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The Impact of Derivatives Usage on Firm Value in Nordic Energy Companies

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ABSTRACT:

Financial derivatives are commonly used by non-financial firms as part of their risk management strategies, yet prior research offers mixed conclusions about whether these instruments contribute to higher firm value. For energy companies in the Nordic region, exposure to highly volatile commodity markets makes hedging particularly relevant, creating a strong context for assessing how derivative usage relates to valuation. This thesis investigates whether the use of financial derivatives is associated with increased firm value among Nordic energy firms, using Tobin's Q as the primary performance measure. The analysis draws on quarterly data from 142 publicly listed Nordic firms between 2018 and 2024. Totally there is 3 976 firm-quarter observations. The study includes univariate tests, correlation analysis, and pooled ordinary least squares regressions, including controls for firm size, leverage, profitability, growth, geographic diversification, liquidity, and dividend policy. The results show that derivative users do not exhibit significantly higher Tobin's Q than non-users in either the full sample or the energy sector subsample. The coefficient on the derivative user dummy is statistically insignificant across all model specifications, whereas firm size and geographic diversification display positive and significant associations with firm value. Energy firm show a lower average Tobin's Q of 1,62 than non-energy firms despite a high derivatives usage rate of 87 percent. Overall, the findings suggest that derivatives usage in Nordic energy companies primarily serves as a risk management tool rather than a value enhancing mechanism, which supports the view that the valuation effects of corporate hedging are context dependent, and that derivatives usage alone does not generate a valuation premium in the Nordic energy sector.

KEYWORDS: Derivative, Options, Futures, Swaps, Nordic companies, Energy companies, Hedging, Firm value, Tobin's Q.

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Tiivistelmä:

Johdannaiset ovat laajasti käytettyjä riskienhallinnan välineitä ei-rahoitusalan yrityksissä, mutta empiirinen näyttö johdannaisten käytön vaikutuksesta yritysarvoon on ristiriitaista eri toimialoilla. Pohjoismaiset energiayhtiöt toimivat erittäin epävakailla hyödykemarkkinoilla, mikä tekee niistä tärkeän tutkimuskohteen johdannaispohjaisen suojautumisen arvovaikutusten tarkastelulle. Tämän tutkielman tavoitteena on tutkia, onko johdannaisten käyttö yhteydessä korkeampaan yritysarvoon pohjoismaisissa energiayhtiöissä Tobin Q:lla mitattuna. Tutkimuksessa hyödynnetään neljännesvuosittaista aineistoa 142 pörssilistatusta pohjoismaisesta yrityksestä ajanjaksolta 2018–2024. Aineistossa on yhteensä 3 976 yritysneljännestä. Analyysi perustuu univariantti- ja korrelaatioanalyyseihin sekä pooled OLS-regressiomalleihin, joissa kontrolloidaan yrityksen koon, velkaantuneisuuden, kannattavuuden, kasvun, maantieteellisen hajautuneisuuden, likviditeetin ja osingonmaksun vaikutukset. Tulokset osoittavat, että johdannaisia käyttävien yritysten Tobin Q ei ole merkitsevästi korkeampi kummassakaan, koko otoksessa tai energiasektorin alaryhmässä. Johdannaisten käyttöä kuvaava indikaattorimuuttuja ei ole tilastollisesti merkitsevä missään mallissa, kun taas yrityksen koko ja maantieteellinen hajautuneisuus ovat positiivisesti ja merkitsevästi yhteydessä yritysarvoon. Energiayhtiöiden keskimääräinen Tobin Q on 1,62, mikä on alempi kuin muilla toimialoilla, vaikka 87 prosenttia energiayhtiöistä käyttää johdannaisia. Kokonaisuudessaan tulokset viittaavat siihen, että johdannaisten käyttö toimii pohjoismaisissa energiayhtiöissä ensisijaisesti riskienhallinnan välineenä eikä suoraan yritysarvoa kasvattavana mekanismina.

KEYWORDS: Johdannaiset, Optio, Futuuri, Swap, Pohjoismaat, Energia yhtiöt, Suojautuminen, Yrityksen arvo, Tobin Q.

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Abbreviations

BSM	Black-Scholes-Merton (option pricing model)
CBOT	Chicago Board of Trade
CDD	Cooling Degree Days
CDS	Credit Default Swap
CME	Chicago Mercantile Exchange
HDD	Heating Degree Days
MMBtu	Million British Thermal Units
OLS	Ordinary least squares
OTC	Over-the-Counter
PSM	Propensity score matching
Q	Tobin´s Q
ROA	Return on Assets
ROE	Return on Equity

1 Introduction

Financial derivatives have become an integral component of modern financial markets and corporate risk management. Defined by Hull (2015), derivatives are financial instruments whose value is derived from an underlying asset, rate, index, or commodity, and they are commonly used for hedging, speculation, and arbitrage. Over recent decades, the rapid development of derivative markets has provided non-financial firms with increasingly sophisticated tools to manage exposure to financial and operational risks. Firms that operate in volatile environments have adopted derivatives as part of their broader financial strategies to stabilize cash flows, protect profitability, and support long-term value creation.

From a corporate finance perspective, derivatives are closely linked to risk management and hedging. Companies are exposed to uncertainties, such as changes in commodity prices, exchange rates, and interest rates, which can affect cash flows, investment capacity, and ultimately firm value. According to Hull (2015), derivatives allow firms to transfer unwanted risk to market participants who are more willing or better able to bear it. This is especially important for non-financial companies, whose main expertise is not in financial market forecasting. By reducing earnings volatility and protecting against adverse price movements, derivatives help firms to maintain financial stability and focus on their core business operations.

Traditional financial theory does not clearly state that corporate hedging increases firm value. Modigliani and Miller (1958) argue that financial policies, including risk management, are irrelevant under perfect capital market conditions. According to their view, shareholders can diversify risk themselves without costs, which makes corporate hedging unnecessary. However, real-world markets are not perfect. They include market imperfections such as taxes, financial distress costs, agency problems, and information asymmetries, which may give risk management a more important role in practice. These imperfections create conditions under which corporate hedging may enhance firm value by reducing expected costs associated with bankruptcy or inefficient financing (Froot et al. 1993).

Empirical research on the relationship between derivatives use and firm value shows mixed results. Many studies find a positive link between corporate hedging and firm value, often measured with Tobin's Q (Allayannis & Weston, 2001; Carter et al., 2008; Panaretou, 2014). These studies argue that firms using derivatives benefit from lower risk exposure, better access to external financing, and more efficient investment decisions. However, other studies report insignificant or even negative effects on firm value. This is especially the case when derivatives are suspected to be used for speculation instead of hedging, or when corporate governance is weak (Fauver & Naranjo, 2010; Naito & Laux, 2011). Overall, the lack of clear consensus suggests that the impact of derivatives on firm value depends on the context, such as industry, governance structure, and firm-specific characteristics.

The energy sector is a relevant setting when studying the role of derivatives. Energy companies are naturally exposed to high commodity price volatility. Prices of oil, natural gas, electricity, and emission allowances can change quickly due to geopolitical events, regulation, and weather conditions. According to Hull (2015), energy prices often follow mean-reverting patterns and show strong seasonality, which increases both price risk and volume risk. Because of this, energy companies are among the most active users of commodity, financial, and even weather derivatives. For these firms, effective risk management is important to maintain stable cash flows and to support the large and long-term investments that are typical in the energy industry.

Within this broader context, the Nordic energy sector offers an especially interesting empirical setting. Nordic economies are highly developed, open, and export-oriented, with energy companies playing a central role in both domestic markets and international trade. Firms in Finland, Sweden, Norway, and Denmark operate under relatively strong institutional frameworks and high transparency requirements. At the same time, the

Nordic energy sector is characterized by structural differences compared to other regions, including a strong presence of renewable energy and sensitivity to weather-related demand fluctuations. These features may influence both the motivation to hedge and the effectiveness of derivatives usage in enhancing firm value.

Despite the important role of derivatives in energy markets and the economic relevance of the Nordic region, empirical evidence on the value effects of derivatives use in Nordic energy companies is still limited. Most studies on Nordic firms examine non-financial companies across different industries instead of focusing only on the energy sector (Brunzell et al., 2011; Rokala, 2023). In addition, results from international energy studies cannot be directly applied to the Nordic context, because market structures, regulation, and corporate governance differ between regions. This creates a clear need for a more focused empirical study that uses firm-level data and takes into account the specific characteristics of the Nordic energy sector.

Against this background, this thesis examines the relationship between derivatives use and firm value in Nordic energy companies. The study builds on established theories and earlier empirical research. The aim is to better understand whether derivatives work as value-enhancing risk management tools in a sector that is highly uncertain and capital intensive. This section introduces the topic and creates a foundation for the later literature review, theoretical framework, and empirical analysis presented in the following chapters.

1.1 Purpose of the study

The purpose of this thesis is to examine whether the use of financial derivatives is associated with higher firm value among Nordic energy companies. Firm value is measured using Tobin’s Q, which is a market-based indicator that reflects investors’ expectations of a firm’s future profitability and growth opportunities. By comparing companies that use derivatives with those that do not, the study aims to assess whether derivatives-based risk management contributes to value creation in the energy sector.

More specifically, the study investigates whether the relationship between derivatives usage and firm value is positive, negative, or statistically insignificant. Given the high exposure of energy companies to financial risks, derivatives may play an important role in stabilizing the value. However, prior empirical evidence has been mixed, making it necessary to examine this relationship in a Nordic context.

The research question of the study is that does the use of financial derivatives improve firm value in the Nordic energy sector.

To address this question, I will test these following hypotheses:

$\boldsymbol{H_0}$**:** The use of derivatives has no effect on firm value.
$\boldsymbol{H_1}$**:** The use of derivatives has a positive effect on firm value.
$\boldsymbol{H_2}$**:** The use of derivatives has a negative effect on firm value.

1.2 Structure of the study

The structure of this thesis is designed to provide a logical and comprehensive examination of how derivatives usage influences firm value in Nordic energy companies. The study proceeds systematically, beginning with a review of relevant literature and theoretical concepts, followed by the data and methodology, and concluding with empirical results, discussion, and implications.

The first chapter introduces the research topic, presents the background and motivation for the study, and outlines the research objectives and questions. It also highlights the importance of understanding derivatives usage in the energy sector, where exposure to commodity and financial risks is substantial.

The second chapter consists of a literature review, which examines previous academic research on derivative usage and its relationship with firm value. This chapter critically reviews existing evidence from both international and Nordic contexts, and focuses on how derivatives affect financial performance, risk exposure, and shareholder value. The literature review also identifies gaps in the current research, regarding the Nordic energy sector, that this thesis seeks to address.

The third chapter presents the theoretical framework. It explains the main types of derivative instruments, including forwards, futures, options, and swaps, as well as their common uses in risk management. Additionally, the chapter discusses the types of users, such as hedgers, speculators, and arbitrageurs, and their respective motives for engaging in derivative markets. This theoretical foundation is essential for understanding the mechanisms through which derivatives may influence firm value.

The fourth chapter describes the data and methodology. It introduces the dataset and defines the dependent and independent variables. The chapter explains how the empirical analysis is implemented using both univariate and multivariate regression models to examine the relationship between derivatives usage and firm value. The chapter also shows the empirical results of the regressions made.

Finally, I will present the discussion and conclusion, interpreting the findings considering the theoretical and empirical literature. The thesis concludes by summarizing the main insights, limitations and suggesting avenues for future research.

