StdDev(ForecastEPS_{i,t})}{StockPrice_{i,t-1}}. \tag{4.1}$$

I/B/E/S provides the standard deviation of analysts' earnings estimates through datatype 'EPS##SD'. ## refers to the last two points of the fiscal year (20##) the forecast is estimated for.

Forecast error is the absolute difference between the actual earnings per share[79] and the median of analysts' earnings forecasts (I/B/E/S datatype 'EPS##MD') deflated by the stock price at the beginning of the fiscal year:

$$Error_{i,t} = \frac{|ActualEPS_{i,t} - Median(ForecastEPS_{i,t})|}{StockPrice_{i,t-1}}. \tag{4.2}$$

[78] I use Datastream datatype 'UP' for the historical stock price traded at the exchange.

[79] I retrieve actual earnings per share via Datastream using Worldscope datatype 'WC18193' for reported EPS at fiscal year-end.

Table 4.1: Sample composition and hedge accounting practices

Panel A: Data manipulations	Firm-year observations		
	Before IFRS 9 introduction (2015-2017)	After IFRS 9 introduction (2018-2019)	Total
All	480	380	860
- TECDAX duplicates in 2018 and 2019	0	-60	-60
- Non-hedge accounting applicants	-130	-103	-233
- Financial firm-year observations	-63	-43	-106
- Firm-year obs. with short fiscal years	-2	0	-2
- Missing data	-51	-30	-81
Sample	**234**	**144**	**378**
Panel B: Actual hedge accounting application - sample composition to test H2			
IFRS 9 hedge accounting (no. of single firms)	0 (0)	106 (56)	106 (56)
adopted in 2018 (no. of single firms)		*103 (53)*	
adopted in 2019 (no. of single firms)		*3 (3)*	
IAS 39 hedge accounting (no. of single firms)	234 (87)	38 (21)	272 (89)
Panel C: Treatment and control group - sample composition to test H1			
Treatment group (no. of single firms)	153 (54)	103 (53)	256 (56)
Control group (no. of single firms)	67 (28)	34 (17)	101 (30)

Notes: In Panel A, the table shows the sample composition before and after IFRS 9 introduction of German listed firms in DAX30, MDAX, SDAX, and TECDAX. The adjusted sample contains 378 firm-year observations. Panel B presents the number of firm-year observations applying IAS 39 and IFRS 9 hedge accounting. It contains 378 firm-year observations, including 91 single firms, and serves to test Hypothesis H2. Panel C splits the sample in treated and untreated observations. It contains 357 firm-year observations, including 86 single firms, and builds the sample for the difference-in-differences research design to test Hypothesis H1.

Similar calculations of forecast error, often also referred to as forecast accuracy, are used in, e.g., Lang & Lundholm (1996), Dadalt et al. (2002), Ernstberger et al. (2008) Panaretou et al. (2013), Lemke & Möller (2019). The forecast error measure of these studies differs mainly in the fraction numerator. Instead of taking the median of earnings forecasts, some researchers insert the mean value. Moreover, some studies use the negative absolute difference between actual and forecast earnings.[80] To reduce the effect of possible outliers,

[80]Studies that focus on the forecast bias, that is, how the forecast differs from the actual earnings (higher/lower), make use of the same formulae, but take the 'normal' difference, not the absolute difference in the numerator (e.g., Das et al., 1998).

I use the median forecasts. I winsorize the dependent variables $Dispersion_{i,t}$ and $Error_{i,t}$ at the 1st and 99th percentile.

$ForecastEPS_{i,t}$ includes all analysts' estimates available in I/B/E/S for the last month before the announcement date of the firm's actual earnings.[81] I retrieve the respective earnings announcement date via I/B/E/S datatype 'EPSANCDT'. To ensure that monthly I/B/E/S data retrieved from Datastream corresponds to the month in which forecasts are produced in I/B/E/S, it is suggested to retrieve forecast estimates after the 20th of the month and before the end of the month.[82] This is because analysts' earnings forecast estimates from I/B/E/S are updated in Datastream around the 15th of each month. Figure 4.2 outlines an exemplary forecast time frame for the fiscal year ending on 2019-12-31 for BASF AG, including the relevant dates used in this study.

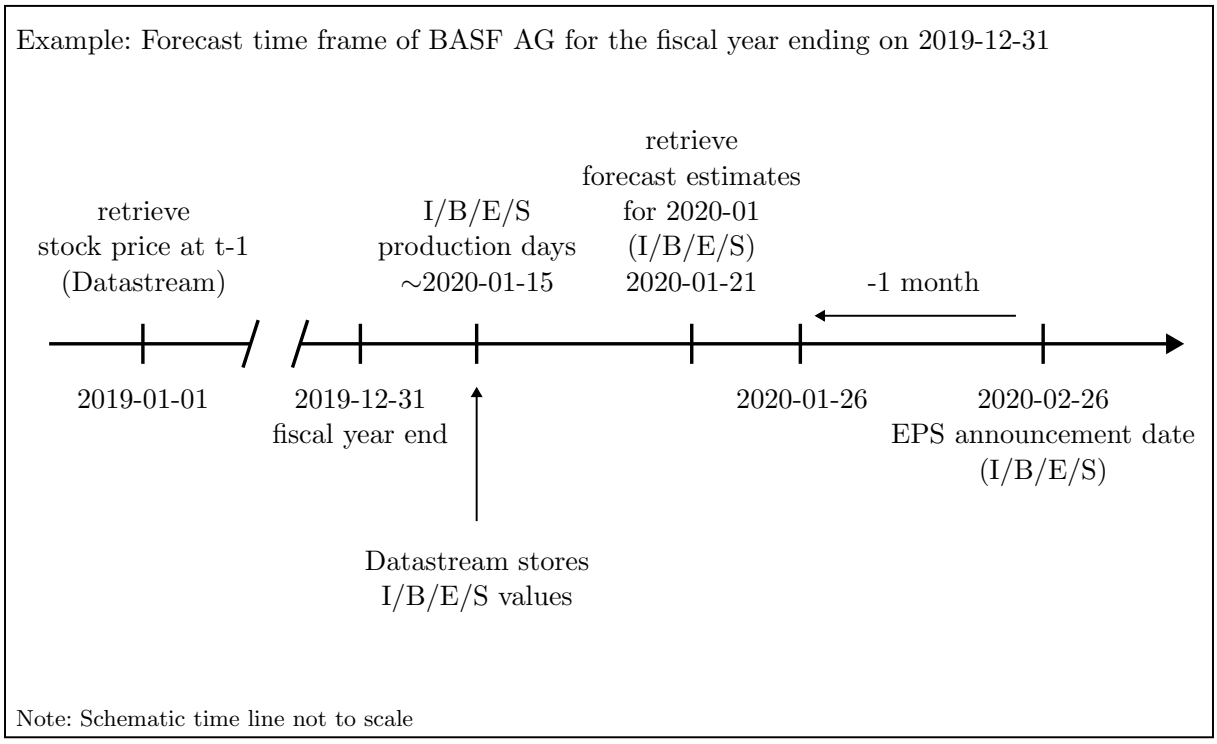

Figure 4.2: The figure illustrates the dates that are relevant to calculate analysts' earnings forecasts with I/B/E/S data. The exemplary time frame depicts the relevant dates of BASF AG for the fiscal year ending on 2019-12-31.

[81] E.g., Dadalt et al. (2002) and Panaretou et al. (2013) also include forecasts within a time frame of one month before the respective earnings announcement date in their forecast measures.
[82] See Refinitiv (2020) for further details.

4.4.3 The Models

I use fixed effects OLS regressions to investigate the developed hypotheses. To examine solely the effect of IFRS 9 hedge accounting application on asymmetric information (H1), I employ a difference-in-differences analysis. The policy change in hedge accounting through IFRS 9 characterizes this study's setting, indicating the voluntary application of IFRS 9 hedge accounting. The voluntary principle implies the possibility to opt for IFRS 9 hedge accounting in later years, i.e., in 2019. Thus, multiple treatment periods exist. To account for this circumstance, it is necessary to issue a rollout design (Huntington-Klein, 2022). A rollout design allows, first, for different treatment groups and second, for different treatment years (Huntington-Klein, 2022), e.g., treatment group 1 gets treated in 2018, treatment group 2 gets treated in 2019.[83] Due to the limited sample size in my study and the fact that only three sample firms opt for IFRS 9 hedge accounting in 2019 (see Table 4.1, Panel B), I refrain from including a separate 2019 treatment group. To still solve the matter, I adjust the sample used in the difference-in-differences analysis by excluding observations from firms that do not opt for IFRS 9 in 2018. Doing so, I define the voluntary adoption of IFRS 9 hedge accounting rules in 2018 as the 'treatment'. Thus, firms that apply IFRS 9 hedge accounting in 2018 for the first time build the treatment group. Hedge accounting applicants that stay with IAS 39 and are not affected by the treatment build the control group. Moreover, I divide the observation period into two parts, one before the introduction of IFRS 9 and one after. Thus, the pre-period lasts from 2015 to 2017 and the post-period from 2018 to 2019. I estimate the following model:

$$\begin{aligned} DependentVariable_{i,t} = \beta_0 + \beta_1 TREAT_i + \beta_2 POST_t + \beta_3 TREAT_i \times POST_t + \\ + \sum_{j=1}^{J} \gamma_{ji,t} \times C_{ji,t} + \epsilon_{i,t}. \end{aligned} \tag{4.3}$$

The coefficient of interest in the difference-in-differences setting given in Eq. (4.3) is the difference-in-differences estimator β_3, which is the coefficient of the interaction term $TREAT_i \times POST_t$. It reflects the effect of IFRS 9 hedge accounting application on the

[83] Goodman-Bacon (2021) describes the problem of applying the classic (two-way fixed effects) difference-in-differences design in a setting with multiple treatment periods from a statistical perspective.

average level of information asymmetry. Since it is compulsory for all hedge accounting applicants, independent of the applied standard being IFRS 9 or IAS 39, to implement the new IFRS 7 disclosure amendments to hedge accounting for fiscal years beginning on 1 January 2018 or later, the difference-in-differences estimator should capture the impact of IFRS 9 hedge accounting solely, without any influence of IFRS 7. In Eq. (4.3), β_1 is the average difference in information asymmetry between treatment and control firms in the pre-period, thus, prior to IFRS 9 introduction. $TREAT_i$ is an indicator variable which is coded as 1 if firm i corresponds to the treatment group (adopts IFRS 9 hedge accounting) and as 0 otherwise. β_2 reflects the average difference in information asymmetry of control firms between pre- and post-period. $POST_t$ is another indicator variable. It is coded as 1 if the observation refers to the post IFRS 9 introduction period and as 0 otherwise. Since the introduction of IFRS 9 in 2018 implies the mandatory application of IFRS 9 in terms of classification, measurement, and impairment of financial instruments for all firms, even for IAS 39 hedge accounting applicants, this effect is also captured in the coefficient of the variable $POST_t$. The same should be true for the disclosure amendments of IFRS 7 accompanying IFRS 9 introduction.

To examine the effect of applying the new hedge accounting rules (H2), which combine the application of IFRS 9 hedge accounting and the respective disclosure amendments of IFRS 7, I estimate the following model:

$$DependentVariable_{i,t} = \beta_0 + \beta_1 HA\ new_{i,t} + \beta_2 POST_t + \sum_{j=1}^{J} \gamma_{ji,t} \times C_{ji,t} + \epsilon_{i,t}. \qquad (4.4)$$

To test my Hypothesis H2, I use the independent variable $HA\ new_{i,t}$, implying the application of IFRS 9 combined with the IFRS 7 disclosure amendments. It is an indicator variable coded as 1 if firm i applies the new hedge accounting rules in time t and as 0 otherwise. The coefficient of interest is β_1. It reflects the average difference in information asymmetry measured through forecast $Dispersion_{i,t}$ or $Error_{i,t}$ between the hedge accounting adopters of the new rules and IAS 39 applicants, all else being equal. In this model specification, I include $POST_t$ as another explanatory variable. This is necessary, as it classifies the observations in pre- (0) and post-period (1) and thus, explicitly cap-

tures the impact of IFRS 9 classification, measurement, and impairment, as well as the impact of IFRS 7 except for its regulation concerning hedge accounting which is captured by $HA\ new_{i,t}$ for IFRS 9 adopters.[84]

In addition to the model-specific independent variables already described above, I use several control variables that are determinants of forecast quality as documented in prior research (e.g., Hope, 2003a; Dadalt et al., 2002; Panaretou et al., 2013). Further information on variable definitions are appended in B.1.

Size: Information availability is likely to vary with firm size. Compared to smaller firms, larger firms have more complex operations and organizational structures, which is why they tend to release more information. Moreover, larger firms have better-developed communication channels through which they provide information. Several studies find evidence that firm size is positively associated with the degree of information about a firm that is available to stakeholders (Brown, 1993; Lang & Lundholm, 1993; Atiase, 1985; Bamber, 1987; Bhushan, 1989; Freeman, 1987). The more information released, the lower should be the information asymmetry between the firm and the analysts following the firm. Thus, I expect the firm size to be inversely related to information asymmetries. In this study, *Size* is calculated as the natural logarithm of a firm's market value of equity (in EUR).

Loss: Whether or not a firm realizes losses might also impact earnings predictability. Prior studies revealed that analysts face more difficulties in forecasting earnings for firms that realized losses than for firms that realized profits in the past (Dowen, 1996; Ciccone, 2005). Multiple explanations seem possible. For example, (i) Loss firms are generally less followed by sell-side analysts (Hwang et al., 1996). Less analyst following might increase forecast error, see below; (ii) Sell-side analysts might be more optimistic in forecasting loss firms compared to profit firms and tend to overestimate their earnings (Das et al., 1998); (iii) Loss years might be driven by big bath accounting (Hope, 2004). Temporary events are more difficult to adequately include in forecast estimates (Hwang et al., 1996) leading to less forecast accuracy. To control for negative earnings, I include the indicator variable *Loss* in my analyses. *Loss* is coded as 1 if a firm had negative EPS in the year

[84] For the sake of brevity, I do not mark the variables with the indices i and t in the subsequent elaborations of this work.

prior to the current reporting year and 0 otherwise. I expect *Loss* to increase information asymmetry.