2 Literature review

The purpose of this chapter is to review and summarize existing research on the use of derivatives and their impact on firm value, with a special focus on the energy sector and Nordic companies. A literature review provides the basis for the theoretical framework and helps identify research gaps that this thesis aims to address. Since derivatives have been widely studied in different industries and countries, it is important to present the main general findings of previous studies before narrowing the focus to the specific context of this research.

Empirical findings in this area are mixed. Some studies show that derivatives can increase firm value by reducing earnings volatility, lowering the cost of capital, and improving financial flexibility. Other studies find no clear effect, or even a negative relationship. These different results suggest that the impact of derivatives on firm value depends on the context. Factors such as industry characteristics, corporate governance, and overall market conditions can influence the outcome.

Given the important role of energy companies in Nordic economies and their strong exposure to commodity price fluctuations, it is relevant to examine whether derivatives provide measurable benefits in this context. This chapter first reviews studies that analyze the relationship between derivatives use and firm value at a general level. After that, the focus is narrowed to research that specifically examines the energy sector and the Nordic market.

Capelle-Blancard (2010) provides a comprehensive survey of academic research on the risks posed by financial derivatives in his paper "Are derivatives dangerous?". He particularly focuses on their systemic implications. He first reviews concerns that derivatives might increase the volatility of their underlying assets. However, empirical studies generally do not support this, suggesting that derivatives do not directly amplify market volatility. More recently, the literature has shifted its focus toward systemic risk, where the sophistication of complex derivatives and lack of transparency in over-the-counter markets may create instability. Capelle-Blancard highlights several “danger zones”, like excessive leverage enabled by derivatives, model risk, operational risk, and the risk of cascading losses during extreme events. To mitigate these threats, the author discusses proposals such as wider use of clearinghouses, restrictions on “naked” derivative positions, and stronger internal risk controls. While acknowledging the economic usefulness of derivatives (e.g., hedging and risk sharing), he cautions that unchecked derivatives use can pose serious risks to financial stability.

Although Modigliani and Miller (1958, pp. 261–297) argue that hedging and other risk management activities are irrelevant in a world without market frictions, later research shows that this does not hold in real markets. When taxes, financial distress costs, and other imperfections exist, firms may create value through hedging. A large amount of empirical research finds a positive relationship between corporate hedging and firm value. For example, Graham and Rogers (1999) study a sample of 531 U.S. firms and find that leverage, firm size, and growth opportunities are positively related to market value. Their results suggest that firms hedge mainly to reduce the costs of underinvestment and financial distress. They also estimate that hedging can increase firm value by about 2.2% to 3.5%, mainly by increasing debt capacity and benefiting from interest tax deductions.

Howton and Perfect (1998) provide early large-sample evidence on how extensively U.S firms use financial derivatives and what firm characteristics are associated with that use. Using two samples, 451 Fortune 500 and S&P 500 firms and 461 randomly selected firms, they document that derivatives usage is widespread among large corporations. More than 61 % of the Fortune/S&P firms report using derivatives, compared with 36 % of the random sample. Across both samples, swaps are reported as the most frequently used interest rate instrument, while forwards and futures are the most commonly used currency contracts. Beyond documenting instrument choice, the authors examine determinants of derivatives use and find that relationships vary depending on the sample and on how derivatives use is defined. Overall, the evidence for the large firm sample is broadly consistent with standard hedging theories, but the authors note that for the random firm sample, derivatives use is not strongly related to the typical theoretical determinants. This study is useful for Nordic and energy sector research because it underscores that derivatives usage is highly uneven across firms and that results can depend on both sample composition and measurement choices.

Bachiller et al. (2021) conduct a meta-analysis of 51 empirical studies to examine the relationship between the use of financial derivatives and firm value. The aim is to explain the mixed results found in earlier research by considering factors such as country-specific institutions and different types of derivatives. Their results show that the use of foreign currency derivatives, either alone or together with other derivatives, is generally linked to higher firm value. The study also finds that hedging creates economic benefits across firms, especially in developed countries and common law systems. Overall, the findings support the idea that derivative-based risk management can increase firm value when market imperfections are managed effectively.

Bartram et al. (2011) provide one of the most comprehensive studies on how derivatives affect firm risk and value. Their sample includes more than 6,800 non-financial firms from 47 countries. The main question is whether derivatives truly reduce risk and increase firm value when endogeneity and selection bias are properly controlled. To deal with these issues, the authors match firms that use derivatives with similar firms that do not, based on their likelihood to hedge. They also apply additional econometric methods to test whether the results hold after controlling for unobserved firm characteristics.

They show strong evidence that derivative users have lower total risk, systematic risk, and downside risk. The overall effect on firm value is positive, but the size of the valuation premium depends on the method used. This suggests that the benefits may sometimes be overstated if the analysis is too simple. The study also shows that derivative users performed better during periods of economic stress, such as the 2001–2002 downturn. These firms had higher abnormal returns and better profitability.

Overall, the results support the view that derivatives, when used for hedging instead of speculation, can improve financial stability and strengthen firms during difficult market conditions (Bartram et al. (2011).

Bartram, Brown, and Fehle (2009) study the use of financial derivatives in a large international sample to understand what drives derivative usage and whether it is related to firm value. Traditional theories suggest that firms use derivatives to reduce financial distress costs, match cash flows with investment needs, or reduce agency problems. However, the authors find that these explanations do not fully explain differences across countries. Instead, they argue that derivative use is closely linked to other financial and operational decisions, such as the amount and maturity of debt, dividend policy, and the level of international activities. Their results also show a positive effect on firm value, especially for firms that use interest rate derivatives. Overall, the study suggests that derivatives are not used in isolation but are part of a firm's broader financial strategy, and that their use is strongly connected to the company's overall structure and decisions.

Butt et al. (2022) study how corporate governance affects the relationship between derivatives use and firm value. Their sample includes 219 non-financial firms listed on the Pakistan Stock Exchange during 2011–2019. They apply several methods, such as ordinary least squares, Fama–MacBeth regressions, two-stage least squares (2SLS), and moderation analysis, to examine whether strong governance can reduce possible negative effects of derivative use.

Their main result shows a negative relationship between derivatives use and firm value. This suggests that in this context, firms may use derivatives more for speculation than for hedging. However, the study also finds that strong corporate governance weakens this negative effect. Firms with better governance structures are more likely to use derivatives for hedging instead of speculation, which reduces the harmful impact on value. The results remain consistent after controlling for firm-specific factors such as size, age, leverage, cash flow, financial distress costs, dividend policy, and growth opportunities. Overall, the authors argue that in emerging markets like Pakistan, weak governance can increase agency problems and lead to speculative behavior, while strong governance can make derivatives a value-enhancing risk management tool.

Carter et al. (2008) study how jet fuel hedging affects firm value in the U.S. airline industry during 1992–2003. Their framework is based on Froot, Scharfstein, and Stein (1993), where firms face a trade-off between cash flow and investment. High fuel prices reduce cash flow, but at the same time, investment opportunities may be more attractive. Since jet fuel is a hedgeable input, airlines can use derivatives to stabilize future fuel costs and protect their ability to invest. The authors use Tobin's Q as a measure of firm value and include variables that capture the share of future fuel consumption that is hedged, together with several control variables. Their results show a significant positive relationship between fuel hedging and firm value. They estimate that airlines that hedge may have a "hedging premium" of up to 10%, which is higher than in many earlier studies. Most of this premium is linked to the interaction between hedging and investment, suggesting that hedging reduces the risk of underinvestment when fuel prices increase. The findings support the idea that effective risk management can help firms maintain growth and increase value under volatile cost conditions.

Fauver and Naranjo (2010) investigate the relationship between corporate derivatives usage and firm value, with a particular focus on how agency costs and monitoring problems moderate this link. They analyse a sample of 1,746 U.S. non-financial firms over the period 1991-2000, using Tobin's Q as a proxy for firm value. Their empirical results show that for firms with greater agency costs, reflected in weak corporate governance, poor transparency, and information asymmetry, derivative use is negatively associated with firm value. Quantitatively, a one standard deviation increase in the firm monitoring index corresponds to about an 8,4 % decline in Tobin's Q. The authors use a variety of robustness checks, including models that address endogeneity, sample selection bias, and clustering of errors, to support their conclusions. They argue that in the presence of agency and monitoring problems, derivatives may be used more for speculation than for hedging, which undermines their value-enhancing potential.

Lau (2016) studies how the use of derivatives affects firm performance in Malaysia, focusing on a developing market environment. The sample includes non-financial firms listed on Bursa Malaysia. Firm performance is measured using market value, return on assets (ROA), and return on equity (ROE). Lau applies a two-stage regression model to control for possible endogeneity between derivatives use and performance. The results show mixed evidence. Derivative use is negatively related to market value, which suggests that capital markets may react carefully to firms that use derivatives. At the same time, derivatives have a positive and significant effect on operational performance, as seen in higher ROA and ROE. This indicates that hedging can help firms manage financial risks more effectively. The study also finds that firms with low operating income margins are more likely to hedge and protect their profitability. These firms appear to generate more revenue from their assets, which suggests that derivatives support growth by managing additional risk. Overall, Lau's research adds important evidence from a developing market and shows that even if market valuation may decrease, operating performance can improve through effective risk management.

Luo and Wang (2018) examine how foreign currency hedging with derivatives affects firm value in China. Their study uses quarterly data from listed Chinese companies between 2000 and 2013. The main result shows that firms that hedge foreign currency risk tend to have higher firm value. This positive effect is stronger for firms with higher profitability and better growth opportunities, which suggests that financially strong firms can use hedging more effectively. The authors also find that the impact of hedging depends on the economic environment. The positive effect is more visible when the exchange rate is depreciating and during economic upturns, but it becomes weaker during crisis periods. In addition, the results differ across industries, meaning that some sectors benefit more from hedging than others.

Naito and Laux (2011) study whether the use of financial derivatives by non-financial firms increases or decreases shareholder wealth. Their sample includes 434 U.S. firms, and they use both univariate and multivariate methods to examine the effects of derivative usage. They also distinguish between the notional value and the fair value of derivative contracts in order to better measure the economic importance of hedge positions. Their results show that derivatives are not always beneficial. In some cases, derivative use is linked to lower firm value, especially when the instruments are used for speculation instead of proper risk management. A central explanation in their study comes from agency theory. Managers may use derivatives in ways that serve their own interests rather than those of shareholders. Overall, the study concludes that derivatives can be a double-edged sword. They can reduce risk and support firm value, but they may also destroy value if they are misused or if managerial incentives are poorly aligned with shareholder interests.

Panaretou (2014) studies how corporate risk management affects firm value in a sample of large non-financial UK firms. The data is based on audited financial reports and reflects improvements in accounting standards. She finds that about 87% of the firms use derivatives to hedge at least one type of price risk. The results show a clear and significant value premium for firms that hedge foreign currency risk, while the evidence for interest rate hedging is weaker. In addition, both the level of hedging and the length of the hedging horizon are positively related to firm value. This suggests that more systematic and longer-term hedging strategies create greater benefits. On the other hand, operational risk management activities, such as hedging non-financial risks, do not seem to have a significant effect on market value.

Allayannis and Weston (2001) study the relationship between foreign currency derivative use and firm market value in a large sample of U.S. non-financial firms. Their panel data covers the period 1990–1995 and includes more than 700 companies, mainly from the S&P 500 index. Firm value is measured using Tobin's Q, and information on derivative use is collected from annual reports. After controlling for firm size, leverage, profitability, growth opportunities, geographic diversification, and other characteristics, they find a strong positive relationship between currency hedging and firm value. Firms that use foreign currency derivatives have significantly higher Tobin's Q than non-users. The authors argue that hedging reduces cash flow volatility, lowers the risk of underinvestment, and decreases financial distress costs. Their results remain consistent across different model specifications. This study provides early and influential empirical evidence that corporate hedging can enhance shareholder value and has served as a foundation for much of the later research in this field.

Aytürk, Gürbüz, and Yanik (2016) investigate the relationship between corporate derivatives usage and firm value in the context of the Turkish market, using data on non-financial firms over the period 2007-2013. The study examines whether currency, interest rate, and commodity derivatives use are associated with higher market valuation, measured by Tobin's Q. It applies several empirical methods including traditional panel regressions, Fama-French three-factor time-series analysis, and system GMM estimators to address potential endogeneity. Almost 36,4 % of firms in the sample report derivative usage, reflecting a moderate level of hedging activity in the Turkish corporate sector. While most estimation techniques do not find a statistically significant hedging premium or discount for derivatives users, results from the system GMM estimator indicate a positive relationship between derivative use and firm value. Similar patterns emerge when examining currency, interest rate, and commodity hedging separately, suggesting that the broader use of financial derivatives may have value-relevant effects under dynamic estimation frameworks. The authors conclude that, in general, financial derivatives usage does not consistently affect firm value across all specifications in the Turkish market, highlighting the importance of model choice in hedging studies.

Ahmed, Fairchild, and Guney (2020) provide a nuanced theoretical and empirical evaluation of corporate hedging, arguing that its impact on firm value is not universally positive. Their theoretical model shows how outcomes depend on a complex mix of agency costs (e.g., managerial self-interest, risk aversion, moral hazard) and behavioral traits (like overconfidence). They study UK-listed firms over the period 2005-2017 and examine hedging across three major financial risk types, which are currency, interest rate, and commodity price risk. Their results confirm that the effect of hedging on performance and value is ambiguous. It varies depending on which risk is hedged, which derivative instruments are used, and the time period. Their study contributes to the literature by showing that hedging can both increase and decrease firm value, depending on firm-specific incentives and the design of risk management strategies.

Ji and Wei (2023) investigate the relationship between corporate derivatives usage and firm value by examining a large international sample of non-financial listed companies from 2013 to 2022. Using regression analysis combined with propensity score matching (PSM) to address endogeneity, the authors find that firms employing derivatives generally exhibit higher market value compared to non-users. The study also conducts robustness checks with alternative variable specifications and matching techniques to confirm the stability of the results. Overall, the evidence suggest that derivative usage can contribute positively to firm value, but the magnitude and direction of the effect depend on the type of risk being hedged and the economic environment. Their findings contribute to the broader literature by providing recent multi-country evidence that supports the value-enhancing role of hedging under appropriate risk management practices.

Fung, Wen, and Zhang (2012) examine the impact of credit default swaps (CDS) usage on firm risk and value, focusing on U.S life and property/casualty insurance companies over the period 2001-2009. Unlike typical hedging studies that focus on currency or commodity derivatives, this research investigates credit derivatives, which have a fundamentally different risk profile. The authors use a Heckman two-stage model to adjust for potential endogeneity in CDS adoption and sample selection. Their empirical results indicate that insurers that use CDS for income generation are associated with greater market risk, deterioration in financial performance, and lower firm value compared to non-users. These adverse outcomes are robust across alternative specifications, suggesting CDS may be used more for speculative purposes rather than effective risk management. This paper contributes to the literature by showing again that not all derivative usage enhances firm value.

Now the thesis starts to focus more on the energy sector and Nordic countries. Yin and Jorion (2006) study the hedging behavior of 119 U.S. oil and gas producers during 1998–2001 and examine its effect on firm value. They collect detailed information on each firm's derivative positions and the value of their oil and gas reserves. Their results show that hedging reduces the sensitivity of stock returns to changes in oil and gas prices. In other words, hedging firms have lower systematic risk. However, they do not find evidence of a significant hedging premium. According to the authors, hedging does not increase market value for these firms. These findings question the traditional view that risk management should automatically create value by stabilizing cash flows and reducing financial distress. The authors suggest that although hedging lowers risk, the benefits may not be large enough to be reflected in higher market valuations, especially in capital-intensive industries like oil and gas.

Rokala (2023) studies whether Finnish non-financial firms that use derivatives have higher firm value. The analysis is based on 107 companies listed on Nasdaq Helsinki during 2016–2020, and firm value is measured using Tobin's Q. The results are mixed. The pooled OLS model shows a significant value discount for derivative users, between –15% and –37%. However, fixed-effects models indicate small and statistically insignificant positive effects. The results also differ across industries. Industrial firms show a value premium, while consumer services and technology firms experience a value discount. In 2020, the negative hedging premium is particularly strong. Overall, the study suggests that in Finland, derivatives do not consistently increase firm value, and the effects depend on the industry and market conditions.

Brunzell, Hansson and Liljeblom (2011) study the use of derivatives among large firms in Finland, Sweden, Norway, and Denmark. Their analysis is based on a detailed survey combined with firm-level financial data. The authors examine both how extensively derivatives are used and why firms use them, separating hedging from trading activities. They find that hedging is the main motive, especially for firms that face significant financial and commodity price risks. Speculative use is more common among financial institutions and firms with more diversified operations. The study also shows that ownership structure, managerial incentives, and firm size strongly affect the likelihood and intensity of derivative use. Firms with more decentralized ownership and stronger risk management systems tend to hedge more systematically. However, the evidence that derivatives increase firm value is weak. This suggests that in the Nordic context, the value effects of hedging may be relatively modest. The findings are relevant for the energy sector, where commodity price exposure is high, as they show how regional governance structures and firm characteristics influence hedging behavior and its potential impact on firm value.

Perez-Gonzalez and Yun (2013) examine the effect of risk management on firm value by exploiting the introduction of weather derivatives as a quasi-natural experiment. Their study focuses on firms whose cash flows are highly sensitive to weather conditions, particularly in the energy and agricultural industries. By using this exogenous expansion in hedging opportunities, the authors are able to address endogeneity concerns common in the hedging literature. They find that firms gaining access to weather derivatives experience a significant increase in firm value, as measured by Tobin’s Q, as well as higher investment and leverage. These results suggest that hedging improves a firm's ability to undertake valuable projects by stabilizing cash flows. The study provides strong causal evidence that derivatives can enhance firm value when they allow firms to manage economically meaningful risks.

Table 1. List of studies that include derivatives and their impact on company value.

Authors	Years	Sample	Effect on value
Modigliani & Miller (1958)			No
Allayannis & Weston (2001)	1990-1995	700 firms	Positive
Aytürk, Gürbüz, and Yanik (2016)	2007-2013	1 428 observations	No effect
Bachiller, Boubaker and Mefteh-Wali	1985-2018	meta-analysis	Positive
Bartman, Brown & Conrad (2011)	1998-2003	6888 firms	Positive
Bartman, Brown & Fehle (2009)	2000-2001	7300 firms	Positive
Brunzell, Hansson & Liljeblom (2011)	2006-2007	112 firms	No effect
Butt, Rizavi, Nazir & Shahzad (2022)	2011-2019	219 nonfinancial firms	Negative
Carter, Rogers, Simkins (2008)	1992-2003	28 airlines	Positive
Fauver & Naranjo (2010)	1991-2000	1746 non-financial firms	Negative
Fung, Wen & Zhang (2012)	2001-2009	191 firms	Negative
Ji and Wei (2023)	2013-2022	-	Positive
Lau (2016)	-	680 firms in Bursa Malaysia	Negative

Luo & Wang (2018)	2000-2013	70 000 firm-quarter	Positive
Naito & Laux (2011)	2011	434 U.S. firms	Negative
Perez-Gonzales and Yun (2013)	-1997	203 U.S energy firms	Positive
Yin & Jorion (2006)	1998-2001	119 oil and gas firms	No effect
Rokala (2023)	2016-2020	107 Finnish firms	No effect
Panaretou (2014)	2003-2010	350	Positive
Ahmed, Fairchild & Guney (2020)	2005-2017	378 UK firms	Mixed

Table 1 summarizes selected prior studies that examine the relationship between derivatives use and firm value. The table presents the authors, sample period, sample characteristics, and the reported effect of derivatives on firm value. The categories “Positive”, “Negative”, and “No effect” describe the main findings of each study. As shown in the table, earlier empirical research provides mixed evidence on the value effects of derivatives usage.

3 Theory

This chapter introduces the key theoretical concepts related to financial derivatives, providing the foundation necessary for understanding the analysis presented in the thesis. It outlines how derivatives function and explains their role in managing various types of financial risk. By discussing the characteristics and purposes of forwards, futures, options, and swaps, the chapter establishes the conceptual groundwork for evaluating how the use of these instruments may affect firm value.

Derivatives are financial contracts whose value depends on the price of an underlying asset, index, or rate (Hull, 2015). They are commonly used for hedging, speculation, and arbitrage. The main types of derivatives are forwards, futures, options, and swaps. In the energy sector, these instruments are primarily used to manage exposure to fluctuations in commodity prices, exchange rates, and interest rates.

3.1 Derivatives instruments

Derivatives are commonly classified into four main types, which are futures, forwards, options, and swaps, but in practice, there is a wider range of instruments. There is, for example, credit, weather, and energy derivatives, as well as more complex 'exotic' forms. I'm going to cover these four main types as well as delve a little into energy and weather derivatives, since we are mainly studying energy companies.

3.1.1 Futures and forwards

A forward contract can be seen as a relatively simple derivative. A forward is a contract where the holder agrees to buy or sell an asset for a specific price at a certain time in the future (Hull, 2015, p.28). According to Hull, in a forward contract, the seller agrees to deliver a specified product at a predetermined price on a future date, while the buyer agrees to purchase the product under the same terms. These contracts are traded in the over-the-counter (OTC) market, usually between two financial institutions or a financial institution and a client. Forward contracts are very popular on foreign exchange (Hull, 2015, p.28).

The forward contract price is determined from this equation,

$$F_0 = S_0 * e^{r*T}, \quad (1)$$

where F_0 is the forward price, S_0 stands for the price of the underlying asset, T is the maturity of the contract, and r is the risk fee rate (Hull, 2015).

Future contracts can be seen basically the same as forward contracts. A futures contract is an agreement between two parties to buy or sell an asset for a certain price at a certain time in the future (Hull, 2015, p.30). Futures differ from forward contracts in that they are normally traded on an exchange. Futures are standardized contracts like every contract on an exchange market, and usually the two parties to the contract don't necessarily know each other, unlike in the OTC market (Hull, 2015, p.30). The largest exchanges where futures are traded are the Chicago Board of Trade (CBOT) and the Chicago Mercantile Exchange (CME) (Hull, 2015, p.30). Those have now merged to form the CME Group, which is the world's leading derivatives marketplace.

"When the short-term risk-free interest rate is constant, the forward price for a contract with a certain delivery date is in theory the same as the futures price for a contract with that delivery date" (Hull, 2015, p.137). But as in the real-world interest rates vary unpredictably, so forward and futures prices are, in theory, no longer the same. Hull mentions that the difference between forward and future prices that last only a few months is usually sufficiently small to be ignored. In practice, there is involved transactions costs, stock exchange settlements, credit risk, and liquidity risk, which do make the prices vary. In his book Hull assumes, for most purposes, that forward and future prices are the same.