Stability: Another compounding factor when estimating earnings is earnings stability. Less volatile, and hence more stable earnings are better predictable (Graham et al., 2005; Dichev & Tang, 2009), leading to more accurate forecasts. Furthermore, finding a forecast consensus among analysts is more complicated when earnings are highly volatile (Dadalt et al., 2002). Therefore, I include earnings stability in the regressions. I/B/E/S provides a datatype that reflects earnings stability based on the past five years' EPS values.[85] *Stability* is determined as the natural logarithm of this datatype. Lower values indicate more stability. I expect more *Stability* to decrease information asymmetry.

Leverage: Earnings variability might also be associated with a firm's capital structure. Highly levered firms might have more volatile earnings due to financial distress (Dadalt et al., 2002; Panaretou et al., 2013). More volatile earnings are less predictable (Graham et al., 2005; Dichev & Tang, 2009), resulting in less accurate earnings forecasts and higher dispersion. Though, firms with more financial distress are more likely to reduce earnings volatility (Smith & Stulz, 1985), which in turn might indicate an increase in forecast quality. I follow previous research and control for a firm's capital structure by including a variable that measures a firm's leverage. *Leverage* is calculated as the ratio of the book value of total debt (in EUR) to the market value of equity (in EUR). I winsorize the variable at the 1st and 99th percentile.

Analysts: This variable determines the number of sell-side analysts following the firm. For example, Bhushan (1989) and Irani & Karamanou (2003) use the number of analysts as a proxy for forecast accuracy. The more analysts follow a firm, the more intense the competition between these analysts and the higher the incentive to make good forecasts (Panaretou et al., 2013). Moreover, according to Shores (1990), the number of analysts is increasing with firm size (Brown, 1993). Since the firm size is associated with the level of information asymmetries, the number of analysts should also be. I expect information asymmetry to decrease with an increasing number of analysts following the firm. I trim

[85] I use I/B/E/S datatype 'YR5STB' to measure earnings stability. The item is defined as "the mean absolute percentage difference between actual reported earnings per share and a five-year historical EPS growth trend line, expressed as a percentage of trend line earnings per share" (Refinitiv, 2020, p. 28).

the data and include only observations with at least three analysts following which is common in the literature (e.g., Dadalt et al., 2002; Chang et al., 2000; Panaretou et al., 2013).

Earnings: Earnings are directly included in the equation of forecast error, see Eq. (4.2). Several studies find that a firm's earnings level itself is associated with the predictability of earnings in terms of forecast error and forecast optimism (Eames & Glover, 2003). Eames & Glover (2003) shows that relatively low earnings are associated with relatively high absolute forecast errors.[86] Less predictable earnings should intuitively also increase forecast dispersion among analysts. *Earnings* present the reported EPS (in EUR) at fiscal year-end divided by the stock price (in EUR) at the beginning of the fiscal year. The calculation is derived from Panaretou et al. (2013, p. 125). I winsorize the variable at the 1st and 99th percentile.

MTB: I also control for the firms' growth opportunities. Firms with more growth opportunities are often associated with higher levels of uncertainty through new future projects. The uncertainty related to new future projects makes earnings more volatile and less predictable (Froot et al., 1993; Dadalt et al., 2002; Panaretou et al., 2013) which consequently might decrease forecast quality. On the contrary, firms with more growth opportunities might have more interest in reducing earnings volatility (Dadalt et al., 2002). I measure firms' growth opportunities using their market-to-book ratio of equity at the end of the respective fiscal year. I winsorize the variable at the 1st and 99th percentile.

Fixed effects: Finally, I include time and industry fixed effects as control variables in the regressions. Time fixed effects capture year-specific events that affect all firms equally (*Year FE*). Industry fixed effects[87] capture industry-specific characteristics that are constant over time (*Industry FE*).

Table 4.2 provides descriptive statistics of the dependent variables *Dispersion* and *Error* as well as of the control variables for the sample firms. The table depicts the number of firm-year observations (N), mean, median, standard deviation (St. Dev.), and minimum

[86] Based on the timing criterion discussed in Angrist & Pischke (2009), I consider *Earnings* not to be a bad control. *Earnings* are determined (but not announced) at fiscal year-end and, thus, before analysts make their earnings forecasts.

[87] I extract the firms' SIC codes from Datastream (Worldscope) using the item 'WC19506' and assign each firm to one of the ten industries classifications determined by Fama & French.

and maximum values. Panel A and B restricts the sample separately to IFRS 9 and IAS 39 hedge accounting applicants. Panel C describes the whole sample.

Table 4.3 provides Pearson and Spearman rank correlation coefficients of the control variables at the lower left and higher right, respectively. Conventional significance levels are depicted with *, **, and *** at 0.1, 0.05, and 0.01 (two-tailed). *Size* and *Analysts* as well as *Loss* and *Earnings* show significantly high bivariate correlation coefficients of 0.77 and 0.78, and -0.71 and -0.50. To account for these correlations, I also estimate the regression models when including correlated variables separately (e.g., Glaum & Klöcker, 2011).

Table 4.2: Descriptive statistics

	N	Mean	Median	St. Dev.	Min	Max
Panel A: IFRS 9 hedge accounting applicants						
Dispersion	106	0.0100	0.0053	0.0155	0.0002	0.0814
Error	106	0.0303	0.0097	0.0608	0.0003	0.3721
Size	106	22.9046	22.8177	1.5504	19.2978	25.7192
Loss	106	0.1132	0	0.3184	0	1
Stability	106	3.0817	3.0938	0.9170	0.6729	4.8201
Leverage	106	0.0006	0.0004	0.0007	0.0000	0.0027
Analysts	106	18.9623	20	8.1485	3	39
Earnings	106	0.0436	0.0531	0.0865	-0.3942	0.2176
MTB	106	2.6168	1.8631	2.2894	0.5078	11.2836
Panel B: IAS 39 hedge accounting applicants						
Dispersion	272	0.0072	0.0042	0.0103	0.0001	0.0814
Error	272	0.0211	0.0062	0.0486	0.0001	0.3721
Size	272	22.2663	22.0252	1.4814	19.5699	25.4675
Loss	272	0.0809	0	0.2732	0	1
Stability	272	3.4119	3.4267	1.0246	-2.6593	6.4416
Leverage	272	0.0005	0.0003	0.0005	0.0000	0.0026
Analysts	272	18.8235	18.5	8.9483	4	41
Earnings	272	0.0442	0.0502	0.0735	-0.3942	0.2176
MTB	272	2.8893	2.4714	2.0409	0.5078	11.2836
Panel C: All firms						
Dispersion	378	0.0080	0.0043	0.0121	0.0001	0.0814
Error	378	0.0237	0.0072	0.0524	0.0001	0.3721
Size	378	22.4453	22.3545	1.5262	19.2978	25.7192
Loss	378	0.0899	0	0.2865	0	1
Stability	378	3.3193	3.3307	1.0054	-2.6593	6.4416
Leverage	378	0.0005	0.0003	0.0006	0.0000	0.0027
Analysts	378	18.8624	19	8.7210	3	41
Earnings	378	0.0441	0.0507	0.0772	-0.3942	0.2176
MTB	378	2.8129	2.2689	2.1140	0.5078	11.2836

(Table 4.2 continued)

(Table 4.2 continued)

Notes: The table shows the descriptive statistics of the dependent variables *Dispersion* and *Error* and the control variables of hedge accounting applicants in the sample. N depicts the number of firm-year observations. St. Dev. is short for standard deviation. *Dispersion* determines the earnings forecast dispersion among sell-side analysts. It is calculated as the ratio of the standard deviation of all analysts' estimates available in I/B/E/S for the last month before the announcement date of the firm's actual earnings, see Eq. (4.1). *Error* determines the earnings forecast error of sell-side analysts. It is calculated as the absolute difference between the actual EPS and the median of analysts' earnings forecasts, available in I/B/E/S for the last month before the announcement date of the firm's actual earnings, deflated by the stock price at the beginning of the fiscal year, see Eq. (4.2). *Size* is the natural logarithm of the market value of equity (in EUR). *Loss* is an indicator variable which equals 1, if a firm had negative EPS in the year prior to the actual reporting year and 0 otherwise. *Stability* reflects the consistency of EPS growth over the last five years. It is the mean absolute percentage difference between actual reported EPS and a five year historical EPS growth trend line, expressed as a percentage of trend line EPS. *Leverage* is the ratio of the book value of total debt (in EUR) to the market value of equity (in EUR). *Analysts* is the number of sell-side analysts following a firm. *Earnings* represent a firm's reported EPS (in EUR) at the end of the fiscal year divided by the stock price (in EUR) at the beginning of the fiscal year. *MTB* reflects the market-to-book ratio of equity. For more details concerning variable definitions, please see the Appendix B.1.

Table 4.3: Correlation matrix

	Dispersion	Error	Size	Loss	Stability	Leverage	Analysts	Earnings	MTB
Dispersion		0.532***	-0.219***	0.325***	0.399***	0.419***	-0.080	0.093*	-0.501***
Error	0.485***		-0.046	0.427***	0.177***	0.226***	-0.027	-0.117**	-0.250***
Size	-0.228***	-0.049		-0.123**	-0.195***	-0.066	0.779***	0.124**	0.276***
Loss	0.502***	0.557***	-0.129**		0.180***	0.180***	-0.069	-0.496***	-0.105**
Stability	0.244***	0.231***	-0.198***	0.176***		0.095*	-0.061	-0.018	-0.246***
Leverage	0.293***	0.211***	-0.012	0.155***	0.095*		-0.030	0.074	-0.503***
Analysts	-0.120**	0.003	0.771***	-0.067	-0.049	-0.012		0.104**	0.122**
Earnings	-0.359***	-0.505***	0.175***	-0.705***	-0.082	-0.094*	0.084		-0.231***
MTB	-0.239***	-0.127**	0.187***	-0.070	-0.127**	-0.347***	0.061	-0.041	

Notes: The table shows the Pearson correlation coefficients at the lower left and the Spearman rank correlation coefficients at the upper right for the dependent and control variables. The corresponding significance levels are *p<0.1, **p<0.05, and ***p<0.01 (two-tailed). For the definitions of the variables, please see Table 4.2.

4.5 Empirical Results

4.5.1 Univariate Analyses

To analyze differences over time and among treated (IFRS 9 adopters) and untreated (non-adopters) firms, I split the sample into four categories: (A) Treated firms in the pre-period, (B) treated firms in the post-period, (C) untreated firms in the pre-period, and (D) untreated firms in the post-period and compare all categories with one another. Table 4.4 presents the results of the non-parametric Mann-Whitney-U tests for the differences in medians of dependent and control variables between these categories.[88] Reported p-values are two-tailed. *, **, and *** depict the conventional significance levels at 0.1, 0.05, and 0.01. The table contains further the number of firm-year observations (N), mean, median, and standard deviation (St. Dev.) of the respective variables.

Descriptively speaking, the table shows higher median values of analysts' earnings forecast *Dispersion* and *Error* for treated firms compared to untreated firms (A:C and B:D) and for forecasts in the post-period compared to forecasts in the pre-period (A:B and C:D). Only forecast *Dispersion* of untreated firms are lower in the post-period compared to the pre-period (C:D). However, its mean value shows the opposite relation. Differences in forecast *Dispersion* and *Error* are partly statistically significant. When comparing treated firms in the pre- and post-period (A:B), I find significant differences in the median forecast *Dispersion* (two-tailed p-value: 0.04) and almost significant differences in the median forecast *Error* (two-tailed p-value: 0.10). Moreover, the median forecast *Dispersion* for treated firms in the post-period is significantly larger (two-tailed p-value: 0.06) compared to that of untreated firms in the post-period (B:D). These univariate results of the dependent variables suggest that the alleged improvements in aligning hedge accounting more closely to firms' risk management strategies rather do not support sell-side analysts in making more consistent and more accurate earnings forecasts. Based on these univariate results, the significant difference in the median forecast *Dispersion* and the almost significant difference in the median forecast *Error* for treated firms between pre-

[88] The Mann-Whitney-U test presents the non-parametric equivalent to the unpaired t-test. Based on the Shapiro-Wilk test, the normality assumption does not hold for all variables. Therefore, I abstain from using t-tests (Bortz & Schuster, 2010, pp. 130-134, 145).

Table 4.4: Univariate analyses

Panel A: Firms opting for IFRS 9 (treatment group)								Mann-Whitney-U test p-value (A:B)
	Pre-period (A)				Post-period (B)			
	N	Mean	Median	St. Dev.	N	Mean	Median	St. Dev.	two-tailed
Dispersion	167	0.0232	0.0071	0.0536	110	0.0302	0.0100	0.0598	0.0435 **
Error	167	0.0067	0.0042	0.0085	110	0.0101	0.0054	0.0152	0.1005
Size	167	22.6553	22.5127	1.6046	110	22.8217	22.7676	1.5840	0.0244 **
Loss	167	0.0778	0.0000	0.2687	110	0.1182	0.0000	0.3243	0.3838
Stability	167	3.2967	3.3222	1.0379	110	3.1179	3.1117	0.9248	0.0710 *
Leverage	167	0.0005	0.0003	0.0006	110	0.0006	0.0004	0.0007	0.9882
Analysts	167	21.0958	22.0000	8.9303	110	18.6636	20.0000	8.1705	0.1277
Earnings	167	0.0484	0.0513	0.0748	110	0.0423	0.0518	0.0859	0.7655
MTB	167	2.8950	2.5371	1.9829	110	2.5738	1.8101	2.2604	0.0013 ***
Panel B: Firms staying with IAS 39 (control group)								Mann-Whitney-U test p-value (C:D)
	Pre-period (C)				Post-period (D)			
	N	Mean	Median	St. Dev.	N	Mean	Median	St. Dev.	two-tailed
Dispersion	67	0.0174	0.0047	0.0421	34	0.0176	0.0035	0.0363	0.5479
Error	67	0.0070	0.0040	0.0120	34	0.0092	0.0046	0.0148	0.7965
Size	67	21.6749	21.6703	0.9830	34	21.7147	21.6410	0.9948	0.3463
Loss	67	0.0597	0.0000	0.2387	34	0.1176	0.0000	0.3270	0.7079
Stability	67	3.6083	3.6336	0.9090	34	3.5123	3.5644	1.1427	0.8249
Leverage	67	0.0003	0.0002	0.0004	34	0.0005	0.0003	0.0004	0.1454
Analysts	67	15.9701	15.0000	7.5618	34	14.2353	11.5000	8.2721	0.3147
Earnings	67	0.0397	0.0470	0.0754	34	0.0369	0.0441	0.0642	0.2946
MTB	67	3.2291	2.5316	2.4356	34	2.3631	2.1431	1.3223	0.2327

	Mann-Whitney-U test p-value (A:C)	Mann-Whitney-U test p-value (B:D)
	two-tailed	two-tailed
Dispersion	0.2125	0.0619 *
Error	0.9814	0.4937
Size	0.0015 ***	0.0035 ***
Loss	0.6267	0.9610
Stability	0.1342	0.1386
Leverage	0.0069 ***	0.5349
Analysts	0.0072 ***	0.0568 *
Earnings	0.2423	0.6007
MTB	0.7595	0.5704

*p<0.1; **p<0.05; ***p<0.01

Notes: The table shows the differences in the treatment group (control group) between the pre and post IFRS 9 introduction period in Panel A (Panel B). N depicts the number of firm-year observations. St. Dev. is short for standard deviation. The last column depicts the two-tailed p-values of the respective medians resulting from the Mann-Whitney-U tests. The lower part of the table displays differences across the treatment and control group before and after treatment, respectively. Two-tailed p-values of medians resulting from the Mann-Whitney-U tests are provided. For the definitions of the dependent and control variables, please see Table 4.2.

and post-period show that the new hedge accounting rules of IFRS 9 combined with the amendments of IFRS 7 might indicate an augmenting relation with information asymmetry. Thus, univariate results seem to provide evidence to support H2. However, strictly

speaking, forecast *Error* does not differ significantly. Hence, only the univariate result based on the median forecast *Dispersion* is in line with H2. The significant increase in the median forecast *Dispersion* for treated firms compared to untreated firms in the post-period (B:D) might indicate that IFRS 9 hedge accounting rules make it more complicated for analysts to find a consensus of forecast earnings which would imply a positive relation with information asymmetry. H1 might be supported for *Dispersion*. For *Error*, I find no significant differences. Notably, the analyses do not show any statistically significant differences in *Dispersion* and *Error* between treated and untreated firms in the pre-period (A:C). Based on this univariate finding, treatment and control groups are common regarding analysts' earnings forecast quality before the treatment in 2018.