3.1.2 Options

An option contract gives the holder the right to buy or sell the underlying asset at a certain time for a certain price (Hull. 2015, p.30). Options are divided into two types, which are call options and put options. A call option gives the holder the right to buy the underlying asset, and a put option gives the holder the right to sell the underlying asset at a certain time for a certain price. It is good to understand that an option gives its holder the right to buy or sell, but the holder doesn't have to exercise this right. This is what distinguishes options from futures and forwards, where the holder is obligated to sell or buy the asset. Options can also be divided in t "European" and "American" options. Black and Scholes (1973, p.1) introduced "American options" as options that can be put to use any time until the option expires, and "European options" can only be exercised on a specific future date.

Options are priced with the Black-Scholes-Merton (BSM) model, which was invented in the 1970s. The model enabled large-scale option trading on derivative exchanges, and it has been a key factor in the development of derivative markets and risk management (Hull, 2015). The option pricing model is a bit complicated compared to forward or futures pricing. Here are the formulas for European call and put options according to Hull (2015, p.357-358).

$$c = S_0 N(d_1) - K e^{-rT} N(d_2), \tag{2}$$

$$p = K e^{-rT} N(-d_2) - S_0 N(-d_1) \tag{3}$$

where, $$d_1 = \frac{\ln(S_0/K) + (r + \sigma^2/2)T}{\sigma\sqrt{T}} \tag{4}$$

$$d_2 = \frac{\ln(S_0/K) + (r - \sigma^2/2)T}{\sigma\sqrt{T}} = d_1 - \sigma\sqrt{T} \tag{5}$$

The definitions for these variables are that c is the call option price and p is the put option price. N(x) is the cumulative probability distribution function for a variable with a standard normal distribution. It is the probability that a variable with a standard normal distribution will be less than x. S_0 is the stock price at time zero. K stands for the strike price. r is the risk-free rate. σ is the volatility of the stick price. T stands for the time to maturity of the option (Hull, 2015, p.358).

3.1.3 Swaps

Swaps are agreements where two companies agree to exchange cash flows in the future in the over-the-counter market. In the agreement, there is defined the dates when the cash flows are to be paid and the way in which they are to be calculated. Commonly, the calculation involves the future value of an interest rate, an exchange rate, or other market variable (Hull, 2015, p.174).

The most common types of swap agreements are interest rate swaps and currency swaps. In an interest rate swap, one party can switch from a fixed interest rate to a floating interest rate cash flow, or it can be the other way around. Interest rate swaps are used for managing interest rate risk (Smith et al. 1988, p.34-44). Here is an example situation where interest rate swaps are used. A company have dept of 20 million euros and they are worried that interest rates will rise in the next couple of years. The company can make an agreement of an interest rate swap, where the company gets 2,5 % floating interest rate from a bank and pays 5 % fixed interest rate to the bank for the next three years. Thus, the company is able to protect itself from increasing interest rates and hedge against interest rate risk.

Currency swap is an agreement where two parties exchange cash flows denominated in different currencies at certain points in the future (Usmen, 1994. p.43-57). For example, through a currency swap, a loan or bond denominated in U.S. dollars can be converted into one denominated in euros. Currency swaps are primarily used to manage both exchange rate and interest rate risks. The advantage of such swaps lies in the principle of comparative advantage (Hull, 2025, p.192), which suggests that companies may obtain more favourable borrowing terms in one currency market, even though their business operations or revenues are primarily denominated in another currency. By engaging in a currency swap, firms can therefore benefit from lower financing costs while aligning their debt exposure with their functional currency.

Clark et al. (2023) explain that a credit default swap (CDS) works like an insurance contract on debt. In a CDS agreement, the buyer pays regular premiums to the seller. In return, the seller agrees to compensate the buyer if the reference entity defaults. The reference entity means the debtor named in the CDS contract. A default usually refers to a failure to make required payments or a declaration of bankruptcy (Clark et al., 2023). The main purpose of a CDS is to protect against credit risk, especially in relation to bonds and government debt. Through these contracts, market participants can transfer and manage credit exposure more effectively.

3.1.4 Energy products

Energy products are among the most important and actively traded commodities in global markets. There are many types of energy derivatives, including contracts based on oil, natural gas, and electricity. These derivatives are traded both in the over-the-counter (OTC) market and on organized exchanges.

According to Hull (2015, p.799), energy prices are often assumed to follow a mean-reverting process. This means that prices tend to move back toward a long-term average over time. When the price of an energy product increases, demand usually decreases and production increases. This creates downward pressure on prices. On the other hand, when prices fall, demand tends to rise, but production becomes less profitable. This creates upward pressure on prices.

Electricity is a special type of commodity because it cannot be stored economically in large quantities. The supply of electricity in a specific region at any given time depends on the total production capacity of the power plants operating there. Demand for electricity is also highly seasonal. A large share of consumption comes from air-conditioning, which increases demand during the summer months. As a result, electricity prices often rise in summer compared to winter (Hull, 2015, p.800).

The electricity sector has gone through significant deregulation and the removal of government monopolies. This has led to the development of an active market for electricity derivatives. For example, the CME Group offers futures contracts based on electricity prices. In addition, there is an active over-the-counter market for forwards, options, and swaps. These contracts usually specify a fixed number of megawatt hours to be delivered or financially settled at an agreed price, location, and time period (Hull, 2015, p.800).

The crude oil market is the largest commodity market in the world, with global demand averaging around 80 million barrels per day. In the over-the-counter market, long-term fixed supply contracts, often spanning up to ten years, have been common practice for many years. These agreements typically take the form of swaps, in which oil priced at a fixed rate is exchanged for oil priced at a floating rate. Grude oil is refined into various products such as gasoline, heating oil, and kerosene. In the OTC market, nearly all derivative instruments available for equities or stock indices are now also available with oil as the underlying asset. Among the most widely used instruments are swaps, forward contracts, and options, which may be settled either in cash or through physical delivery. Exchange-traded contracts are likewise highly popular, with the CME Group offering a wide range of oil futures and options on futures (Hull, 2015, p.799).

The global natural gas industry experienced extensive deregulation and the elimination of government monopolies during the 1980s and 1990s. As a result, the supplier of natural gas is no longer necessarily the same entity as its producer. Suppliers face the ongoing challenge of meeting fluctuating daily demand. In the over-the-counter market, a typical contract involves the delivery of a specified quantity of natural gas at a relatively constant rate over a one-month period. Forward contracts, options, and swaps are also widely traded in the OTC market. The seller is typically responsible for transporting the gas through pipelines to the agreed delivery location. Natural gas serves as a major energy source for heating buildings and is also used in electricity generation, which in turn powers air-conditioning systems. Consequently, demand for natural gas is highly seasonal and closely influenced by weather conditions (Hull, 2015, p. 799). This pronounced seasonality heightens the exposure of energy companies to volume and price risks, making the use of derivatives an essential component of their overall hedging strategy.

3.1.5 Weather derivatives

Weather derivatives are commonly used by energy companies to hedge the amount of energy needed for heating or cooling during a specific period. Many firms are affected by weather conditions, and their financial results can change significantly because of temperature differences. To reduce this uncertainty, companies can hedge weather-related risks in the same way they hedge foreign exchange or interest rate risks (Hull, 2015, p.807). This is especially important for energy companies, since their revenues and costs are often closely linked to temperature changes and seasonal weather patterns. Effective weather hedging strategies can therefore play a crucial role in stabilizing their cash flows and ensuring operational resilience.

The first over-the-counter weather derivatives were introduced in 1997. In September 1999, the Chicago Mercantile Exchange (CME) began trading weather futures and European options on weather futures. A typical over-the-counter product is a forward or option contract that provides a payoff dependent on the cumulative HDD (Heating degree days) or CDD (Cooling degree days) during a month. CME now offers weather futures and options for many cities throughout the world. It also offers futures and options on hurricanes, frost, and snowfall (Hull, 2015, p.807)

A weather derivatives seller agrees to assume weather-related or disaster risk in exchange for a premium. Unlike conventional derivatives, which are typically used to hedge price risks, weather derivatives are designed to mitigate capacity or volume risks that arise from fluctuations in weather conditions. Their primary objective is to protect firms against the financial impact of changes in demand or operational capacity caused by variations in weather, rather than movements in market prices. Meanwhile, traditional futures or commodity-based instruments are more effective for hedging direct cost or price risks associated with input materials (Al-Ramadan & Hasan, 2022).

3.2 Type of traders

According to Hull (2015), participants in derivative markets can generally be categorized into three main groups: hedgers, speculators, and arbitrageurs. In addition to these, derivatives can also be utilized for two other important purposes, which are option-implied information and structured products, but these remain only at the level of mention. First, there is hedging, which can be seen as a safety net, where the trader shields themselves from price fluctuations in the target asset (Clark & Ghost, 2004). Hedgers use derivatives such as forward and option contracts to reduce their risks. Hedging with derivatives plays a crucial role in corporate financial management by promoting stability, protecting shareholder value, and supporting sustainable long-term growth. We will go through some hedging and its strategies in the next chapter.

Speculation is often described as the opposite of hedging (Clark & Ghosh, 2004). While hedgers try to reduce risk, speculators take risk in order to earn profits. They aim to benefit from expected changes in prices or other market variables. This can be seen as a calculated risk taken in the hope of higher returns (Clark & Ghosh, 2004). Speculators usually use futures and options to take positions based on whether they believe prices will increase or decrease. According to Hull (2015, p.38), there is an important difference between futures and options in speculation. Futures can lead to unlimited gains, but also unlimited losses. Options, on the other hand, limit the potential loss to the premium paid, and the gain is also limited by the contract structure. Even though speculation focuses on taking risk instead of reducing it, it plays an important role in derivatives markets. Speculators increase market liquidity and improve price discovery. This makes it easier for companies, including energy firms, to hedge their risks more efficiently.

The third type of trader is the arbitrageur. An arbitrageur buys and sells the same or similar asset in different markets at the same time in order to profit from price differences (Clark & Ghosh, 2004). Arbitrage opportunities usually arise when the price of a futures contract differs from the spot price of the underlying asset (Hull, 2015, p.38). The arbitrageur takes opposite positions in two or more markets to earn a risk-free profit. Arbitrage is not a form of hedging, but it plays an important role in the market. By taking advantage of price differences, arbitrageurs help keep prices aligned across markets. This improves market efficiency and ensures that derivative prices reflect the value of the underlying asset more accurately. In turn, this benefits corporate hedgers, who can enter into more fairly priced and reliable risk management contracts.

3.3 Hedging strategies

In today's volatile global economy, financial risk has become an important part of corporate financial strategy. Changes in interest rates, exchange rates, and commodity prices can have a strong effect on a company's cash flows and profitability. This is especially true for firms that operate internationally or rely on volatile input costs. To reduce these uncertainties, companies use hedging strategies with derivative instruments such as forwards, futures, options, and swaps. This chapter discusses different hedging strategies, what kind of companies use derivatives for hedging, and the main motives behind corporate hedging.

Hull (2015) illustrates the mechanics of hedging with futures and notes that many participants in futures markets are primarily hedgers. Their objective is to use futures contracts to mitigate specific risks they face, such as fluctuations in oil prices, exchange rates, equity market levels, or other key variables. A perfect hedge is one that completely eliminates the targeted risk, though such situations are uncommon in practice. Consequently, the study of hedging with futures largely focuses on designing hedge positions that approximate a perfect hedge as closely as possible, given market constraints and the nature of the underlying exposure.

When a firm or an individual decides to hedge using futures markets, the main objective is to take a position that offsets the existing exposure as closely as possible. According to Hull (2015), there are two main types of futures hedges: short hedges and long hedges. A short hedge means taking a short position in a futures contract. It is suitable when the hedger already owns an asset and plans to sell it in the future. For example, a farmer who owns hogs and expects to sell them in two months can use a short hedge to protect against a possible fall in prices. A short hedge can also be used when the asset is not yet owned but will be sold at a later date (Hull, 2015, p.72).

A hedge that involves taking a long position in futures contracts is called a long hedge. A long hedge is suitable when a company expects to buy an asset in the future and wants to lock in the price in advance to protect against possible price increases (Hull, 2015, p.72).

Here is a simple example. A small energy company expects to purchase 50,000 MMBtu of natural gas in three months to meet winter heating demand. The company is worried that prices may rise because of seasonal factors or supply problems. To reduce this risk, the company takes a long position in natural gas futures today. By doing this, it locks in the future price. If the price of natural gas increases, the company will pay more for the physical gas. However, it will make a profit on the long futures position, which offsets the higher cost. If prices decrease, the company benefits from buying cheaper gas, but it will face a loss on the futures contract. In both situations, the long hedge stabilizes the total cost of natural gas. This helps the company plan its budget and forecast expenses more reliably.

Hull explains some arguments for and against of hedging. The case for hedging is so strong that it almost speaks for itself. Most nonfinancial companies focus on activities such as manufacturing, retailing, wholesaling, or providing services. They typically lack the expertise to predict variables like interest rates, exchange rates, or commodity prices. Therefore, it is logical for them to hedge against risks arising from these factors as they become apparent. Doing so it allows companies to concentrate on their core operations, where their true strengths lie. Hedging also helps avoid unpleasant surprises, such as sudden spikes in the cost of essential commodities. In reality, however, many risks remain unhedged. The following section outlines three reasons why companies choose not to hedge (Hull, 2025, p.73).

One common argument against corporate hedging is that shareholders can manage risk themselves, if they want to, and therefore the company does not need to hedge on their behalf. However, this argument has weaknesses. It assumes that shareholders have the same information as management about the firm's risk exposure. Management usually has better and more detailed information. In addition, individual hedging involves transaction costs, such as commissions, which can make it more expensive for shareholders to hedge on their own. Companies can often hedge at lower cost because of economies of scale. Individual investors may also face practical limitations. For example, futures contracts are often large, which makes direct hedging difficult for small investors. On the other hand, shareholders do benefit from diversification. By holding a well-diversified portfolio, they can reduce many risks that affect a single firm (Hull, 2015, p.74).

A second argument against hedging is that if it is not common practice within a particular industry, it may be impractical for one company to adopt a different approach.

Competitive pressures often cause industry-wide prices for goods and services to fluctuate in response to changes in raw material costs, interest rates, and exchange rates. In such cases, a company that does not hedge can expect relatively stable profit margins, whereas a company that does hedge may experience greater variability in its margins. Therefore, when designing a hedging strategy, it is essential to consider all potential implications of price changes on profitability to ensure adequate protection (Hull, 2015, pp.74-75).

Third, it is important to recognize that hedging with futures contracts can either increase or decrease a company's profits compared to an unhedged position. For instance, if oil prices decline, a company incurs losses on its sale of one million barrels of oil, but the futures position generates an offsetting gain. In this scenario, the treasurer's foresight in implementing the hedge benefits the company, and ideally, other executives acknowledge this contribution. Conversely, if oil prices rise, the company gains from its oil sales, but experiences an offsetting loss on the futures position and leaves it worse off than without hedging. Although the decision to hedge is rational, the treasurer may face challenges in justifying the outcome, which explains why many treasurers hesitate to hedge. While hedging reduces corporate risk, it can increase personal risk for the treasurer if others fail to understand its purpose. Ideally, hedging policies should be established by the board of directors of a company and communicated clearly to both management and shareholders (Hull, 2015, pp.75-76).

4 Data and methodology

The empirical section of this study begins with a description of the sample data, which includes selected Nordic companies. After that, the dependent variable and the control variables used in the regression analysis are presented and explained. Descriptive statistics, such as mean and median values, are reported for all variables to give an overview of the data. The chapter ends with a methodology section that describes the univariate and multivariate regression models used in the analysis.

4.1 Data

The data used in this thesis consists of financial and firm-level information on non-financial companies operating in Finland, Sweden, Norway, and Denmark. The study covers the 7-year period from 2018 to 2024, allowing for an up-to-date and relevant analysis of the relationship between derivatives use and firm value.

To construct the sample, companies were mainly selected from major Nordic stock indices, such as OMX Nordic 40, the OBX Index, and small-cap indices from the Helsinki, Stockholm, Oslo, and Copenhagen exchanges. From each small-cap index, around 20 companies were randomly selected to ensure variation and better representation of smaller firms. Financial companies were excluded from the sample to keep the focus consistent with the research objective. In total, the dataset includes 142 companies. This number also contains a few energy firms that are not part of the mentioned indices but were added because of their importance to the Nordic energy market.

The sample covers a broad range of industries, which reflects the diversity of Nordic listed firms. Figure 1 below illustrates the distribution of companies across ten broad industry categories. Industrial firms constitute the largest group (32 companies), followed by Energy (24), Technology (19), and Healthcare (19). Transportation and Logistics (13) represent mid-sized segments, while Basic Materials (11) and Food &

Beverages (9) are smaller but notable. Consumer Goods (7) and Communication Services (5) are relatively minor categories, and Real Estate is represented by only 3 companies. Thus, variation underscores the dominance of industrial and energy sectors in this thesis and provides context for the comparative analysis of derivative usage within the energy sector.

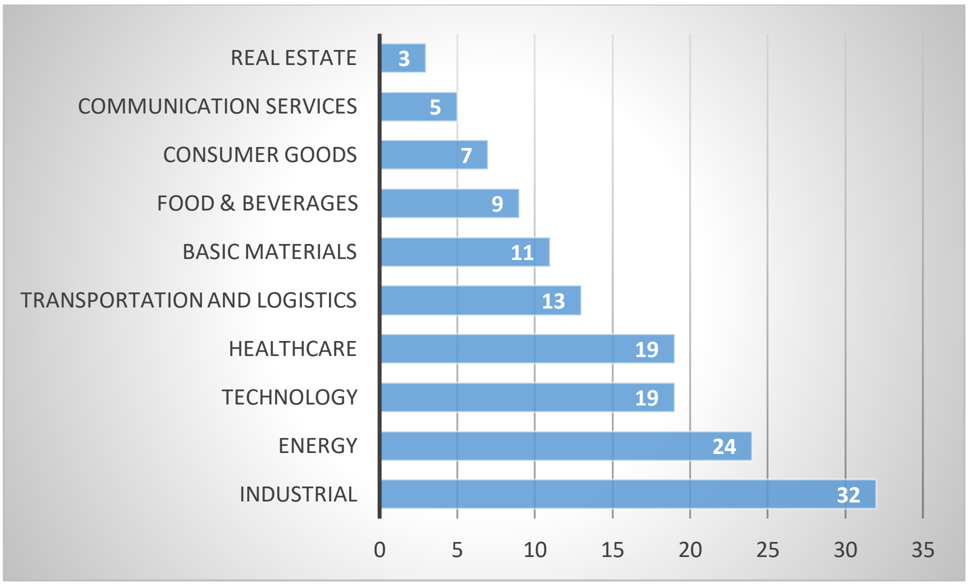

Figure 1. Industry variation

Figure 2 shows how the firms in the sample are distributed across countries. The largest number of companies comes from Norway (44 firms). Sweden follows with 40 firms, and Denmark with 33 firms. Finland has the smallest share, with 25 firms. This distribution provides a fairly balanced representation of the Nordic region. It also makes it possible to examine potential cross-country differences in derivatives use and firm value within the Nordic context.

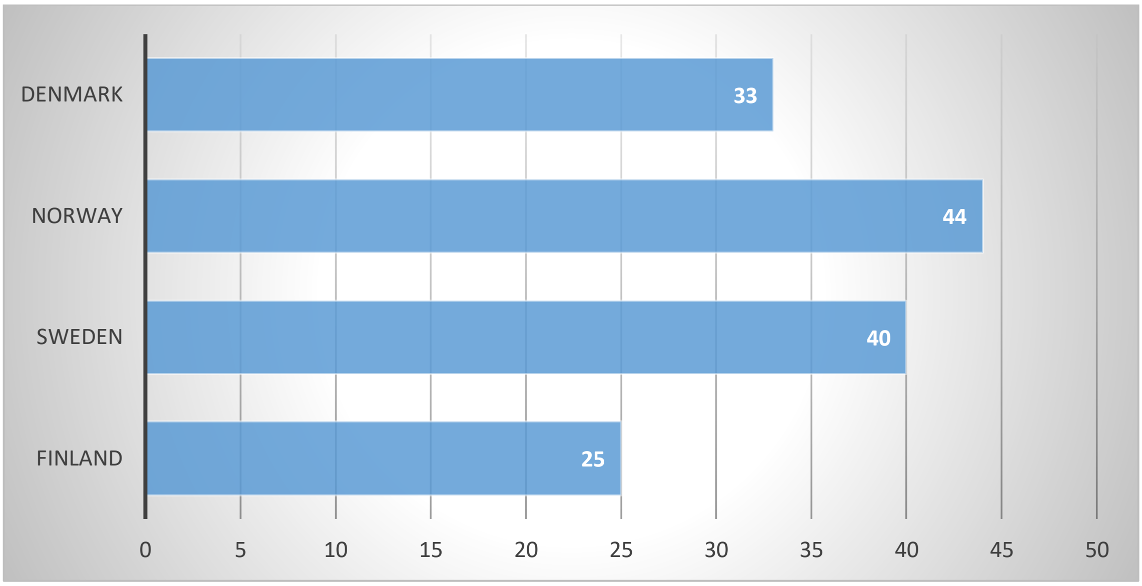

Figure 2. Variation by country

4.1.1 Dependent variable

To measure firm value, this thesis uses Tobin's Q, which is a widely applied valuation measure in corporate finance and risk management research. Tobin's Q reflects the market's expectations about a firm's future profitability by comparing the market value of assets to their replacement cost. Because of this, it is well suited for studies that examine how financial policies, such as hedging, affect firm value.

Previous research often relies on Tobin's Q when studying the value effects of derivatives. For example, Carter, Rogers, and Simkins (2008) use Tobin's Q to analyze how fuel hedging affects the valuation of U.S. airline companies. Fauver and Naranjo (2010) also apply Tobin's Q to study how agency problems influence the relationship between derivatives use and firm value. By following this established approach, this thesis ensures comparability with earlier studies and uses a measure that captures how the market values derivative strategies in Nordic firms.