I also examine the differences between A, B, C, and D regarding the control variables. The table illustrates significant differences between treated and untreated firms in the pre-period (A:C) in terms of *Size*, *Leverage*, and *Analysts*. Treated firms have significantly higher median values for all three variables. The same is true for *Size* and *Analysts* in the post-period (B:D). Comparing the differences of control variables in the pre- and post-period for treated firms (A:B), I find significantly higher median values in the post-period for *Size* and significantly lower median values for *Stability* and *MTB*. The significant decrease in *Stability* indicates that earnings variability is lower after the introduction of IFRS 9 and the disclosure amendments of IFRS 7. For untreated firms, univariate analyses do not depict significant differences between pre- and post-period (C:D).

The results from univariate analyses need to be perceived with caution. Even if I find statistically significant differences in the median forecast *Dispersion* and almost statistically significant differences in the median forecast *Error* for treated firms between the pre- and post-period, these differences might arise not exclusively from changes in the hedge accounting regulation, but also from the general impact of IFRS 9 and other thinkable factors that have changed from 2018 onward. Moreover, the differences are economically rather small. In the following section, I run multivariate analyzes, including models controlling for a possible self-selection bias into treatment and several robustness tests.

4.5.2 Multivariate Analyses

In this section, I analyze the hypotheses developed in Section 4.3.2 using my unbalanced panel. To do so, I employ fixed effects regressions. Fixed effects models are generally used when analyzing longitudinal or time-varying aspects of scientific problems (e.g., Giesselmann & Windzio, 2012; Wooldridge, 2020). Therefore, they seem suitable for my intention to analyze the effect of the new hedge accounting rules. E.g., Giesselmann & Windzio (2012) and Wooldridge (2020) explain and discuss in their textbooks several methods to analyze panel data according to the underlying research questions. Besides fixed effects estimations, random effects models might also apply to panel data. However, random effects models have stronger assumptions (Wooldridge, 2020, p. 470). They assume the independent variable to be time-invariant (Giesselmann & Windzio, 2012, p. 108) as well as unobserved variables to be uncorrelated with explanatory variables (Wooldridge, 2020, p. 470) and time-invariant (Giesselmann & Windzio, 2012, p. 100). Especially the first aspect does not comply with my research design as the key explanatory variables, the application of IFRS 9 hedge accounting and IFRS 7 disclosure amendments, do vary from pre- to post-period.
I address my Hypotheses H1 and H2 throughout Sections 4.5.2.1 and 4.5.2.2. In the regression tables, Column (1) always illustrates the full model with all control variables. Columns (2) to (5) include highly correlated variables separately in the regressions. For details on bivariate correlations, please see Table 4.3.

4.5.2.1 Does the application of IFRS 9 hedge accounting impact information asymmetry?

The policy change through IFRS 9 hedge accounting characterizes the setting of this study. In empirical research, a policy change is often associated with a difference-in-differences research design (Wooldridge, 2020). Such a research design is mainly applied to data gathered from a natural or quasi-experiment where an exogenous shock (i.e., policy change) affects the environment of firms. Affected firms are supposed to be treated and build the treatment group. Firms not affected by the shock build the control group (Wooldridge,

2020). The difference-in-differences methodology is based on the key assumption of parallel or common trends: treatment and control groups exhibit a similar development before the treatment (Angrist & Pischke, 2009). After the treatment occurred, the treated group is assumed to differ from the control group only because of the received treatment. That is, treatment and control groups would have still been common in absence of the treatment (Angrist & Pischke, 2009; Huntington-Klein, 2022). I conduct a placebo test to investigate whether the parallel trend assumption holds in my research design. To do so, I focus on the period prior to the IFRS 9 introduction and examine whether treatment and control groups differ. I estimate the model in Eq. (4.3) using fake treatment periods (Huntington-Klein, 2022) in 2016 and 2017. Table 4.5 depicts the respective difference-in-differences estimators. All specifications show insignificant coefficients of the interaction terms suggesting that treated and untreated groups do not differ prior to the actual treatment in 2018. In Section 4.5.3, I control for a possible self-selection bias into treatment as IFRS 9 hedge accounting allows for voluntary application of the new hedge accounting regulation. Hence, the treatment in this setting is not exogenous but rather reveals firm preferences.

Based on the assumption that treatment and control groups exhibit parallel trends prior to the treatment, I examine the effect of applying IFRS 9 hedge accounting rules on information asymmetry (H1) using a difference-in-differences research design. In Table 4.6, I present the regression results of the difference-in-differences estimation resulting from Eq. (4.3). The coefficient of interest is β_3, the coefficient of the interaction term. If the application of IFRS 9 hedge accounting is positively or negatively associated with the level of information asymmetry, the interaction term $TREAT \times POST$ should exhibit a significantly positive or negative coefficient estimate. OLS regression coefficients of the independent and control variables are displayed in the upper part of the table with their respective t-statistics in parentheses. *, **, and *** depict the conventional significance levels at 0.1, 0.05, and 0.01, respectively. Reported p-values are one-tailed if a directional prediction is made and two-tailed otherwise. Standard errors are heteroskedasticity-robust and clustered by firm. The lower part of the table depicts the type of fixed effects used, the number of observations, and the adjusted R^2.

With forecast *Dispersion* as dependent variable, the regression results fail to exhibit a significant difference-in-differences estimator of the interaction term $TREAT \times POST$, suggesting that the application of IFRS 9 hedge accounting is not significantly associated with the average level of *Dispersion* among analysts' earnings forecasts. The difference between IFRS 9 and IAS 39 hedge accounting applicants does not significantly change in the post-period compared to the difference of their respective pre-period counterparts. The result does not provide evidence to support H1. The respective main effects *TREAT* and *POST* are insignificant, too. Hence, the analysis neither shows a significant difference between treated and untreated firms prior to the introduction of IFRS 9 (*TREAT*), nor between pre and post-observations of untreated firms (*POST*). Referring to the control variables, I find a significantly positive linear association between *Stability* and *Dispersion* as well as between *Leverage* and *Dispersion* in all Models D1.1 to D1.5, implying that analysts' earnings forecasts are more dispersed the more volatile a firm's earnings are and the more levered a firm is. Moreover, firm *Size* is negatively associated with forecast *Dispersion*. As expected, forecast *Dispersion* is lower for larger firms. Moreover, *Loss* shows the predicted sign. It is positively associated with forecast *Dispersion*, suggesting that forecasts are more dispersed for firms that experienced a loss in the previous year.

Using forecast *Error* as the dependent variable shows similar results for the independent variables. Hence, the application of IFRS 9 hedge accounting does not seem to be significantly related to information asymmetry. The results provide no evidence to support H1. All model specifications E1.1 to E1.5 show insignificant interaction terms. *Stability* shows a positive and highly significant coefficient at the 1%-level. This result is robust throughout all model specifications E1.1 to E1.5, indicating that the forecast error is higher, the more volatile a firm's earnings are. Again, *Loss* depicts a positive sign whenever included in the regressions. Moreover, the control variable *Earnings* depicts a significantly negative coefficient, as predicted, whenever included in the model specifications. It indicates that analysts make more accurate forecasts for firms with higher earnings levels. Against my expectations, the control variables *Size*, *Leverage*, and *Analysts* are not statistically significant. For both dependent variables, *Dispersion* and *Error*, the respective fully specified Models D1.1 and E1.1 show the highest values of the adjusted R^2 with 41.5% and 42.7%.

Table 4.5: Placebo tests: Difference-in-differences estimators using fake treatments

	Treatment in t-2 (2016)		Treatment in t-1 (2017)	
	Dispersion	*Error*	*Dispersion*	*Error*
TREAT × POST	0.005	0.005	0.004	-0.003
	(0.165)	(0.610)	(0.136)	(0.832)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	220	220	220	220

Notes: The table shows the regression coefficients of the interaction term $TREAT \times POST$ and the two-tailed p-values in parentheses using fake treatment periods in t-2 (2016) and in t-1 (2017). Standard errors are heteroskedasticity-robust and clustered at the firm level.

Table 4.6: The impact of applying IFRS 9 hedge accounting on forecast dispersion and error (H1)

		H1: Dispersion					*H1: Error*				
	Pred.	(D1.1)	(D1.2)	(D1.3)	(D1.4)	(D1.5)	(E1.1)	(E1.2)	(E1.3)	(E1.4)	(E1.5)
TREAT	+/-	0.001	0.001	0.002	0.000	0.001	0.005	0.001	0.008	0.002	0.009
		(0.527)	(0.517)	(0.912)	(0.050)	(0.518)	(0.609)	(0.216)	(0.968)	(0.328)	(1.121)
POST	+/-	0.003	0.003	0.004	0.002	0.004	0.003	0.000	0.010	0.001	0.010
		(1.091)	(0.803)	(1.390)	(0.571)	(1.168)	(0.302)	(0.003)	(1.005)	(0.067)	(1.061)
TREAT × POST	+/-	0.003	0.002	0.002	0.002	0.002	0.009	0.010	0.008	0.010	0.008
		(0.892)	(0.881)	(0.726)	(0.841)	(0.687)	(0.859)	(0.992)	(0.734)	(1.013)	(0.751)
Size	-	-0.002***	-0.001***	-0.001***			0.003	0.001	0.002		
		(-2.726)	(-2.487)	(-2.342)			(0.851)	(0.402)	(0.547)		
Loss	+	0.017***	0.019***		0.020***		0.067***	0.105***		0.105***	
		(2.650)	(3.428)		(3.408)		(3.145)	(4.038)		(4.040)	
Stability	+	0.002**	0.002***	0.002***	0.002**	0.002***	0.008***	0.007***	0.010***	0.007***	0.010***
		(2.191)	(2.359)	(2.705)	(2.302)	(2.639)	(2.560)	(2.455)	(2.571)	(2.513)	(2.645)
Leverage	+/-	4.284**	4.281**	4.207**	4.371**	4.268**	4.813	7.235	5.189	7.194	5.114
		(2.139)	(2.063)	(2.060)	(2.014)	(2.078)	(0.542)	(0.816)	(0.530)	(0.820)	(0.522)
Analysts	-	0.000			-0.000	-0.000	-0.000			0.000	0.000
		(1.133)			(-1.031)	(-0.936)	(-0.441)			(0.260)	(0.257)
Earnings	-	-0.010		-0.054**		-0.057**	-0.189*		-0.356***		-0.353***
		(-0.332)		(-2.149)		(-2.175)	(-1.413)		(-3.299)		(-3.293)
MTB	+/-	-0.001	-0.001*	-0.001**	-0.001**	-0.001**	-0.002*	-0.002	-0.003*	-0.001	-0.002*
		(-1.605)	(-1.740)	(-2.005)	(-2.069)	(-2.481)	(-1.770)	(-1.144)	(-1.672)	(-1.178)	(-1.665)
Constant		0.041***	0.029**	0.033**	0.001	0.006	-0.069	-0.055	-0.037	-0.033*	-0.005
		(2.785)	(2.392)	(2.426)	(0.258)	(0.906)	(-1.058)	(-0.937)	(-0.562)	(-1.667)	(-0.199)
Year FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations		357	357	357	357	357	357	357	357	357	357
Adjusted R^2		0.415	0.413	0.346	0.397	0.330	0.427	0.399	0.383	0.399	0.382

*p<0.1; **p<0.05; ***p<0.01

(Table 4.6 continued)

(Table 4.6 continued)

Notes: The table shows the regression results of the difference-in-differences analyses for the model in Eq. (4.3) to test Hypothesis H1. The results present the regression coefficients and the corresponding t-statistics in parentheses. Standard errors are heteroskedasticity-robust and clustered at the firm level. Reported p-values are one-tailed whenever a directional prediction is made and two-tailed otherwise. *TREAT* is an indicator variable that is coded as 1 if a firm applies IFRS 9 hedge accounting during the observation period and as 0 otherwise. *POST* is an indicator variable that is coded as 1 if the firm-year observation corresponds to the post IFRS 9 introduction period and as 0 otherwise. $TREAT \times POST$ is the difference-in-differences estimator. It reflects the effect of IFRS 9 hedge accounting application on the average level of information asymmetry. Definitions of the dependent and control variables are provided in Table 4.2.