Tobin's Q is relatively simple to calculate, since the required information can be obtained from companies' balance sheets and market data. It is defined as the ratio of the market value of total assets to their replacement cost. The market value of total assets is calculated by adding total liabilities to market capitalization. Market capitalization is measured as the share price multiplied by the number of outstanding shares. In line with earlier studies, the book value of total assets is used as a proxy for replacement cost, because the actual replacement cost is not directly observable and would require more detailed information. Tobin's Q is therefore calculated as follows:

$$Tobin's\ Q = \frac{Market\ Value\ of\ Total\ Assets}{Total\ Assets} \tag{6}$$

4.1.2 Independent variables

This section introduces the independent variables used to analyze the relationship between corporate derivatives use and firm value. The choice of variables is based on earlier empirical research on hedging, capital structure, and financial performance. This ensures that the results can be compared with prior studies. Each variable represents a firm-specific characteristic that may affect both the decision to use derivatives and the impact on market value. The model includes variables such as leverage, firm size, profitability, growth, geographical diversification, liquidity, and relevant dummy variables.

Leverage is included as a key control variable because capital structure has a well-documented relationship with both risk management decisions and firm value. In this thesis, leverage is measured as the book value of long-term debt divided by total assets. This definition is widely used in empirical corporate finance. Prior literature shows that firms with higher leverage face greater financial distress costs and therefore have stronger incentives to hedge to reduce the probability of costly external financing (Graham & Rogers, 1999). Similarly, Fauver and Naranjo (2010) incorporate leverage as an important determinant when examining how derivatives usage interacts with agency costs and monitoring mechanisms to influence firm value. Including leverage in this study, therefore, helps isolate the effect of derivative usage on firm value by accounting for a fundamental structural characteristic of firms.

Firm size is included as a control variable because it is linked to both risk exposure and the ability to use hedging strategies. In this thesis, firm size is measured as the natural logarithm of total assets. This is a common method in empirical studies on firm value and derivatives use. Larger firms usually have better access to financial markets, more advanced risk management systems, and more diversified operations. These factors can influence both their use of derivatives and their overall firm value (Allayannis & Weston, 2001). By controlling for firm size, the analysis considers structural differences between companies. This helps ensure that the estimated effect of derivatives use on firm value is not driven simply by differences in company scale.

Profitability is included as a control variable because it reflects a firm's internal financial strength and its capacity to engage in risk management activities. In this thesis, profitability is measured as net income divided by total assets (ROA), which is a standard metric in corporate finance research. Carter et al. (2008) control for profitability when analyzing the effects of hedging on U.S. airline firms, noting that profitability affects the firm's ability to absorb shocks and the potential benefits of hedging. Including profitability ensures that the relationship between derivative use and firm value is not confounded by differences in a firm's earning capacity.

Growth is included as a control variable to capture a firm's investment opportunities and expansion potential, which can influence both its risk profile and hedging behavior. In this thesis, growth is measured as capital expenditures divided by total assets, which reflects the proportion of resources allocated to future productive capacity relative to revenue. Firms with higher growth often face greater uncertainty regarding future cash flows, making effective risk management through derivatives more relevant. By including growth as a control, this study accounts for differences in strategic investment intensity that may shape the relationship between derivative use and firm valuation.

The level of a firm's international operations can affect both its risk exposure and its need to hedge. In this thesis, geographical diversification is measured as the ratio of foreign sales to total assets. This measure shows how much of the firm's revenue comes from outside the domestic market. Firms with higher foreign sales are usually more exposed to exchange rate movements and other international financial risks. For these firms, derivatives can be an important risk management tool (Allayannis & Weston, 2001). By controlling for geographical diversification, the analysis accounts for differences in foreign exposure that may influence both derivative use and firm value.

Liquidity is included as a control variable because it shows a firm's short-term financial strength and ability to meet its obligations. This can affect both risk management decisions and firm value. In this thesis, liquidity is measured using the current ratio, which is calculated as current assets divided by current liabilities. The current ratio is a common indicator of a firm's ability to cover short-term debts. Firms with high liquidity are usually better able to handle unexpected shocks and may feel less pressure to hedge. In contrast, firms with lower liquidity may rely more on derivatives to manage cash flow risks. By including liquidity as a control variable, the analysis accounts for differences in short-term financial flexibility.

To capture whether a firm engages in risk management through derivatives, this thesis includes a dummy variable indicating derivative usage. This variable takes the value 1 if the firm uses financial derivatives and 0 otherwise. Information on derivative use is collected manually from the firm's annual reports. Using a manually coded dummy variable provides a clear distinction between hedgers and non-hedgers and allows the analysis to examine whether derivative users differ systematically in firm value from firms that do not hedge. This measure is particularly important because disclosure practices vary across firms, and manually verifying each report ensures higher accuracy and consistency in identifying derivative users.

To control for firms' payout policies, the analysis includes a dividend payer dummy variable, coded as 1 if the firm distributed dividends during the quarter and 0 otherwise. Dividend information is obtained directly from Datastream, ensuring consistency and reliability across firms and time periods. By distinguishing dividend-paying firms from non-payers, the model accounts for differences in financial policy and shareholder preferences that could otherwise confound the estimated relationship between derivatives use and firm value.

Table 2. Summary of variables

Variables	**Predicted sign**	**Definition**
Tobin's Q		MV of total assets / BV of total assets
Leverage	-	BV of long term dept / total assets
Firm size	+	Natural logarithm of total assets
Profitability	+	Net income / total assets
Growth	+	Capital expenditures / total sales
Geographical Diver.	+	Foreign sales / total sales
Liquidity	+	Current assets / Current liabilities
Derivative user	+	Dummy variable for derivatives users
Dividend	-	Dummy variable for dividend payers

This table summarizes the main variables used in the empirical analysis. Tobin's Q is employed as the proxy for firm value. Predicted signs indicate the expected direction of the relationship between each explanatory variable and firm value based on prior literature. All accounting variables are constructed using firm-level financial statement data. Dummy variables take the value one if the condition is met and zero otherwise.

4.1.3 Summary statistics

Table 3 presents the descriptive statistics for all 142 firms with 3 976 quarter observations. The mean Tobin's Q of 2,06 suggests that, on average, firms are valued by the market at roughly twice the book value of their assets, reflecting positive growth expectations. The median (1,31) is notably lower, indicating a right-skewed distribution driven by a small number of high valuation firms. Firm size, measured as the logarithm of total assets, shows moderate variation, with a mean of 11,91 and a median of 12,27, suggesting that the sample mainly consists of medium to large firms.

Leverage is relatively low on average (0,16), consistent with conservative capital structures typical of Nordic firms, although some firms exhibit very high leverage. Profitability is centered close to zero, but with wide variation. Growth exhibits extreme dispersion reflecting heterogeneous investment behavior across firms and years. The mean liquidity ratio of 2,08 indicates that firms generally maintain short-term solvency, though the extreme maximum suggests a few outliers with unusually high cash buffers. Companies are highly international, with foreign sales representing 44,93% of total revenue on average. Finally, 59% of observations correspond to derivative users. This confirms that risk management through derivatives is common.

Table 3. Descriptive statistics, all firms.

All companies	Mean	Median	Stand. Dev.	Min	Max	Count
Tobin's Q	2,06	1,31	3,40	0,14	96,96	3976
Firms size	11,91	12,27	4,83	1,11	19,24	3976
Leverage	0,16	0,13	0,16	0,00	2,51	3976
Profitability	0,00	0,01	0,09	-1,87	2,82	3976
Growth	0,24	0,01	4,03	0,00	192,48	3976
Geog. Diver	44,93	40,11	43,59	0,00	111,13	3976
Liquidity	2,08	1,24	4,11	0,00	101,74	3976
Derivative user	0,59	1,00	0,49	0,00	1,00	3976
Dividend payer	0,20	0,00	0,40	0,00	1,00	3976

This table presents descriptive statistics for the full sample of firms. Mean, median, standard deviation, minimum, and maximum values are reported for each variable based on 3 976 firm-quarter observations. Counts denote the number of firm-quarter observations in each subsample.

Table 4 shows that the descriptive statistics reveal clear and economically meaningful differences between derivative users and non-users. The total number of observations is 3,976, of which 2,364 (59%) are classified as derivative users and 1,612 (41%) as non-users. This indicates that the use of financial derivatives is common among the firms in the sample.

There is a significant difference in firm size between the two groups. Derivative users are clearly larger, with a mean size of 13.50, compared to 9.57 for non-users. This result supports the view that larger firms are more likely to use derivatives for hedging purposes.

Geographical diversification also shows a clear difference between derivative users and non-users. Derivative users generate, on average, 59,93 % of their sales abroad, compared to only 22,93 % for non-users. The median values reinforce this gap (77,76 %

versus 0 %), indicating that most non-users operate primarily in domestic markets, whereas derivative users are mostly international firms. This provides strong economic motivation for the use of derivatives as a tool to manage foreign exchange and operational risk.

Capital structure and profitability also differ between the two groups. Derivative users have higher leverage, with an average of 0.18 compared to 0.12 for non-users. They also show slightly higher profitability, while non-users have negative average profitability. Liquidity shows the opposite pattern. Non-users are more liquid on average, with a mean of 2.88 compared to 1.53 for derivative users.

Market valuation, measured by Tobin's Q, is quite similar between the two groups when looking at mean values. Derivative users have an average Tobin's Q of 2.03, while non-users have 2.09. However, the distribution shows some differences. Derivative users have a higher median Tobin's Q, 1.37 compared to 1.16 for non-users. In addition, users show greater dispersion in their Tobin's Q values. This hints that there are more heterogeneous growth opportunities among hedging firms.

Overall, the univariate evidence indicates that derivative users are larger, more internationalized, more leveraged, and financially more complex companies. Non-users are smaller, more domestic, and rely more heavily on liquidity rather than financial hedging. These patterns strongly motivate the subsequent multivariate analysis.

Table 4. Descriptive statistics, all firms, derivatives users, and non-users.

	Mean	Median	Stand. Dev.	Minimum	Maximum	Count
All companies						
Tobin's Q	2,06	1,31	3,40	0,14	96,96	3976
Firms size	11,91	12,27	4,83	1,11	19,24	3976
Leverage	0,16	0,13	0,16	0,00	2,51	3976
Profitability	0,00	0,01	0,09	-1,87	2,82	3976
Growth	0,24	0,01	4,03	0,00	192,48	3976
Geog. Diver	44,93	40,11	43,59	0,00	111,13	3976
Liquidity	2,08	1,24	4,11	0,00	101,74	3976
Derivative user	0,59	1,00	0,49	0,00	1,00	3976
Dividend payer	0,20	0,00	0,40	0,00	1,00	3976
Derivative users						
Tobin's Q	2,03	1,37	3,60	0,26	96,96	2364
Firms size	13,50	14,98	4,56	1,12	19,24	2364
Leverage	0,18	0,16	0,15	0,00	0,92	2364
Profitability	0,01	0,01	0,06	-1,19	0,72	2364
Growth	0,23	0,02	4,04	0,00	192,48	2364
Geog. Diver	59,93	77,76	41,01	0,00	111,13	2364
Liquidity	1,53	1,21	1,65	0,00	21,01	2364
Derivative user	1,00	1,00	0,00	1,00	1,00	2364
Dividend payer	0,28	0,00	0,45	0,00	1,00	2364
Derivative non-users						
Tobin's Q	2,09	1,16	3,08	0,14	60,52	1612
Firms size	9,57	10,87	4,23	1,11	15,61	1612
Leverage	0,12	0,05	0,17	0,00	2,51	1612
Profitability	-0,01	0,00	0,11	-1,87	2,82	1612
Growth	0,27	0,00	4,03	0,00	133,29	1612
Geog. Diver	22,93	0,00	37,51	0,00	100,00	1612
Liquidity	2,88	1,42	6,04	0,00	101,74	1612
Derivative user	0,00	0,00	0,00	0,00	0,00	1612
Dividend payer	0,08	0,00	0,28	0,00	1,00	1612

Table reports descriptive statistics for the full sample of firms, derivative users, and derivative non-users.