4.5.2.2 Does the application of the new hedge accounting rules impact information asymmetry?

Second, I examine the effect of applying the new hedge accounting rules on information asymmetry. As mentioned earlier, the new hedge accounting rules combine the voluntary application of IFRS 9 hedge accounting and the mandatory disclosure amendments of IFRS 7. I study the average differences in information asymmetry when firms apply IFRS 9 compared to IAS 39 hedge accounting. I estimate the model of Eq. (4.4) for both dependent variables, forecast *Dispersion* and forecast *Error*. If the application of the new hedge accounting rules ameliorates information asymmetry, Models D2 and E2 should exhibit a negative coefficient of the independent variable of interest *HA new*. If the application of the new hedge accounting rules deteriorates information asymmetry, *HA new* should exhibit a positive coefficient. Table 4.7 presents the results from the fixed effects OLS regressions with heteroskedasticity-robust standard errors clustered at the firm level. OLS coefficients and t-statistics in parentheses are reported. *, **, and *** depict the conventional significance levels at 0.1, 0.05, and 0.01, respectively. Reported p-values are one-tailed if a directional prediction is made and two-tailed otherwise.

When using *Dispersion* as the dependent variable, *HA new* shows an insignificant coefficient estimate throughout all model specifications D2.1 to D2.5, indicating that the application of the new hedge accounting rules is not significantly associated with a linear change in forecast *Dispersion*. Analysts' earnings forecasts are, on average, not more or less dispersed for firms applying IFRS 9 hedge accounting and IFRS 7 disclosure amendments relative to IAS 39 hedge accounting applicants. Thus, the models show no evidence to support H2. Concerning the control variables, I find positive and robust coefficients for *Stability* and *Leverage* throughout all model specifications D2.1 to D2.5, indicating that forecast *Dispersion* increases with earnings volatility and leverage. As expected, *Size* depicts a negative sign whenever included in the regressions. Thus, forecast *Dispersion* decreases with increasing firm size. Again, also the estimate of *Loss* shows the expected positive sign. Moreover, the coefficient of *MTB* exhibits a negative and significant sign in all models, indicating that earnings forecasts among analysts are less dispersed for growth firms.

Also, when using forecast *Error* as the dependent variable, the regression results of Models E2.1 to E2.4 show no significant association between *HA new* and *Error*, indicating that applying the new hedge accounting rules is not linearly associated with a change in forecast accuracy. H2 cannot be supported. In Model E2.5, the coefficient of *HA new* becomes significant at the 10% level. The two-tailed p-value is 0.095. This result would indicate that the application of the new hedge accounting rules deteriorates analysts' earnings forecast estimates in terms of forecast accuracy leading to a higher *Error*. However, the result is not robust throughout Models E2.1 to E2.4. Hence, the application of IFRS 9 hedge accounting seems neither to be related to forecast *Dispersion* nor forecast *Error*. The control variable *Stability* is robust, showing highly positive and significant coefficients at all conventional significant levels throughout all model specifications E2.1 to E2.5. This result indicates that analysts' forecast error is higher, the more volatile a firm's earnings are. *Loss* and *Earnings* exhibit the expected signs whenever included in the regressions and are largely statistically significant. Like in Models E1.1 to E1.5, the control variables *Size*, *Leverage*, and *Analysts* are not statistically significant. Again, the respective fully specified Models D2.1 and E2.1 show the highest values of the adjusted R^2.

Given the analyzed sample and observation period, I summarize the results of my main analyses as follows. Neither the application of IFRS 9 hedge accounting solely nor the application of the new hedge accounting rules in total, combining IFRS 9 hedge accounting and IFRS 7 disclosure amendments on hedge accounting, are associated with analysts' earnings forecasts made one month prior to the EPS announcement date in terms of forecast dispersion and forecast error. Referring to H1, it seems that IFRS 9 and IAS 39 hedge accounting rules together with the extended disclosure requirements of IFRS 7 are equally suitable for sell-side analysts to make their forecasts. Moreover, in terms of H2, the application of IFRS 9 hedge accounting combined with IFRS 7 disclosure amendments seems as suitable as the application of IAS 39 hedge accounting combined with the disclosure on hedge accounting determined in IFRS 7 (f.v.). Nevertheless, the statistically insignificant results might be associated with a lack of comparability within firms across a longer time and across firms due to the choice in the hedge accounting regulation between IFRS 9

and IAS 39. Moreover, the lack of experience for analysts and the possibly associated elevated task complexity might be an additional factor for these results.

Table 4.7: The impact of applying IFRS 9 hedge accounting and IFRS 7 disclosure amendments to hedge accounting on forecast dispersion and error (H2)

		H2: Dispersion					*H2: Error*				
	Pred.	(D2.1)	(D2.2)	(D2.3)	(D2.4)	(D2.5)	(E2.1)	(E2.2)	(E2.3)	(E2.4)	(E2.5)
HA new	+/-	0.004	0.003	0.004	0.003	0.003	0.011	0.010	0.012	0.010	0.013*
		(1.500)	(1.469)	(1.536)	(1.181)	(1.297)	(1.347)	(1.182)	(1.456)	(1.354)	(1.672)
POST	+/-	0.003	0.002	0.004	0.002	0.003	0.001	-0.001	0.005	0.000	0.006
		(1.276)	(0.931)	(1.375)	(0.910)	(1.353)	(0.078)	(-0.079)	(0.688)	(0.002)	(0.737)
Size	-	-0.002***	-0.001***	-0.001***			0.003	0.001	0.002		
		(-2.852)	(-2.490)	(-2.338)			(1.010)	(0.630)	(0.871)		
Loss	+	0.015***	0.017***		0.017***		0.060***	0.091***		0.091***	
		(2.443)	(3.279)		(3.276)		(3.370)	(4.252)		(4.244)	
Stability	+	0.002**	0.002**	0.002***	0.002***	0.002***	0.007***	0.006***	0.009***	0.006***	0.009***
		(2.120)	(2.295)	(2.620)	(2.345)	(2.662)	(2.516)	(2.440)	(2.513)	(2.464)	(2.557)
Leverage	+/-	3.846**	3.851**	3.735**	3.818**	3.670**	3.333	5.242	3.502	5.363	3.675
		(2.174)	(2.086)	(2.094)	(1.989)	(2.039)	(0.451)	(0.694)	(0.431)	(0.728)	(0.457)
Analysts	-	0.000			-0.000	-0.000	-0.000			0.000	0.000
		(1.381)			(-0.997)	(-0.898)	(-0.270)			(0.546)	(0.567)
Earnings	-	-0.011		-0.050**		-0.053**	-0.164*		-0.323***		-0.318***
		(-0.387)		(-2.107)		(-2.151)	(-1.422)		(-3.432)		(-3.401)
MTB	+/-	-0.001*	-0.001*	-0.001**	-0.001**	-0.001***	-0.002*	-0.001	-0.003*	-0.001	-0.002
		(-1.768)	(-1.904)	(-2.231)	(-2.257)	(-2.716)	(-1.739)	(-1.175)	(-1.764)	(-1.133)	(-1.639)
Constant		0.042***	0.028**	0.031**	0.002	0.007	-0.064	-0.055	-0.041	-0.025	0.003
		(2.966)	(2.451)	(2.499)	(0.467)	(1.167)	(-1.113)	(-1.025)	(-0.689)	(-1.526)	(0.112)
Year FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations		378	378	378	378	378	378	378	378	378	378
Adjusted R^2		0.386	0.381	0.328	0.366	0.315	0.413	0.389	0.365	0.389	0.363

*p<0.1; **p<0.05; ***p<0.01

(Table 4.7 continued)

(Table 4.7 continued)

Notes: The table shows the OLS regression results for the model in Eq. (4.4) to test Hypothesis H2. The results present the regression coefficients and the corresponding t-statistics in parentheses. Standard errors are heteroskedasticity-robust and clustered at the firm level. Reported p-values are one-tailed whenever a directional prediction is made and two-tailed otherwise. *HA new* is an indicator variable that is coded as 1 if firm i applies IFRS 9 hedge accounting rules at time t and as 0 otherwise. It reflects the effect of IFRS 9 hedge accounting application and IFRS 7 disclosure amendments to hedge accounting on the average level of information asymmetry. *POST* is an indicator variable that is coded as 1 if the firm-year observation corresponds to the post IFRS 9 introduction period and as 0 otherwise. Definitions of the dependent and control variables are provided in Table 4.2.

4.5.3 Controlling for a Possible Self-Selection Bias Arising from Self-Selection into Treatment

As described previously, the introduction of IFRS 9 is not related to the mandatory IFRS 9 hedge accounting application. Firms decide by themselves whether they select to apply the new hedge accounting regulation of IFRS 9, that is, they self-select to get treated or not. Obviously, the setting of this study does not allow for random assignment to control or treatment groups. Hence, the results of my main analyses might be biased through self-selection. Heckman (1979) describes self-selection as a case of sample selection bias, meaning that the estimated OLS coefficients are biased due to the endogenous sample selection (Wooldridge, 2013, p. 857). Heckman (1979)'s two-step estimator to correct for the selection bias is a common approach (Greene, 2020) in the extant literature (e.g., Panaretou et al., 2013; Ernstberger et al., 2008). Based on Heckman (1979)'s two-step estimator, Barnow et al. (1980, pp. 18-23) developed the unbiased treatment effects model. Given the setting of my study, I follow the two-step treatment effects approach of Barnow et al. (1980) to account for the self-selection bias (Leuz, 2003) in my main models when testing H1 and H2. First, I estimate the first-stage selection model for IFRS 9 hedge accounting adoption using a probit regression. Second, I calculate the inverse Mills ratios from the probit model and insert them as an additional control variable in the second-stage outcome regression to control for self-selection (Barnow et al., 1980, pp. 18-23; Greene, 2012, pp. 930-931; Greene, 2020, p. 961).

I follow the approach in Chapter 3 to estimate the selection model. As presented in Chapter 3, I find evidence that the adoption of IFRS 9 hedge accounting regulation is associated with the type of risk firms hedge. According to my results, the application of IFRS 9 hedge accounting is positively related to firms that hold derivatives to hedge and hedge account for commodity and interest rate risk exposure, and it is negatively related to foreign exchange rate risk. The intuition why the hedge accounting of specific types of risk exposures might be associated with firms' decision to adopt IFRS 9 hedge accounting is mainly based on the institutional framework. IAS 39 is highly restrictive, especially regarding the designation of non-financial hedged items. IAS 39, para. 82

allows the designation of non-financial hedged items only in their entirety, except for non-financial hedged items for foreign currency risks. Designating a non-financial hedged item in its entirety implies that additional components like quality premia, discounts, and others, that are in fact included in the value of the hedged item are not incorporated in the hedging instrument. The unequal composition of the hedged item and the hedging instrument consequently leads to increased ineffectiveness accounted for through profit or loss (IAS 39, para. 89(b), 95(b), 102(b)).[89] Designating single risk components of non-financial hedged items reduces ineffectiveness in the sense that the aligned hedging instrument is theoretically and practically able to offset the movements of the hedged item. Due to their business transactions, the designation of non-financial hedged items is crucial to non-financial firms. IFRS 9 extends, among others, the designation possibilities of non-financial hedged items for exposures of commodity and interest rate risks (IFRS 9, para. 6.3.1, 6.3.7). Therefore, the regulation of IFRS 9 hedge accounting seems to be more suitable for non-financial firms that hedge commodity and interest rate risk to a relatively high extent. Of course, the final decision of a firm's managers to adopt a new accounting standard depends on the firm-individual trade-off between the benefits of aligning its hedge accounting more closely to its risk management and the costs of adopting the new regulation.

I build the probit model including proxies for different risk exposures (*Commodity*, *Interest Rate*, and *Foreign Exchange Rate*) as explanatory variables in the first-step regression. *Commodity* reflects the portion of the sum of the fair values of hedging instruments' gross positions used to reduce commodity price risk exposures, deflated by the sum of total assets. Fair values of hedging instruments are only included in *Commodity*, if the hedging instruments are part of a hedging relationship to reduce commodity price risk and for which the firm applies hedge accounting. *Interest Rate*, and *Foreign Exchange Rate* are calculated in the corresponding manner. Fair values of hedging instruments are hand-collected from annual reports for the post-period years 2018 and 2019. The application of IFRS 9 hedge accounting is the binary dependent variable in the selection model. It is coded as 1 for firms that adopt IFRS 9, and as 0 otherwise. In doing so, the

[89] Pricewaterhouse Coopers (2017b, p. 19) gives a vivid example of designating single components of non-financial hedged items.

selection model includes only explanatory variables that are not used in the second-stage outcome regression. Hence, the basic assumption of the exclusion restriction in the two-step estimator should be satisfied (Wolfolds & Siegel, 2019, p. 436). The explanatory variables of the probit regression do not affect my main models of information asymmetry (Wooldridge, 2020, p. 591).[90] I estimate the following selection model:

$$\begin{aligned} IFRS\ 9\ Adopter_{i,t} = \beta_0 + \beta_1 Commodity_{i,t} + \beta_2 Interest\ Rate_{i,t} + \\ + \beta_3 Foreign\ Exchange\ Rate_{i,t} + \\ + \eta_t + \delta_i + \epsilon_{i,t}. \end{aligned} \tag{4.5}$$

η_t denotes the time fixed effects of year t. δ_i denotes the industry fixed effects of firm i. Table 4.8 reports the results of IFRS 9 adoption. Regression coefficients and z-statistics are reported. *, **, and *** depict the conventional significance levels at 0.1, 0.05, and 0.01 for one-tailed p-values. *Interest Rate* exhibits a positive and significant coefficient estimate. I conduct a Hosmer-Lemeshow test to assess the goodness of fit of the estimated probit estimation (Panaretou et al., 2013), see the lower part of Table 4.8. The insignificant p-value indicates a good model fit.

Next, I calculate the inverse Mills ratios ($\lambda_{i,t}$) for each firm i in year t from the probit regression following the treatment effects approach. To control for the self-selection bias into treatment in my main Models D1.1, E1.1, D2.1 and E2.1, testing Hypotheses H1 and H2, I include λ as an additional control variable. Table 4.9 depicts the corresponding correction models. Additional data requirements shrink my sample slightly. Regression coefficients and t-statistics in parentheses are reported. Standard errors are clustered at the firm level.[91] *, **, and *** depict the conventional significance levels at 0.1, 0.05, and 0.01 for one-tailed p-values whenever a directional prediction is made and two-tailed otherwise. Using the dependent variable *Dispersion*, both models retain the insignificant coefficients of the variables of interest, the interaction term $TREAT \times POST$ (H1) and

[90] Due to the exclusion restriction (Wolfolds & Siegel, 2019, p. 436), I omit *Size* in the selection model, as I control for it in my outcome regression.

[91] I use the usual t-statistic in the regressions including the self-selection parameter λ. λ exhibits insignificant coefficients throughout all specifications. According to Wooldridge (2020, p. 591), this approach is valid in case of no selection bias. Otherwise, a correction as given in Maddala (1983) would be appropriate (Ernstberger et al., 2008).

HA new (H2), see Columns (1) and (3) in Table 4.9. Moreover, λ shows insignificant coefficients, indicating that there is no evidence that self-selection into treatment, i.e., to adopt IFRS 9 hedge accounting, distorts my results concerning H1 and H2. Referring to the dependent variable *Error*, the coefficients of λ are indeed insignificant in both models, see Columns (2) and (4) in Table 4.9. However, the coefficients of the variables of interest become positive and significant. Furthermore, they differ in their magnitude from those of my main analyses in Models E1.1 and E2.1.[92] Hence, given the models in Columns (2) and (4) successfully address the self-selection bias into treatment, the results in my main Models E1.1 and E2.1 in terms of analysts' earnings forecast *Error* might be biased towards zero. To get a clearer picture of this issue, further analyses are needed.

Of course, all findings concerning whether a self-selection bias into treatment occurs or not are based on the model assumptions of the two-step estimator of Heckman (1979), and the modified treatment effects approach given in Barnow et al. (1980) (Leuz, 2003).

[92] Wooldridge (2020, pp. 591-592) states that it is important to check the coefficients of the inverse Mills ratios (λ) as well as the differences in the estimated coefficients.

Table 4.8: First-stage selection model - probit regression for IFRS 9 hedge accounting adoption

		IFRS 9 hedge accounting (= 1)	
	Expected sign	Coefficients	z-statistics
Commodity	+	1.242	0.060
Interest Rate	+	287.261**	2.039
Foreign Exchange Rate	-	-6.544	-0.396
Constant		0.222	0.474
Year FE		Yes	
Industry FE		Yes	
Observations		146	

Test	Chi-squared	p-value
Hosmer-Lemeshow	3.066	0.930

*p<0.1; **p<0.05; ***p<0.01

Notes: In the upper part, the table shows the probit regression results for the selection model given in Eq. (4.5). The dependent variable *IFRS 9 hedge accounting* is an indicator variable coded as 1 if a firm applies IFRS 9 hedge accounting in the corresponding year and as 0 otherwise. The table depicts the regression coefficients and the corresponding z-statistics. Standard errors are clustered at the firm level and reported p-values are one-tailed according to the directional prediction. *Commodity* is the sum of the fair values of derivative hedging instruments' gross positions, designated to hedge commodity price risk, deflated by total assets. *Interest Rate* is the sum of the fair values of derivative hedging instruments' gross positions, designated to hedge interest rate risk, deflated by total assets. *Foreign Exchange Rate* is the sum of the fair values of derivative hedging instruments' gross positions, designated to hedge foreign exchange rate risk, deflated by total assets. The lower part of the table presents the Hosmer-Lemeshow test to assess the goodness of fit of the selection model.

Table 4.9: Regressions on forecast dispersion and error including the self-selection parameter λ

		(H1)				(H2)	
		Dispersion	*Error*			*Dispersion*	*Error*
	Pred.	(1)	(2)		Pred.	(3)	(4)
TREAT	+/-	0.001	0.004	HA new	+/-	0.004	0.036*
		(0.494)	(0.624)			(0.992)	(1.798)
POST	+/-	0.004	-0.042	POST	+/-	0.003	-0.036
		(0.744)	(-1.300)			(0.577)	(-1.178)
TREAT × POST	+/-	0.002	0.041*				
		(0.570)	(1.795)				
λ	+/-	-0.002	0.040	λ	+/-	-0.001	0.033
		(-0.556)	(1.468)			(-0.330)	(1.252)
Size	-	-0.002***	0.002	Size	-	-0.002***	0.002
		(-3.481)	(0.967)			(-3.635)	(1.082)
Loss	+	0.017***	0.062***	Loss	+	0.015***	0.056***
		(3.067)	(3.227)			(2.803)	(3.408)
Stability	+	0.002**	0.008***	Stability	+	0.001**	0.007***
		(2.285)	(3.050)			(2.149)	(2.900)
Leverage	+/-	4.057**	5.640	Leverage	+/-	3.544**	3.365
		(2.193)	(0.738)			(2.171)	(0.526)
Analysts	-	0.000	0.000	Analysts	-	0.000	0.000
		(1.574)	(-0.250)			(1.754)	(0.024)
Earnings	-	0.005	-0.227**	Earnings	-	0.005	-0.191*
		(0.175)	(-1.723)			(0.173)	(-1.630)
MTB	+/-	-0.0004*	-0.002**	MTB	+/-	-0.0004**	-0.002*
		(-1.849)	(-2.079)			(-1.982)	(-1.917)
Constant		0.040***	-0.054	Constant		0.041***	-0.048
		(3.420)	(-1.160)			(3.537)	(-1.140)
Year FE		Yes	Yes	Year FE		Yes	Yes
Industry FE		Yes	Yes	Industry FE		Yes	Yes
Observations		334	334	Observations		354	354
Adjusted R^2		0.363	0.425	Adjusted R^2		0.333	0.407

*p<0.1; **p<0.05; ***p<0.01

Notes: The left-hand side of the table shows the regression results of the difference-in-differences model from Eq. (4.3) to test Hypothesis H1 including the inverse Mills ratio (λ) which captures the self-selection bias. *TREAT* is an indicator variable that is coded as 1 if a firm applies IFRS 9 hedge accounting during the observation period and as 0 otherwise. *POST* is an indicator variable that is coded as 1 if the firm-year observation corresponds to the post IFRS 9 introduction period and as 0 otherwise. *TREAT* × *POST* is the difference-in-differences estimator. It reflects the effect of IFRS 9 hedge accounting application on the average level of information asymmetry.

(Table 4.9 continued)

(Table 4.9 continued)

The right-hand side of the table shows the regression results for the model from Eq. (4.4) to test Hypothesis H2 including the inverse Mills ratio (λ). *HA new* is an indicator variable that is coded as 1 if firm i applies IFRS 9 hedge accounting rules at time t and as 0 otherwise. It reflects the effect of IFRS 9 hedge accounting application and IFRS 7 disclosure amendments to hedge accounting on the average level of information asymmetry. The results present the regression coefficients and the corresponding t-statistics in parentheses. Standard errors are clustered at the firm level. Reported p-values are one-tailed whenever a directional prediction is made and two-tailed otherwise. Definitions of the dependent and control variables are provided in Table 4.2.

4.5.4 Robustness Checks

In this section, I conduct several robustness tests. First, I check whether my results are sensitive to different dependent variables. I estimate regression Eq. (4.3) and Eq. (4.4) with alternative measures of forecast dispersion and forecast error following the approach given in Chang et al. (2000). To compute forecast dispersion, they deflate the standard deviation of analysts' earnings forecasts by the absolute value of the mean estimates instead of deflating it by the stock price at the beginning of the fiscal year as given in Eq. (4.1).[93] This measure is also applied in Panaretou et al. (2013, p. 123). Regarding forecast error, Chang et al. (2000, p. 5) use the actual earnings instead of the stock price at the beginning of the fiscal year.[94] The relations between the dependent and independent variables concerning Eq. (4.3) and Eq. (4.4) are mainly not sensitive to these modifications, see Table B1 in the Appendix. Only regarding H2, *HA new* exhibits a significant coefficient when using *Error* as the dependent variable, indicating a positive association between the application of the new hedge accounting rules, IFRS 9 and IFRS 7, and analysts' earnings forecast error.

Second, I tighten the winsorizing criterion in case severe outliers are still included when winsorizing at the 1st and 99th percentile. I adapt the winsorizing criterion to the 5th and 95th percentile for the continuous variables *Dispersion*, *Error*, *Leverage*, *MTB*, and *Earnings*. Regression results are not unduely affected, see the appended Table B2. Only the control variable *MTB* does not always show consistent coefficients.

Third, I run a robustness check with a limited observation period in order to exclude fiscal years affected by the consequences of the Covid-19 pandemic. Since I assign fiscal years strictly to the calendar years they start in, fiscal years beginning during 2019 end in 2020 and thus, are possibly affected by changes in the economic environment due to Covid-19. Therefore, I eliminate observations from 2019 that originated from firms having fiscal years unequal to calendar years. By doing so, I assure that Covid-19 does not

[93] I modify forecast dispersion with the following formula:
$Dispersion_{i,t} = StdDev(ForecastEPS_{i,t})/|Mean(ForecastEPS_{i,t})|$ (Chang et al., 2000, p. 5). I/B/E/S defines this measure as the coefficient of variation (datatype 'EPS1CV'). Panaretou et al. (2013) use the same measure for forecast dispersion.

[94] I modify the calculation of forecast error in this way:
$Error_{i,t} = |(ActualEPS_{i,t} - Median(ForecastEPS_{i,t}))/ActualEPS_{i,t}|$.

directly or indirectly influence the variables in this study. Running the regressions with the shortened observation period does not unduly change my results. The coefficients of all independent variables are still insignificant and do not support H1 and H2, see Table B3 in the Appendix. Moreover, the relation between the dependent variable *Dispersion* and the control variables is robust. However, regarding the dependent variable *Error*, the association with several control variables is not consistent.

4.5.5 Changing the Forecast Horizon of Analysts' Earnings Estimates

Prior studies show that forecast quality is negatively associated with the forecast horizon (e.g., Capstaff et al., 1998; Tan et al., 2011). In the main analyses of my study, I include all analysts' earnings forecasts available for the last month prior to the announcement date of the actual earnings, see also Dadalt et al. (2002) and Panaretou et al. (2013). For example, Lemke & Möller (2019) compute the forecast estimates as the average of the last, second last, and third last month before the announcement date. I re-estimate my main Models D1.1, E1.1, D2.1, and E2.1 following the approach applied by Lemke & Möller (2019) and again when including all available estimates reported three months before the earnings announcement date. I illustrate the regression results in Table 4.10. OLS coefficients and t-statistics in parentheses are reported. *, **, and *** depict the conventional significance levels at 0.1, 0.05, and 0.01, respectively. Reported p-values are one-tailed if a directional prediction is made and two-tailed otherwise. Varying the forecast horizon materially alters my results concerning H1 and H2 when analyzing the impact on forecast *Dispersion*. The models in Columns (1) and (3) of Table 4.10 show a significant and positive coefficient estimate of the interaction terms $TREAT \times POST$ (H1). These results indicate that the application of IFRS 9 hedge accounting is linearly associated with an increase in the *Dispersion* of analysts' earnings forecasts. It seems that for the longer forecast horizons of three months and the average of the last three months before the announcement date, sell-side analysts have more difficulties finding a consensus on earnings estimates for firms that apply IFRS 9 hedge accounting than for

their counterfactual, given the new disclosure requirements of IFRS 7. The application of IFRS 9 hedge accounting increases the *Dispersion* of forecasts by 0.0035 percentage points and 0.0034 percentage points according to a three months and three months average forecast horizon, respectively, prior to the EPS announcement date. Concerning H2, the regression results depict significant and positive coefficients of the independent variable *HA new*, indicating that analysts' earnings forecasts are more dispersed for firms that apply IFRS 9 hedge accounting in combination with IFRS 7 disclosure amendments on hedge accounting compared to firms that apply IAS 39 hedge accounting together with disclosure amendments of IFRS 7 (f.v.). The application of the new hedge accounting rules leads to a linear increase in *Dispersion* of 0.0044 and 0.0042 percentage points for the extended forecast horizons, respectively, see Columns (5) and (7). Hence, longer forecast horizons impede analysts' ability to find earnings forecast consensuses for firms that apply the new hedge accounting rules. This association, however, seems to occur only temporarily as it disappears for the shorter forecast horizon of one month, as shown in the main analyses. Analyzing the forecast *Error* as the dependent variable with the larger forecast horizons does not change my original results. Independent variables of interest are insignificant, see Table 4.10, Columns (2), (4), (6), and (8). IFRS 9 hedge accounting per se as well as the new hedge accounting rules of IFRS 9 combined with IFRS 7 are not significantly associated with analysts' earnings forecast *Error*. To sum up, these results indicate that applying the new hedge accounting requirements is associated with a higher *Dispersion* for longer forecast time horizons. Nevertheless, the accuracy of forecasts, reflected by *Error*, does not change.