Table 5. highlights differences between energy firms and non-energy firms, as well as between derivative users and non-users. The table is divided into only energy companies, companies using derivatives that are not energy companies, and companies that do not use derivatives and aren't energy companies. Energy firms are large and highly internationalized. Their average firm size (13,81) is comparable to the derivative using non-energy firms (13,35) and higher than non-derivative non-energy companies (9,53). This indicates that energy companies resemble derivative users in scale, regardless of industry.

Geographical diversification is also common among energy firms (52,45 %), though slightly lower than derivative using non-energy firms (60,66 %), and higher than non-derivative non-energy firms (22,66 %). This confirms that both the energy sector and derivative usage are associated with stronger international exposure.

Energy firms show higher leverage (0,20) than both derivatives using non-energy firms (0,18) and non-derivative non-energy firms (0,12). This indicates that energy firms face higher financial risk. The result is consistent with the capital-intensive nature of the energy industry and its exposure to volatile commodity prices. Liquidity is lowest among derivative users (1,54) and energy firms (1,81), while non-derivative non-energy firms maintain much higher liquidity (2,81). This supports the idea that firms either hedge financial risk externally through derivatives or internally via liquidity buffers.

Table 5 shows that energy firms have much higher growth variability. Their mean growth is 0.98, and the standard deviation is very high at 9.34. This reflects the cyclical nature of energy markets, where growth can change significantly from year to year. In comparison, non-energy firms that use derivatives show more stable growth, with a mean of 0.09 and a standard deviation of 0.6. Profitability is relatively modest across all groups. However, it is slightly higher for derivative users. Non-derivative non-energy firms, on the other hand, show negative average profitability.

Energy firms have the lowest average Tobin's Q (1.62), compared to non-energy derivative users (2.12) and non-energy non-users (2.10). This suggests that even though energy companies are often large and operate globally, the market values them more conservatively. Energy firms are also heavy users of derivatives. In this group, 87% of the observations are classified as derivative users, which is higher than in the overall sample. In addition, their dividend payout rate is the highest at 32%, compared to 27% for derivative-using non-energy firms and only 8% for non-derivative non-energy firms. This indicates that energy companies often combine active risk management with relatively stable dividend policies. However, it is important to note that the dividend percentage is based on monthly data. Some firms show higher percentages simply because they pay dividends more frequently. The measure does not reflect the actual euro number of dividends paid.

To summarize Table 5, energy firms are structurally more like derivative-using firms than to non-derivative firms. However, they face higher operational risk and have lower market valuation. This underlines the importance of industry characteristics when analyzing the economic role of derivatives.

Table 5. Descriptive statistics, energy firms, derivatives users, and non-users.

Energy firms

	Mean	Median	Std. Dev.	Minimum	Maximum	Count
Tobin's Q	1,62	1,31	1,80	0,00	32,30	476
Firms size	13,81	15,39	5,09	7,21	19,24	476
Leverage	0,20	0,17	0,17	0,00	0,92	476
Profitability	0,00	0,01	0,04	-0,27	0,24	476
Growth	0,98	0,06	9,34	0,00	192,48	476
Geog. Diver	52,45	67,84	41,74	0,00	100,04	476
Liquidity	1,81	1,42	3,29	0,00	48,66	476
Derivative user	0,87	1,00	0,34	0,00	1,00	476
Dividend payer	0,32	0,00	0,47	0,00	1,00	476

Derivative users and non-energy

	Mean	Median	Std. Dev.	Minimum	Maximum	Count
Tobin's Q	2,12	1,38	3,93	0,26	96,96	1944
Firms size	13,35	14,68	4,46	1,12	18,37	1944
Leverage	0,18	0,16	0,14	0,00	0,73	1944
Profitability	0,01	0,01	0,07	-1,19	0,72	1944
Growth	0,09	0,02	0,60	0,00	20,01	1944
Geog. Diver	60,66	80,33	40,87	0,00	111,13	1944
Liquidity	1,54	1,20	1,69	0,00	21,01	1944
Derivative user	1,00	1,00	0,00	1,00	1,00	1944
Dividend payer	0,27	0,00	0,44	0,00	1,00	1944

Non-derivative and non-energy

	Mean	Median	Std. Dev.	Minimum	Maximum	Count
Tobin's Q	2,10	1,17	3,02	0,14	60,52	1556
Firms size	9,53	10,83	4,18	1,11	15,61	1556
Leverage	0,12	0,05	0,17	0,00	2,51	1556
Profitability	-0,01	0,00	0,12	-1,87	2,82	1556
Growth	0,20	0,00	3,78	0,00	133,29	1556
Geog. Diver	22,66	0,00	37,62	0,00	100,00	1556
Liquidity	2,81	1,38	5,94	0,00	101,74	1556
Derivative user	0,00	0,00	0,00	0,00	0,00	1556
Dividend payer	0,08	0,00	0,26	0,00	1,00	1556

Table reports descriptive statistics for energy firms, non-energy derivative users, and non-energy non-users. Counts denote the number of firm-quarter observations in each subsample.

4.2 Methodology

The empirical analysis examines whether the use of financial derivatives affects firm value, measured by Tobin's Q. First, I apply univariate pooled OLS regressions to study the direct relationship between derivatives usage and firm value. After that, I use multivariate pooled OLS regressions that include key firm characteristics such as size, leverage, profitability, and growth. In addition, I conduct a sub-sample analysis focusing on energy firms to identify possible industry-specific effects.

Earlier studies have found positive effects of derivatives use on firm value and suggested that risk management can improve financial performance (Allayannis & Weston, 2001; Panaretou, 2014). By combining univariate and multivariate methods, this approach provides a broader and more reliable evaluation of the relationship between derivatives usage and firm value.

4.2.1 Univariate analysis

I begin the empirical analysis by estimating a univariate pooled ordinary least squares (OLS) regression in which firm value, measured by Tobin's Q, is regressed on a dummy variable indicating whether a firm uses financial derivatives. The purpose of this initial specification is to examine the raw association between derivatives usage and firm value without controlling for other specific characteristics. The results will show clear implications of whether derivative users succeeded better compared to non-users in terms of firm value. The formula used for the univariate regression is here:

$$Tobin's\ Q = \beta_0 + \beta_1 DerivativeUser_{it} + u \tag{7}$$

Table 6 shows the results for the univariate test. The regression is estimated using 3 976 firm-quarter observations. The coefficient on the derivatives user variable is negative (β = -0,065), indicating that firms using derivatives exhibit, on average, a slightly lower

Tobin's Q than non-users. However, the estimated effects is economically small relative to its standard error (0,110), and the model explains none of the variation in firm value, as reflected by an R^2 of 0,00009. Overall, the univariate results provide no evidence that derivatives usage is meaningfully associated with firm value in the full sample.

Table 6. Univariate pooled OLS regression with all companies

Variable	(1) Full Sample	(2) Energy Firms
Derivatives user	**–0.065**	**–0.176**
	(0.110)	(0.243)
Constant	2.094***	1.774***
	(0.085)	(0.226)
Observations	3,976	476
R^2	0.000088	0.0011

This table reports univariate pooled OLS regressions examining the relationship between derivatives usage and firm value. The dependent variable is Tobin's Q. Column (1) presents results for the full sample of firms, while Column (2) reports results for the subsample of energy firms. Derivatives user is a dummy variable equal to one if the firm uses financial derivatives and zero otherwise. Coefficients are reported in the first row and standard errors are reported in parentheses. Observations denote the number of firm-quarter observations used in each regression. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

To examine whether the relationship between derivatives use and firm value differs across industries, I repeat the univariate pooled OLS regression using only energy firms. This subsample includes 476 firm-quarter observations. Table 6 shows that the coefficient for the derivatives user variable is still negative and slightly larger in magnitude (β = –0.176). However, the standard error is relatively large (0.243), which weakens the statistical reliability of the estimate. The explanatory power of the model remains very low, with an R^2 of 0. 0011. These results suggest that even in the energy sector, where derivatives are widely used for risk management, derivative usage alone is not positively related to firm value.

4.2.2 Correlation matrix

Table 7 reports the Pearson correlation coefficients between the main variables used in the analysis. The correlation matrix has two main purposes. First, it gives an initial overview of how firm value is related to the explanatory variables. Second, it helps to detect possible multicollinearity problems that could affect the regression results (Gujarati & Porter, 2009; Wooldridge, 2010).

Firm value, measured by Tobin's Q, shows weak positive correlations with firm size (0.122) and liquidity (0.142). This suggests that larger and more liquid firms tend to have slightly higher market valuations. Tobin's Q is weakly negatively correlated with leverage (-0.075) and shows a positive correlation with profitability (0.227). The relationship with profitability may indicate that firms with stronger earnings are valued higher, although mature firms with stable profits may have fewer growth opportunities. Growth and geographical diversification show only weak and statistically insignificant correlations with firm value.

Most importantly for this study, the correlation between derivatives usage and Tobin's Q is close to zero (-0.009). This means that, in the raw data, there is no simple linear relationship between derivative use and firm value. This finding is in line with the earlier univariate regression results and underlines the need to control for firm-specific characteristics.

The correlation matrix also helps to detect possible multicollinearity between the explanatory variables. High correlations between independent variables can increase standard errors and make coefficient estimates less reliable (Wooldridge, 2010). A commonly used rule is that correlations above 0,7 or 0,8 may indicate serious multicollinearity concerns (Gujarati & Porter, 2009). In the present data, the highest correlations are observed between firm size and leverage (0,406), firm size and geographic diversification (0,424), and geographic diversification and derivatives usage (0,417). While these relationships are economically meaningful, their magnitudes remain well below thresholds. This suggests that multicollinearity is unlikely to create a serious problem in the multivariate regression analysis.

Overall, the correlation analysis provides useful preliminary insights into the data structure. The weak correlations between Tobin's Q and most explanatory variables indicate that firm value is influenced by multiple interacting factors rather than any single variable. Furthermore, the absence of extreme correlations among the regressors supports the reliability of the regression framework in the empirical analysis.

Table 7. Correlation matrix

	Q	*Size*	*Lev.*	*Prof.*	*Grow.*	*Geo.D.*	*Liq.*	*Deriv.*	*Div.*
Q	1								
Size	0,122***	1							
Lev.	-0,075***	0,406***	1						
Prof.	-0,227***	0,132***	0,006	1					
Grow.	0,008	-0,001	-0,010	-0,028*	1				
Geo.D.	0,066***	0,424***	0,068***	0,124***	-0,002	1			
Liq.	0,142***	0,061***	-0,150***	-0,017	0,117***	-0,110***	1		
Deriv.	-0,009	0,400***	0,188***	0,121***	-0,005	0,417***	-0,162***	1	
Div.	-0,006	0,311***	0,136***	0,131***	-0,018	0,110***	-0,037**	0,243***	1

This table reports Pearson correlation coefficients for the main variables used in the analysis based on 3 976 firm-quarter observations. Tobin's Q is used as the proxy for firm value. Size is measured as the natural logarithm of total assets. Leverage is defined as total debt divided by total assets. Profitability is measured as return on assets. Growth is measured as the percentage change in sales. Geographic diversification is measured as the share of foreign sales. Liquidity is defined as current assets divided by current liabilities. Derivative is a dummy variable equal to one if the firm uses financial derivatives and zero otherwise. Dividend is a dummy variable equal to one if the firm pays dividends.
***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

4.2.3 Multivariate analysis

The univariate regressions give a first view of the relationship between derivatives use and firm value. However, they do not control for other firm-specific factors that are known to influence valuation. Because of this, the results may suffer from omitted variable bias. Derivatives usage is likely related to variables such as firm size, leverage, profitability, growth opportunities, liquidity, and geographical diversification.