Table 4.10: Regression results using alternative forecast horizons

Forecast horizon		3 months		3 months average			3 months		3 months average	
	H1	*Dispersion*	*Error*	*Dispersion*	*Error*	H2	*Dispersion*	*Error*	*Dispersion*	*Error*
	Pred.	(1)	(2)	(3)	(4)	Pred.	(5)	(6)	(7)	(8)
TREAT	+/-	0.001	0.004	0.001	0.004	HA new	+/-	0.004***	0.013	0.004***	0.012
		(0.623)	(0.506)	(0.685)	(0.518)			(3.233)	(1.632)	(2.596)	(1.535)
POST	+/-	-0.001	-0.000	0.001	0.001	POST	+/-	-0.001	-0.002	0.001	-0.001
		(-0.550)	(-0.017)	(0.482)	(0.054)			(-0.606)	(-0.197)	(0.529)	(-0.141)
TREAT × POST	+/-	0.004**	0.012	0.003*	0.011						
		(2.156)	(1.147)	(1.758)	(1.074)						
Size	-	-0.002***	0.001	-0.002***	0.002	Size	-	-0.002***	0.001	-0.002***	0.002
		(-3.598)	(0.426)	(-3.366)	(0.625)			(-3.826)	(0.538)	(-3.533)	(0.763)
Loss	+	0.015***	0.070***	0.015***	0.068***	Loss	+	0.013***	0.062***	0.014***	0.061***
		(2.964)	(3.177)	(2.791)	(3.166)			(2.802)	(3.310)	(2.641)	(3.347)
Stability	+	0.001**	0.008***	0.001**	0.008***	Stability	+	0.001**	0.007***	0.001**	0.007***
		(1.881)	(2.610)	(2.067)	(2.570)			(1.842)	(2.527)	(1.981)	(2.501)
Leverage	+/-	2.781	3.252	3.329*	4.446	Leverage	+/-	2.610*	1.477	2.923*	2.725
		(1.645)	(0.379)	(1.798)	(0.514)			(1.796)	(0.210)	(1.895)	(0.383)
Analysts	-	0.000	0.000	0.000	-0.000	Analysts	-	0.000	0.000	0.000	0.000
		(1.166)	(0.142)	(1.226)	(-0.103)			(1.354)	(0.403)	(1.406)	(0.128)
Earnings	-	0.016	-0.237**	0.002	-0.221**	Earnings	-	0.015	-0.215**	0.004	-0.197**
		(0.923)	(-1.985)	(0.100)	(-1.821)			(0.902)	(-2.100)	(0.210)	(-1.918)
MTB	+/-	-0.000*	-0.003**	-0.000*	-0.003**	MTB	+/-	-0.000*	-0.003**	-0.000*	-0.002**
		(-1.777)	(-2.280)	(-1.735)	(-2.103)			(-1.893)	(-2.242)	(-1.888)	(-2.075)
Constant		0.037***	-0.029	0.041***	-0.047	Constant		0.038***	-0.024	0.042***	-0.042
		(3.743)	(-0.501)	(3.511)	(-0.786)			(3.984)	(-0.480)	(3.702)	(-0.805)
Year FE		Yes	Yes	Yes	Yes			Yes	Yes	Yes	Yes
Industry FE		Yes	Yes	Yes	Yes			Yes	Yes	Yes	Yes
Observations		357	357	357	357			378	378	378	378
Adjusted R^2		0.393	0.488	0.424	0.468			0.355	0.471	0.386	0.454

*p<0.1; **p<0.05; ***p<0.01

(Table 4.10 continued)

(Table 4.10 continued)

Notes: The left-hand side of the table shows the regression results of the difference-in-differences model from Eq. (4.3) to test Hypothesis H1. The right-hand side shows the regression results for the model from Eq. (4.4) to test Hypothesis H2. In contrast to my main analyses, I use two alternative forecast horizons. In Columns (1), (2), (5), and (6) I use analysts' earnings forecast estimates including all available I/B/E/S estimates reported three months before the earnings announcement date (*3 months*). In Columns (3), (4), (7), and (8) I use analysts' earnings forecast estimates of the last, second last, and third last month before the announcement date (*3 months average*). The results present the regression coefficients and the corresponding t-statistics in parentheses. Standard errors are heteroskedasticity-robust and clustered at the firm level. Reported p-values are one-tailed whenever a directional prediction is made and two-tailed otherwise. *TREAT* is an indicator variable that is coded as 1 if a firm applies IFRS 9 hedge accounting during the observation period and as 0 otherwise. *POST* is an indicator variable that is coded as 1 if the firm-year observation corresponds to the post IFRS 9 introduction period and as 0 otherwise. $TREAT \times POST$ is the difference-in-differences estimator. It reflects the effect of IFRS 9 hedge accounting application on the average level of information asymmetry. *HA new* is an indicator variable that is coded as 1 if firm i applies IFRS 9 hedge accounting rules at time t and as 0 otherwise. It reflects the effect of IFRS 9 hedge accounting application and IFRS 7 disclosure amendments to hedge accounting on the average level of information asymmetry. Definitions of the dependent and control variables are provided in Table 4.2.

4.5.6 Bid-Ask Spreads - An Alternative Proxy for Information Asymmetry

Bid-ask spreads present an alternative proxy for information asymmetry which is widely used in the literature (e.g., Welker, 1995; Leuz & Verrecchia, 2000; Leuz, 2003; Daske et al., 2008, 2013; Steffen, 2021). Compared to the analysts' earnings forecast measures used in the main analyses, *Dispersion* and *Error*, which are based foremost on accounting numbers, bid-ask spreads are assumed to capture also other aspects of financial reporting, such as disclosure (Leuz, 2003). According to this assumption, regressions on bid-ask spreads might unveil possible effects of the application of IFRS 7 disclosure amendments on information asymmetry.

I compute daily bid-ask spreads as the difference between the ask and the bid price divided by their midpoint (Daske et al., 2008, p. 1135):

$$Spread_{i,d} = \frac{Ask_{i,d} - Bid_{i,d}}{(Ask_{i,d} + Bid_{i,d})/2} \tag{4.6}$$

for firm i at day d. Taking the median of daily spreads gets me the spreads of firm i in year t (*Bid-ask Spreads* $_{i,t}$). Following Daske et al. (2008), I use a log-linear specification for the regression on bid-ask spreads and control for size, monthly return variability, and share turnover.[95] *Size* is a firm's market value of equity. *Return Variability* is computed as the annual standard deviation of monthly stock returns. *Share Turnover* is the ratio of a firm's trading volume to its market value of equity. The control variables are lagged by one year (e.g., Daske et al., 2008, 2013; Panaretou et al., 2013) to make firms more comparable prior to the treatment and to counter concerns on reverse causality (Leszczensky & Wolbring, 2022). Data is derived through Datastream. As in the main analyses, I include industry and year fixed effects in the regression. Former literature suggests and finds a negative association of *Log(Size* $_{t-1}$*)* and *Log(Share Turnover* $_{t-1}$*)* and a positive association of *Log(Return Variability* $_{t-1}$*)* with *Log(Bid-ask Spreads* $_{t}$*)* (e.g., Leuz & Verrecchia, 2000; Leuz, 2003; Daske et al., 2008, 2013).

[95] A log-linear specification is used because of the multiplicative relationship between the bid-ask spread and its determinants which was found in the literature (Leuz, 2003) and is common in liquidity models (Daske et al., 2008). For continuous variables, the natural logarithm is taken.

Table 4.11: Regression results using bid-ask spreads as an alternative proxy for information asymmetry

Log(Bid-ask Spreads)					
	Pred.	H1		Pred.	H2
TREAT	+/-	0.026	HA new	+/-	0.024
		(0.407)			(0.384)
POST	+/-	-0.294***	POST	+/-	-0.302***
		(-4.524)			(-4.565)
TREAT × POST	+/-	0.010			
		(0.152)			
Log(Size $_{t-1}$)	-	-0.467***	Log(Size $_{t-1}$)	-	-0.465***
		(-19.708)			(-21.767)
Log(Share Turnover $_{t-1}$)	-	-0.186***	Log(Share Turnover $_{t-1}$)	-	-0.183***
		(-5.139)			(-6.292)
Log(Return Variability $_{t-1}$)	+	0.078	Log(Return Variability $_{t-1}$)	+	0.087
		(1.015)			(1.244)
Constant		3.255***	Constant		3.252***
		(5.364)			(6.136)
Year FE		Yes	Year FE		Yes
Industry FE		Yes	Industry FE		Yes
Observations		406	Observations		427
Adjusted R^2		0.824	Adjusted R^2		0.825

*p<0.1; **p<0.05; ***p<0.01

Notes: The table shows the regression results of the difference-in-differences analyses for the model in Eq. (4.3) to test Hypothesis H1 on the left-hand side and of the OLS regression for the model in Eq. (4.4) to test Hypothesis H2 on the right-hand side. The results present the regression coefficients and the corresponding t-statistics in parentheses. Standard errors are heteroskedasticity-robust and clustered at the firm level. Reported p-values are one-tailed whenever a directional prediction is made and two-tailed otherwise. The dependent variable is *Log(Bid-ask Spreads)*. Eq. (4.6) provides the calculation of *Bid-ask Spreads*. *TREAT* is an indicator variable that is coded as 1 if a firm applies IFRS 9 hedge accounting during the observation period and as 0 otherwise. *POST* is an indicator variable that is coded as 1 if the firm-year observation corresponds to the post IFRS 9 introduction period and as 0 otherwise. *TREAT* × *POST* is the difference-in-differences estimator. It reflects the effect of IFRS 9 hedge accounting application on the average level of information asymmetry. *HA new* is an indicator variable that is coded as 1 if firm i applies IFRS 9 hedge accounting rules at time t and as 0 otherwise. It reflects the effect of IFRS 9 hedge accounting application and IFRS 7 disclosure amendments to hedge accounting on the average level of information asymmetry. The control variables are: *Log(Size)* is the natural logarithm of a firm's market value of equity. *Log(Share Turnover)* is the natural logarithm of the ratio of a firm's trading volume to its market value of equity. *Log(Return Variability)* is the natural logarithm of the annual standard deviation of monthly stock returns. All control variables are lagged by one year, denoted by *t-1*.

Table 4.11 provides the regression results from the fixed effects OLS regressions. Standard errors are heteroskedasticity-robust and clustered at the firm level. OLS coefficients and t-statistics in parentheses are reported. *, **, and *** depict the conventional significance levels at 0.1, 0.05, and 0.01, respectively. Reported p-values are one-tailed if a directional prediction is made and two-tailed otherwise. The left-hand side of the table depicts the model for testing H1. I find no significant association of the difference-in-differences estimator *TREAT* × *POST*. The insignificant coefficient of the interaction term indicates that the application of IFRS 9 hedge accounting is not related to *Bid-ask Spreads* as a proxy for information asymmetry. This result supports the inferences made from Models D1.1 and E1.1. I find no evidence to support H1. The coefficient of the main effect of treatment *TREAT* is insignificant, too. However, I find a negative and significant coefficient of the main effect *POST*. That is, firms in the control group, IAS 39 hedge accounting applicants, differ significantly between the pre- and post-period. Thus, IFRS 7 disclosure amendments seem to be negatively associated with bid-ask spreads, which would indicate a decrease in information asymmetry. This result, however, has to be interpreted cautiously since the independent variable *POST* also incorporates other aspects that change from pre- to post-period. Explicitly speaking, these aspects certainly include the effects from IFRS 9 classification, measurement, and impairment. These effects are not negligible, as IFRS 9 entails major changes in these aspects, e.g., the fair value option and the expected credit loss model for impairments. As proposed by former literature, the coefficients of *Log(Size* $_{t-1}$*)* and *Log(Share Turnover* $_{t-1}$*)* are significant and negatively associated with *Log(Bid-ask Spreads* $_{t}$*)*. The right-hand side of the table depicts the model for testing H2. In line with my main analyses in Models D2.1 and E2.1, the coefficient of the independent variable *HA new* remains insignificant. H2 cannot be supported. Underlining my previous result concerning the independent variable *POST*, I find a negative and significant coefficient estimate. The coefficients of *Log(Size* $_{t-1}$*)* and *Log(Share Turnover* $_{t-1}$*)* are again negative and significant.

4.5.7 Discussion

The univariate differences between IFRS 9 hedge accounting applicants in the post-period and their IAS 39 counterparts in the pre-period (Table 4.4, A:B), indicating a significant increase in forecast *Dispersion* and an almost significant increase in *Error* (two-tailed p-value: 0.1005), cannot be supported by the conducted multivariate analyses. My results show no evidence that the new hedge accounting rules are associated with analysts' earnings forecast quality. There are several reasonable interpretations for these results. First, the institutional framework of IFRS 9 hedge accounting aims to align hedge accounting and risk management more closely through extended designation possibilities and a more qualitative approach to effectiveness testing. Especially, the designation of single components of non-financial hedged items, independent of the hedged risk exposure (IFRS 9, para. 6.3.7), provides non-financial firms the possibility to match hedging instruments and hedged items more adequately to achieve the desired offsets. As a consequence, ineffectiveness, which needs to be accounted for through profit or loss[96] (IFRS 9, para. 6.5.8, 6.5.11(c), 6.5.13(b)), arising from suboptimal matches of hedging instruments and hedged items should decrease and hence, lead to less volatility in profit or loss. In turn, earnings should be more predictable (Graham et al., 2005; Dichev & Tang, 2009) and thus, ameliorate analysts' forecast quality. Moreover, the new cost of hedging approach in IFRS 9 also reduces earnings volatility. Non-designated parts of hedging instruments are recognized in OCI (IFRS 9, para. 6.5.15-16) instead of recognizing them in profit or loss as prescribed in IAS 39, para. 95-96. However, the fact that IFRS 9 is new and analysts are not yet familiar with the new hedge accounting rules might reduce their forecast qualities. These counteracting aspects might explain why IFRS 9 hedge accounting is not significantly related to analysts' earnings forecast dispersion and error. A second interpretation of the results might be that both hedge accounting standards, IAS 39 and IFRS 9 and respective disclosure amendments might be equally suitable or equally unsuitable for non-financial firms to present their risk management strategies through hedge accounting. If so, differences in forecast quality depending on the applied standard should

[96] An exception exists in case the hedged item is an equity instrument for which changes in the fair values are recognized in OCI. Here, ineffectiveness needs to be accounted for in OCI (IFRS 9, para. 6.5.3).

not occur. Third, IFRS 9 hedge accounting applicants might have adopted the new rules rather for signaling purposes than the informational effect. Possibly, they indeed adopt IFRS 9 hedge accounting but do not or not yet actually make use of them. Hence, the supposed advantages of the new rules are hardly applied. Daske et al. (2013) observe such behavior when analyzing what they call 'serious' and 'label' adopters of IAS/IFRS around the time of voluntary and mandatory IAS/IFRS adoptions. If the adoption of IFRS 9 hedge accounting is driven by this signaling effect, analysts would be confronted with a presentation of hedge accounting similar to that of IAS 39, which would not alter their forecast quality.

4.6 Conclusion

The extraordinary transition period of IFRS 9 hedge accounting allows a co-existence of two IFRS hedge accounting regimes in the market: hedge accounting applicants may choose between the 'old' IAS 39 and the 'new' IFRS 9 hedge accounting rules. In this work, I examine whether adopting the new hedge accounting regulations determined in IFRS 9 impacts sell-side analysts' earnings forecast quality, measured through analysts' earnings forecast dispersion and error. These measures are proxies for information asymmetries between firms' managers and the sell-side analysts following the firms. The institutional setting of my study allows me to examine the exclusive impact of voluntarily adopting IFRS 9 hedge accounting (H1) and to investigate in another analysis the impact of voluntarily adopting IFRS 9 hedge accounting combined with the mandatory application of IFRS 7 disclosure amendments (H2). I use a self-collected German data set of non-financial hedge accounting applicants with a five-year observation period from 2015-2019. My results indicate that differences in forecast quality between IFRS 9 and IAS 39 hedge accounting applicants are neither statistically significant nor economically meaningful. I find no evidence that adopting IFRS 9 hedge accounting alters the quality of analysts' earnings forecasts. My results indicate that analysts can make comparable earnings forecasts independent of the applied hedge accounting standards. Moreover, among each other, analysts do not find better consensuses of forecast earnings for IFRS 9 compared

to IAS 39 users. The results are consistent with those of the analysis of the application of the new hedge accounting rules, combining IFRS 9 hedge accounting and the related IFRS 7 disclosure amendments. Furthermore, the analysis on bid-ask spreads as an alternative proxy for information asymmetry confirms my findings. Hence, the informational effect of the different hedge accounting regulations for external stakeholders seems to be similar.

The results of this study might be of particular importance to standard setters. My work gives insights into how the quality of analysts' earnings forecasts changes with the application of the new hedge accounting regulations and, therefore, tries to shed some light on whether the IASB succeeded in pursuing its objective to better align hedge accounting with risk management. Given the findings of this study, the alignment of hedge accounting and risk management does not lead to significant differences in earnings forecast dispersion and errors.

Besides the insights and contributions concerning the new hedge accounting rules, my study also has several limitations. First, the institutional setting allows for voluntary adoption of IFRS 9 hedge accounting regulation. Even though I conduct additional analyses to counter concerns, I cannot entirely exclude the possibility that this also leads to selection-into-treatment problems. Second, the relatively short period post IFRS 9 introduction (2018-2019) might hamper analysts' ability to adapt their earnings forecasts to the new hedge accounting framework. If so, the results of my study would only hold in the short run, and possible disadvantages for analysts lacking experience with the new rules might outweigh informational advantages. In the long run, analysts should become more familiar with the new hedge accounting rules. Therefore, a longer post IFRS 9 time frame might more explicitly point out whether the new rules impact information asymmetry in the form of forecast quality. Third, the simultaneity of mandatory IFRS 9 adoption in terms of classification, measurement, and impairment and IFRS 7 disclosure amendments to hedge accounting impedes the possibility of disentangling the impact of these regulations without an external control group which is not subject to these changes. The critical aspect in this constellation is the fact that the fair value option of IFRS 9 should generally lead to more volatility in profit or loss (Pricewaterhouse Coopers, 2017a) and might counteract the effects of IFRS 7. Fourth, the variables concerning hedge accounting

practices (IFRS 9 vs IAS 39) are based on the fact that firms have hedging relationships at the end of the respective fiscal years for which they apply hedge accounting. Observations of firms that end hedging relationships during a fiscal year are not included in the sample.

Further research might be needed to analyze the long-term effects of applying the new hedge accounting rules on information asymmetry. Doing so would give insights into whether the alignment of hedge accounting and risk management strategies changes the perception of external stakeholders concerning risk management after better adapting to the new rules. Moreover, disentangling the impact of IFRS 7 disclosure amendments to hedge accounting would be compelling. Of particular interest would be to analyze the importance of hedge accounting disclosure according to IFRS 7 compared to the rather technical accounting rules of IFRS 9 and IAS 39, respectively.

Chapter 5

Summary, Discussion, and Outlook

This dissertation addresses the requirements on hedge accounting during the transition from IAS 39 towards IFRS 9. The work is motivated by the ongoing and extraordinary transition period in which the IASB grants firms to choose between the equally acceptable hedge accounting models of IAS 39 and IFRS 9. Throughout my dissertation, I analyze this topic by considering different scientific issues. While in Chapter 2 a model-based approach is used to analyze specific differences in the accounting techniques of hedging relationships between IAS 39 and IFRS 9, Chapters 3 and 4 consist of empirical analyzes. The former focuses on differences in the determinants of hedge accounting according to the respective standards, the latter on differences in earnings forecasting quality of sell-side analysts. Even though the proportion of derivatives designated in hedging relationships is relatively low for non-financial firms, financial instruments and their accounting have become increasingly important during the last decades (European Securities and Markets Authority, 2018; Panaretou et al., 2013). Globalization, worldwide trade, and internationally connected financial markets provide chances for new business transactions but also bear risks arising from these transactions. Hedging risk exposures and making risk management strategies transparent to external stakeholders is indispensable to meet the informative purposes of international financial reporting. Also, the long development process of IFRS 9 through the IASB and the introduction of the new hedge accounting model without having finalized the macro hedging project on dynamic risk management under-

lines the increasing economic relevance of financial instruments and hedge accounting. The next three paragraphs of this conclusion briefly summarize the key findings of my work on hedge accounting. Subsequently, it gives a result discussion and closes with an outlook.

Chapter 2 analyzes and evaluates the effect of different possible cash flow hedge accounting rules on a firm's portfolio earnings, i.e., profit or loss according to IAS 39 and IFRS 9. The considered hedging relationship consists of a highly probable forecast transaction, purchasing raw material denominated in foreign currency, and a forward contract to mitigate the foreign exchange rate risk. I conduct a Monte Carlo simulation study to generate the accounting entries of the respective cash flow hedge possibilities. The main differences between the standards result from the possibility of designating only the spot element of the forward contract as the hedging instrument. IAS 39 and IFRS 9 regulate the recognition of the non-designated forward element differently. While IAS 39 prescribes recording it in profit or loss, IFRS 9 determines to recognize it in a separate component of equity in other comprehensive income. During the lifetime of the hedging relationship, portfolio earnings are lower and less volatile when applying IFRS 9. Moreover, portfolio earnings between fully effective and ineffective hedging relationships deviate less strongly for IFRS 9 hedge accounting. Varying macroeconomic input parameters in the simulation of the hedging relationships, the study illustrates that the hedge accounting possibilities of IFRS 9 are less sensitive to changes in the domestic to foreign interest rates ratio but more sensitive to changes in the exchange rate volatility. The simulation results are robust to changes in the capital structure of the model firm. Furthermore, including default risk for the parties that entered the forward contract underlying the hedging relationship in the model does not change the relation of the different hedge accounting possibilities to one another.

Chapter 3 investigates the determinants of IAS 39 and IFRS 9 hedge accounting for a German sample of non-financial firms from 2017 to 2019. For the period prior to the introduction of IFRS 9 in 2018, I examine which sample firms opt for applying IFRS 9 hedge accounting. The analyses suggest that firms opting for IFRS 9 hedge accounting differ from those staying with IAS 39 already in the pre-period. Univariate results indi-

cate that they designate more derivatives to mitigate commodity price risk and use more fair value hedges. Moreover, they are larger in terms of their market values of equity and have higher leverage. The results related to the hedge accounting practices also hold for multivariate analyses and are robust to changes in the regression variables. After the introduction of IFRS 9, differences between IFRS 9 and IAS 39 applicants are even larger. Univariate analyses indicate that IFRS 9 hedge accounting applicants designate more derivatives for hedging purposes in general and for mitigating commodity price and interest rate risk in particular. In addition, IFRS 9 applicants are larger and have lower bid-ask spreads. These findings mainly hold for the multivariate analyses and are robust to regression specifications. Besides that, Chapter 3 shows that hedge accounting applicants designate more hedging relationships after the introduction of IFRS 9. It also gives insights into the partitioning of mitigating different types of risk of non-financial firms. Even though mitigating foreign exchange rate risk still makes the largest portion of designated hedging relationships in the post-period, its share shrinks from 72% to 58% while the shares of interest rate and commodity price risk increase from 13% to 19% and 11% to 22%, respectively.

Chapter 4 examines the effect of the new hedge accounting requirements on information asymmetry. The new hedge accounting requirements consist of IFRS 9 hedge accounting and IFRS 7 disclosure amendments to hedge accounting. I use sell-side analysts' earnings forecast quality measured through forecast dispersion among analysts and forecast error as proxies for asymmetric information. I analyze a German sample of non-financial hedge accounting applicants from 2015 to 2019. The findings indicate no evidence that IFRS 9 itself or the combination of IFRS 9 and IFRS 7 is, on average, associated with a change in the earnings forecast quality of sell-side analysts for forecasts estimated one month prior to the EPS announcement date. These results are robust to several model specifications. Moreover, it seems that a possible self-selection bias originating from choosing to opt for applying IFRS 9 hedge accounting does not distort my findings concerning the forecast dispersion among analysts. Referring to the forecast error, the results might be possibly biased towards zero. Analyzing the effect of the new hedge accounting requirements on information asymmetry using bid-ask spreads as an alternative proxy does not change my

original inferences. When extending the time horizon of forecast estimates to up to three months before the announcement of the actual EPS, I find a statistically significant increase in forecast dispersion among analysts for firms applying the new hedge accounting requirements. Hence, analysts seem to have more difficulty finding a forecast consensus for longer forecast horizons. However, their forecast estimates per se do not deteriorate. I find no significant association between the new hedge accounting requirements and analysts' forecast error.

The crucial aspect of the IFRS 9 hedge accounting model is to succeed in aligning the accounting more closely to risk management activities. The diverse research methods used in this dissertation enable me to compare my findings concerning this aspect on different levels. From a purely institutional point of view, an alignment of hedge accounting and risk management should at least be possible with the new regulatory framework. The model-based simulation approach presented in Chapter 2 compares IAS 39 and IFRS 9 to get a deeper understanding of the respective accounting techniques prescribed by the standards and how these techniques are associated with earnings volatility on a transaction-based level. It illustrates that the hedge accounting model in IFRS 9 is associated with less earnings volatility. According to the determinant analysis in Chapter 3, it seems that IFRS 9 provides more suitable requirements for non-financial firms to associate the accounting of the hedging relationships resulting from their business transactions with their risk management activities. Opting for the IFRS 9 hedge accounting model is not mandatory. Firms decide according to their individual preferences. Most hedge accounting applicants however, switch from IAS 39 to IFRS 9. They designate particularly more hedging relationships to mitigate commodity price risk exposures. Hence, this finding might indicate a closer alignment of the accounting and the risk management through IFRS 9 and might lower the information asymmetry between managers and external stakeholders. Based on the empirical study in Chapter 4 however, I find no evidence that applying the new hedge accounting model is, on average, associated with a decrease in information asymmetry. This finding at least questions the alignment of IFRS 9 hedge accounting with the risk management activities. There are several interpretations thinkable why Chapter 4 does not underline this association. An important aspect might be the relatively short

observation period. External stakeholders may need time to adapt to the new regulatory environment and to evaluate the accounting information resulting from the new regulatory framework. In addition, managers may need time to adapt to the new requirements, and preparers of financial reports may need time to improve in presenting the risk management activities. Admittedly, the alignment of accounting and risk management presumes the willingness to do so from the side of the firm's management.

Even though the studies underlying this work do not clearly indicate whether or not the IASB succeeds with its objective to align hedge accounting more closely with risk management activities, they provide first insights regarding the hedge accounting practices of non-financial firms during the transition from IAS 39 towards IFRS 9 and raise further demand for research. Future research in this area might exploit whether the transition to IFRS 9 hedge accounting could be related to real effects for non-financial firms, especially in commodities. Moreover, investigating the long-term effects of IFRS 9 hedge accounting on information asymmetry might help make further inferences concerning the alignment of the accounting and the risk management through IFRS 9.

Appendices

A Appendix Chapter 3

A.1 Variable Definitions

Size: Is determined as the natural logarithm of a firm's consolidated market value of equity (in EUR). I use 'MVC' from Datastream, measured at fiscal year-end.

Leverage: I calculate the leverage ratio of a firm as the ratio of a firm's total debt (in EUR) to total assets (in EUR) using Worldscope[97] items 'WC03255' and 'WC02999', both measured at fiscal year-end.

Bid-ask spread: I retrieve a firm's daily closing bid and ask prices (in EUR) from Datastream using 'PB' and 'PA'. I calculate a firm's daily bid-ask spreads as given in Daske et al. (2008, p. 1135). I divide the difference of the daily closing bid and ask prices by their midpoint and take the median of these spreads over the year.

Earnings volatility: A firm's earnings volatility is the standard deviation of a firm's quarterly net income before extraordinary items and preferred and common dividends as given in Zhang (2009), using Worldscope item 'WC01551'. I calculate earnings volatility only for firms for which four quarters of data are available. Zhang (2009) calculates earnings volatility on minimum basis of eight quarters of data. He works with a longer time horizon.

Market-to-book value (MTB): I calculate a firm's market-to-book value of equity as the

[97] I access Worldscope data via Datastream.

ratio of a firm's consolidated market value of equity securities (in EUR) to a firm's book value of common equity (in EUR) using the datatype 'MVC' Datastream and the Worldscope item 'WC03501', both measured at fiscal year-end.

Free float: I use Datastream 'NOSHFF' for data on free float. Free float is calculated as the percentage of a firm's total shares in issue available to ordinary investors multiplied by 100, measured at fiscal year-end. I use decimal values and therefore, divide the Datastream outcome by 100.

A.2 Appended Tables

Table A1: Hedge accounting application among non-financial firms separated by industry classifications

		Hedge accounting				Hedge accounting applicants			
		non-applicants		applicants		IAS 39		IFRS 9	
		# firms	(%)	# firms	(%)	# firms	(%)	# firms	(%)
2017	Consumer Non-Durables	1	(20%)	4	(80%)	4	(100%)	0	(0%)
	Consumer Durables	2	(22%)	7	(78%)	7	(100%)	0	(0%)
	Manufacturing	7	(17%)	33	(83%)	33	(100%)	0	(0%)
	Energy	1	(100%)	0	(0%)	0	(0%)	0	(0%)
	Business Equipment	15	(60%)	10	(40%)	10	(100%)	0	(0%)
	Telecommunications	4	(50%)	4	(50%)	4	(100%)	0	(0%)
	Shops	3	(23%)	10	(77%)	10	(100%)	0	(0%)
	Healthcare	3	(27%)	8	(73%)	8	(100%)	0	(0%)
	Utilities	0	(0%)	5	(100%)	5	(100%)	0	(0%)
	Other	7	(44%)	9	(56%)	9	(100%)	0	(0%)
	Total	43	(32%)	90	(68%)	90	(100%)	0	(0%)
2018	Consumer Non-Durables	1	(25%)	3	(75%)	0	(0%)	3	(100%)
	Consumer Durables	2	(22%)	7	(78%)	2	(29%)	5	(71%)
	Manufacturing	9	(21%)	33	(79%)	11	(33%)	22	(67%)
	Energy	1	(100%)	0	(0%)	0	(0%)	0	(0%)
	Business Equipment	14	(61%)	9	(39%)	2	(22%)	7	(78%)
	Telecommunications	4	(50%)	4	(50%)	1	(25%)	3	(75%)
	Shops	5	(33%)	10	(67%)	2	(20%)	8	(80%)
	Healthcare	2	(22%)	7	(78%)	2	(29%)	5	(71%)
	Utilities	0	(0%)	5	(100%)	0	(0%)	5	(100%)
	Other	6	(37%)	10	(63%)	2	(20%)	8	(80%)
	Total	44	(33%)	88	(67%)	22	(25%)	66	(75%)
2019	Consumer Non-Durables	1	(25%)	3	(75%)	0	(0%)	3	(100%)
	Consumer Durables	2	(20%)	8	(80%)	2	(25%)	6	(75%)
	Manufacturing	7	(17%)	33	(83%)	8	(24%)	25	(76%)
	Energy	1	(100%)	0	(0%)	0	(0%)	0	(0%)
	Business Equipment	14	(58%)	10	(42%)	2	(20%)	8	(80%)
	Telecommunications	3	(43%)	4	(57%)	1	(25%)	3	(75%)
	Shops	5	(36%)	9	(64%)	2	(22%)	7	(78%)
	Healthcare	4	(36%)	7	(64%)	1	(14%)	6	(86%)
	Utilities	0	(0%)	4	(100%)	0	(0%)	4	(100%)
	Other	7	(47%)	8	(53%)	2	(25%)	6	(75%)
	Total	44	(34%)	86	(66%)	18	(21%)	68	(79%)

Notes: The table shows the hedge accounting practices of German non-financial firms listed in DAX30, MADX, SDAX, or TECDAX throughout the observation period from 2017 to 2019. For each year, the table presents the hedge accounting practices separated

(Table A1 continued)

(Table A1 continued)

by the industry definition according to Fama & French 10 industries classifications. "Energy" combines oil, gas, and coal extraction and products. "Shops" combines wholesale, retail, and some services (laundries, repair shops). "Healthcare" combines healthcare, medical equipment, and drugs. "Business Equipment" combines computers, software, and electronic equipment. The classification "Other" does not include the finance sector, as financial firms are generally excluded from the analyses.

B Appendix Chapter 4

B.1 Definitions of Control Variables

Size: I calculate firm size as the natural logarithm of a firm's market value of equity (in EUR). I use the Datastream datatype 'MVC' measured at fiscal year-end.

Analysts: I retrieve the number of sell-side analysts following a firm from I/B/E/S at fiscal year-end.

Loss: I determine *Loss* as an indicator variable that is coded as 1 if a firm had negative earnings per share (EPS) in the year prior to the actual reporting year, and 0 otherwise. I use the Worldscope datatype 'WC18193' for reported EPS at fiscal year-end.

Earnings: I calculate *Earnings* as the EPS (in EUR) reported by the firm at fiscal year-end divided by the stock price (in EUR) at the beginning of the respective fiscal year, as given in Panaretou et al. (2013). I use the Worldscope datatype 'WC18193' for reported EPS and Datastream datatype 'UP' for the stock price.

Stability: I calculate earnings stability as the natural logarithm of the I/B/E/S earnings stability measure 'YR5STB'. The item is defined as "the mean absolute percentage difference between actual reported earnings per share and a five year historical EPS growth trend line, expressed as a percentage of trend line earnings per share" (Refinitiv, 2020, p. 28).

Leverage: I calculate a firm's leverage as the ratio of the book value of total debt (in EUR) to the market value of equity (in EUR) using Worldscope datatype 'WC03255' and the Datastream item 'MVC', both measured at fiscal year-end.

MTB: I calculate a firm's market-to-book ratio of equity (*MTB*) as the ratio of a firm's consolidated market value of equity securities (in EUR) to a firm's book value of common equity (in EUR) using the Datastream datatype 'MVC' and Worldscope datatype 'WC03501', both measured at fiscal year-end.

B.2 Appended Tables

Table B1: Robustness check using alternative measures for forecast dispersion and forecast error as given in Chang et al. (2000)

		(H1)				(H2)	
		Dispersion	*Error*			*Dispersion*	*Error*
	Pred.	(1)	(2)		Pred.	(3)	(4)
TREAT	+/-	0.018	0.003	HA new	+/-	0.044	0.013*
		(0.590)	(0.395)			(0.912)	(1.782)
POST	+/-	0.060	-0.001	POST	+/-	0.037	-0.002
		(1.344)	(-0.150)			(0.808)	(-0.280)
TREAT × POST	+/-	0.017	0.012				
		(0.377)	(1.218)				
Size	-	-0.033**	0.002	Size	-	-0.035**	0.002
		(-2.050)	(0.814)			(-2.309)	(0.903)
Loss	+	0.446***	0.062***	Loss	+	0.375***	0.054***
		(3.589)	(3.153)			(3.355)	(3.264)
Stability	+	0.031**	0.008***	Stability	+	0.031**	0.007***
		(1.875)	(2.600)			(2.044)	(2.585)
Leverage	+/-	9.943	4.510	Leverage	+/-	10.252	3.116
		(0.237)	(0.556)			(0.281)	(0.444)
Analysts	-	0.002	-0.000	Analysts	-	0.002	-0.000
		(0.812)	(-0.357)			(0.916)	(-0.152)
Earnings	-	0.074	-0.196**	Earnings	-	-0.049	-0.184**
		(0.172)	(-1.762)			(-0.121)	(-1.834)
MTB	+/-	-0.005	-0.002*	MTB	+/-	-0.006	-0.002*
		(-0.763)	(-1.902)			(-0.943)	(-1.868)
Constant		0.718**	-0.052	Constant		0.792**	-0.047
		(2.135)	(-0.938)			(2.481)	(-0.925)
Year FE		Yes	Yes	Year FE		Yes	Yes
Industry FE		Yes	Yes	Industry FE		Yes	Yes
Observations		357	357	Observations		378	378
Adjusted R^2		0.418	0.450	Adjusted R^2		0.398	0.434

*p<0.1; **p<0.05; ***p<0.01

(Table B1 continued)

(Table B1 continued)

Notes: The table shows the robustness check using alternative measures for forecast dispersion and error: $Dispersion_{i,t} = StdDev(ForecastEPS_{i,t})/|Mean(ForecastEPS_{i,t})|$ and $Error_{i,t} = |(ActualEPS_{i,t} - Median(ForecastEPS_{i,t}))/ActualEPS_{i,t}|$, see Chang et al. (2000, p. 5). The left-hand side of the table shows the regression results of the difference-in-differences model from Eq. (4.3) to test Hypothesis H1. *TREAT* is an indicator variable that is coded as 1 if a firm applies IFRS 9 hedge accounting during the observation period and as 0 otherwise. *POST* is an indicator variable that is coded as 1 if the firm-year observation corresponds to the post IFRS 9 introduction period and as 0 otherwise. $TREAT \times POST$ is the difference-in-differences estimator. It reflects the effect of IFRS 9 hedge accounting application on the average level of information asymmetry. The right-hand side of the table shows the regression results for the model from Eq. (4.4) to test Hypothesis H2. *HA new* is an indicator variable that is coded as 1 if firm i applies IFRS 9 hedge accounting rules at time t and as 0 otherwise. It reflects the effect of IFRS 9 hedge accounting application and IFRS 7 disclosure amendments to hedge accounting on the average level of information asymmetry. The results present the regression coefficients and the corresponding t-statistics in parentheses. Standard errors are heteroskedasticity-robust and clustered at the firm level. Reported p-values are one-tailed whenever a directional prediction is made and two-tailed otherwise. Definitions of the dependent and control variables are provided in Table 4.2.

Table B2: Robustness check using a tightened winsorizing criterion for continuous variables

		(H1)				(H2)	
		Dispersion	*Error*			*Dispersion*	*Error*
	Pred.	(1)	(2)		Pred.	(3)	(4)
TREAT	+/-	0.001	-0.000	HA new	+/-	0.002	0.005
		(0.641)	(-0.026)			(1.394)	(1.165)
POST	+/-	0.001	0.000	POST	+/-	0.001	0.001
		(1.106)	(0.011)			(1.153)	(0.193)
TREAT × POST	+/-	0.001	0.005				
		(0.685)	(1.170)				
Size	-	-0.001***	0.001	Size	-	-0.001***	0.001
		(-2.439)	(1.007)			(-2.692)	(0.741)
Loss	+	0.010***	0.077***	Loss	+	0.010***	0.072***
		(3.228)	(7.242)			(3.232)	(6.922)
Stability	+	0.001***	0.004***	Stability	+	0.001***	0.004***
		(2.613)	(3.172)			(2.711)	(3.292)
Leverage	+/-	2.510*	-0.198	Leverage	+/-	2.523*	0.416
		(1.650)	(-0.053)			(1.862)	(0.112)
Analysts	-	0.000	-0.000	Analysts	-	0.000	-0.000
		(0.903)	(-1.046)			(1.108)	(-0.659)
Earnings	-	0.018	0.191***	Earnings	-	0.020	0.184***
		(0.965)	(3.122)			(1.162)	(3.170)
MTB	+/-	-0.000*	0.000	MTB	+/-	-0.000*	0.000
		(-1.692)	(0.006)			(-1.676)	(0.115)
Constant		0.024**	-0.045	Constant		0.026***	-0.037
		(2.587)	(-1.642)			(2.901)	(-1.420)
Year FE		Yes	Yes	Year FE		Yes	Yes
Industry FE		Yes	Yes	Industry FE		Yes	Yes
Observations		357	357	Observations		378	378
Adjusted R^2		0.450	0.505	Adjusted R^2		0.428	0.473

*p<0.1; **p<0.05; ***p<0.01

Notes: The table shows the robustness check adapting the winsorizing criterion to the 5th and 95th percentile. The left-hand side of the table shows the regression results of the difference-in-differences model from Eq. (4.3) to test Hypothesis H1. *TREAT* is an indicator variable that is coded as 1 if a firm applies IFRS 9 hedge accounting during the observation period and as 0 otherwise. *POST* is an indicator variable that is coded as 1 if the firm-year observation corresponds to the post IFRS 9 introduction period and as 0 otherwise. *TREAT* × *POST* is the difference-in-differences estimator. It reflects the effect of IFRS 9 hedge accounting application on the average level of information asymmetry. right-hand side of the table shows the regression results for the model from Eq. (4.4) to test Hypothesis H2. *HA new* is an indicator variable that is coded as 1

(Table B2 continued)

(Table B2 continued)

if firm i applies IFRS 9 hedge accounting rules at time t and as 0 otherwise. It reflects the effect of IFRS 9 hedge accounting application and IFRS 7 disclosure amendments to hedge accounting on the average level of information asymmetry. The results present the regression coefficients and the corresponding t-statistics in parentheses. Standard errors are heteroskedasticity-robust and clustered at the firm level. Reported p-values are one-tailed whenever a directional prediction is made and two-tailed otherwise. Definitions of the dependent and control variables are provided in Table 4.2.

Table B3: Robustness check using a limited observation period due to the Covid-19 pandemic

		(H1)				(H2)	
		Dispersion	*Error*			*Dispersion*	*Error*
	Pred.	(1)	(2)		Pred.	(3)	(4)
TREAT	+/-	0.001	0.001	HA new	+/-	0.002	0.004
		(0.496)	(0.205)			(1.217)	(0.626)
POST	+/-	0.002	-0.001	POST	+/-	0.001	-0.002
		(0.742)	(-0.158)			(0.719)	(-0.249)
TREAT × POST	+/-	0.001	0.003				
		(0.590)	(0.394)				
Size	-	-0.002***	0.004	Size	-	-0.002***	0.004
		(-2.827)	(1.812)			(-2.861)	(1.804)
Loss	+	0.017***	0.085***	Loss	+	0.015***	0.073***
		(2.536)	(4.051)			(2.526)	(3.999)
Stability	+	0.001**	0.005***	Stability	+	0.001**	0.005***
		(1.908)	(2.601)			(1.834)	(2.402)
Leverage	+/-	2.979*	-4.534	Leverage	+/-	2.839**	-3.224
		(1.954)	(-0.824)			(2.177)	(-0.603)
Analysts	-	0.000	-0.000*	Analysts	-	0.000	-0.000
		(0.945)	(-1.307)			(1.132)	(-1.002)
Earnings	-	0.008	-0.087	Earnings	-	0.010	-0.094
		(0.336)	(-1.141)			(0.411)	(-1.212)
MTB	+/-	-0.000	-0.002*	MTB	+/-	-0.000*	-0.002
		(-1.583)	(-1.662)			(-1.744)	(-1.551)
Constant		0.034***	-0.070	Constant		0.035***	-0.067
		(2.884)	(-1.628)			(2.984)	(-1.591)
Year FE		Yes	Yes	Year FE		Yes	Yes
Industry FE		Yes	Yes	Industry FE		Yes	Yes
Observations		348	348	Observations		368	368
Adjusted R^2		0.397	0.525	Adjusted R^2		0.358	0.483

*p<0.1; **p<0.05; ***p<0.01

Notes: The table shows the robustness check a limited observation period. I exclude fiscal years affected by the Covid-19 pandemic. The left-hand side of the table shows the regression results of the difference-in-differences model from Eq. (4.3) to test Hypothesis H1. *TREAT* is an indicator variable that is coded as 1 if a firm applies IFRS 9 hedge accounting during the observation period and as 0 otherwise. *POST* is an indicator variable that is coded as 1 if the firm-year observation corresponds to the post IFRS 9 introduction period and as 0 otherwise. *TREAT* × *POST* is the difference-in-differences estimator. It reflects the effect of IFRS 9 hedge accounting application on the average level of information asymmetry. The right-hand side of the table shows the regression results for the model from Eq. (4.4) to test Hypothesis H2. *HA new* is an indicator

(Table B3 continued)

(Table B3 continued)

variable that is coded as 1 if firm i applies IFRS 9 hedge accounting rules at time t and as 0 otherwise. It reflects the effect of IFRS 9 hedge accounting application and IFRS 7 disclosure amendments to hedge accounting on the average level of information asymmetry. The results present the regression coefficients and the corresponding t-statistics in parentheses. Standard errors are heteroskedasticity-robust and clustered at the firm level. Reported p-values are one-tailed whenever a directional prediction is made and two-tailed otherwise. Definitions of the dependent and control variables are provided in Table 4.2.

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