To reduce this problem, the analysis continues with multivariate regression models. These models allow the effect of derivatives use on firm value to be examined while controlling for the main determinants of valuation at the same time. This approach provides more reliable and economically meaningful estimates of the relationship between hedging and firm value (Allayannis & Weston, 2010; Gujarati & Porter, 2009).

Formally, the pooled OLS multivariate model is specified as follows:

$$Tobin's\ Q_{it} = \beta_0 + \beta_1 DerivativeUser_{it} + \beta_2 Size_{it} + \beta_3 Leverage_{it} + \beta_4 Profitability_{it} + \beta_5 Growth_{it} + \beta_6 GeographicDiversification_{it} + \beta_7 Liquidity_{it} + \beta_8 Dividend_{it} + u \quad (8)$$

In the model, i refers to the firm, and t refers to the time period. By estimating this regression, the analysis isolates the marginal effect of derivatives usage on firm value while holding other firm characteristics constant. These characteristics have been shown in earlier studies to affect valuation. Using a multivariate regression therefore allows for a more precise test of whether hedging with derivatives is linked to higher firm value.

Table 8 reports the results of the multivariate pooled OLS regression for the full sample (1. model), derivative users (2. model), and non-users (3. model). The coefficient on the derivatives user variable in model 1 is negative and statistically significant at the 10 percent level (-0,233). This indicates that after controlling for firm characteristics, firms that use derivatives show lower Tobin's Q than non-users. This finding suggests that derivatives usage is not associated with higher firm value in the sample and may even reflect value-reducing effects once differences in size, leverage, profitability, growth, geographic diversification, liquidity, and dividend policy are taken into account.

Several control variables show clear and economically meaningful relationships with firm value. Firm size is positive and highly statistically significant, which suggests that larger firms tend to have higher Tobin's Q. Both leverage and profitability have large negative coefficients. Geographic diversification and liquidity are positively related to firm value, indicating that international exposure and financial flexibility may support higher valuation. Growth and dividend payout, however, are not statistically significant in this specification.

Overall, model 1 explains about 11% of the variation in Tobin's Q. This is a clear improvement compared to the univariate regressions. The result shows that controlling for firm-specific characteristics is important.

Models 2 and 3 show clear structural differences between hedging and non-hedging firms. Among derivatives users, leverage and profitability exert substantially stronger negative effects on firm value, while liquidity remains positively related to valuation. In contrast, non-users display a weaker sensitivity of firm value to leverage and profitability, but a stronger positive effect of geographical diversification. The explanatory power is higher for derivative users (R^2 = 0,179) than for non-users (R^2 = 0,138). This indicates that firm characteristics explain valuation more effectively among firms that actively manage financial risk with derivatives. These differences highlight heterogeneity in the valuation mechanisms of hedging and non-hedging firms.

These findings lead to the following conclusions. Hypothesis 0 (no effects is rejected at the 10 % significance level, as the derivatives usage coefficient is statistically different from zero. Hypothesis 1 (positive effect) is also rejected, because the estimated coefficient is negative, not positive. Hypothesis 2 (negative effect) is supported, as derivatives usage is associated with a statistically significant decline in firm value. This outcome challenges the positive valuation effects reported in some prior studies (e.g., Allayannis & Weston, 2001) and suggests that, in the Nordic corporate context examined here, derivatives usage does not translate into higher firm value.

Table 8. Multivariate regression results – All firms.

Variable	**1. model**	**2. model**	**3. model**
Derivatives user	−0.233*	—	—
	(0.122)	-	-
Firm size	0.140***	0.1509***	0.1603***
	(0.014)	(8.12)	(8.24)
Leverage	−2.849***	-3.9642***	-1.3174***
	(0.360)	(-7.77)	(-2.84)
Profitability	−9.730***	-22.1823***	-4.0260***
	(0.590)	(-19.95)	(-6.38)
Growth	−0.010	-0.0275	0.0041
	(0.012)	(-1.65)	(0.23)
Geographic diversification	0.0038***	0.0025	0.0103***
	(0.0014)	(1.39)	(5.13)
Liquidity	0.088***	0.1196***	0.0820***
	(0.013)	(2.85)	(6.39)
Dividend payer	−0.085	0.2672*	-0.7830***
	(0.136)	(1.70)	(-2.97)
Constant	0.644***	0.5000**	0.2595
	(0.139)	(2.30)	(1.47)
Observations	3,976	2364	1612
R^2	0.110	0.1792	0.1382

This table reports pooled OLS regression results with Tobin's Q as the dependent variable. All models include firm-level control variables. Standard errors are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Observations denote the number of firm-quarter observations used in each model. Models (1)-

(3) correspond to different subsamples as indicated in the column headers. Here Model (1) is full sample, Model (2) derivative users and Model (3) non-users.

Table 9 reports the results of the multivariate regression analysis conducted for the subsample of energy firms. Model 1 includes all energy firms, Model 2 includes the energy firms that do not use derivatives, and Model 3 includes energy firms that use derivatives. This sample analysis allows for an industry-specific examination of whether derivatives usage affects firm value and whether it differs between hedging and non-hedging firms.

In model 1, several firm characteristics are significant determinants of firm value. Firm size has a positive coefficient (0.067) and is highly significant, which means that larger energy firms tend to have higher Tobin's Q. Liquidity also shows a strong positive effect (0.290), suggesting that financial flexibility is especially important in the volatile energy sector. Geographic diversification is slightly positive (0.004), which may reflect the benefits of spreading risk across different markets and regulatory systems.

On the other hand, leverage has a negative coefficient (–1.021), indicating that higher debt levels are associated with lower firm value. The coefficient for the derivative user variable is positive, but it is not statistically significant. This suggests that derivative use does not have a clear impact on firm value among energy firms when all companies are analyzed together.

Model 2 presents the results for energy firms that do not use derivatives. The explanatory power of the model is relatively high. However, the small number of observations (N=56) leads to large standard errors and limited statistical significance. Liquidity remains positively and significantly related to firm value, highlighting its importance for non-hedging energy firms. Growth shows a weakly negative relationship with Tobin's Q. Overall, the results for non-users should be interpreted with caution due to the limited sample size.

Model 3 in Table 9 focuses on energy firms that actively use derivatives. In this subsample, firm size, profitability, liquidity, and geographic diversification all show positive and statistically significant relationships with firm value. This means that among energy firms that hedge, basic financial characteristics explain market valuation to a large extent. Leverage remains negatively related to Tobin's Q, which highlights the importance of a conservative capital structure in the energy industry.

When comparing these results to Table 8, which includes all firms, some clear differences can be seen. In the full sample, derivatives usage was weakly negatively related to firm value. However, within the energy sector, derivatives usage does not show any statistically significant effect on valuation. Instead, firm value seems to be driven mainly by size, liquidity, profitability, and diversification. This suggests that the role of derivatives may depend on the industry and its specific risk structure.

Regarding the hypotheses, the energy sector results lead to the following conclusions. Hypothesis 0 cannot be rejected, because derivatives usage does not have a statistically significant effect on firm value. Hypothesis 1 is not supported, because there is no evidence of a positive valuation effect. Hypothesis 2 is also not supported, as no negative effect is found. Overall, the findings indicate that while derivatives usage may matter in the broader sample, its impact within the energy sector appears neutral, and firm fundamentals play a more important role in determining market value.

Table 9. Multivariate regression results – Energy firms.

Variable	**1. model**	**2. model**	**3. model**
Derivatives user	0.322	—	—
	(1.46)	-	-
Firm size	0.067 ***	0.120	0.076 ***
	(4.03)	(0.79)	(6.98)
Leverage	-1.021**	17.212	-0.574 **
	(−2.30)	(0.18)	(−1.97)
Profitability	1.420	4.749	3.070 ***
	(0.80)	(0.32)	(2.68)
Growth	-0.007	-0.135	-0.001
	(−0.89)	(−1.88)*	(−0.13)
Geographic diversification	0.004 **	-0.030	0.006***
	(2.05)	(−0.82)	(4.68)
Liquidity	0.290***	0.375***	0.096 ***
	(12.95)	(4.83)	(2.94)
Dividend payer	-0.013	-1.117	0.117
	(−0.08)	(−0.86)	(1.06)
Constant	-0.097	0.151	-0.349
	(−0.38)	(0.14)	(−1.00)
Observations	476	56	420
R^2	0.321	0.444	0.276

This table reports pooled OLS regression results with Tobin's Q as the dependent variable. All models include firm-level control variables. Standard errors are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Observations denote the number of firm-quarter observations used in each model. Models (1)-(3) correspond to different subsamples as indicated in the column headers. Here Model 1 includes all energy firms, Model 2 includes the energy firms that do not use derivatives, and Model 3 includes energy firms that use derivatives.

Table 10 presents the multivariate regression results for firms operating outside the energy sector. Model (1) includes all non-energy firms, Model (2) focuses on non-energy firms that use derivatives, and Model (3) includes non-energy firms that do not use derivatives. This analysis complements the earlier results for all firms and the energy sector sample by examining whether the valuation effects of derivatives usage differ in industries.

In Model 1, several firm characteristics are significant determinants of firm value among non-energy firms. Firm size has a positive (0.155) and highly significant relationship with Tobin's Q, which shows that larger non-energy firms tend to receive higher market valuations. Liquidity is also positively and significantly related to firm value. On the other hand, leverage and profitability have strong negative coefficients. This may reflect that highly leveraged and more mature firms have fewer growth opportunities and are therefore valued lower by the market.

The coefficient for the derivatives user variable is negative, but it is not statistically significant. This means that derivatives usage does not show a clear valuation effect in the non-energy sample. As a result, Hypothesis 0 cannot be rejected, and Hypothesis 1 is not supported. These results differ from the full sample analysis, where a weakly negative and marginally significant relationship was observed. This suggests that the negative association in the full sample is likely driven by sectors other than non-energy firms.

Model 2 presents the results for non-energy firms that actively use derivatives. In this group, firm size and liquidity remain positively and significantly related to firm value. Leverage and profitability continue to show strong negative effects. The coefficients for leverage and profitability are larger than in the full non-energy sample, which indicates that firm value among derivative-using non-energy firms is especially sensitive to financial structure and earnings performance. The relatively high explanatory power of the model ($R^2 = 0.198$) further suggests that firm fundamentals are important in explaining valuation differences in this group.

Model 3 examines non-energy firms that do not use derivatives. In this group, firm size and liquidity remain positively and significantly related to Tobin’s Q. Leverage and profitability again show negative and statistically significant effects. Geographic diversification has a strong positive association with firm value, which suggests that international operations support valuation. Dividend payout is negatively related to firm value, which may indicate that dividend-paying non-hedging firms have fewer growth opportunities.

When comparing Table 10 with the earlier results for all firms and for energy firms, a few important differences appear. In the full sample, derivatives usage was weakly negatively related to firm value. In the non-energy sample, however, derivatives usage does not show a statistically significant effect. Similarly, in the energy sector analysis, no significant valuation effect was found. Overall, the non-energy results suggest that derivatives are largely neutral in terms of firm value. Instead, valuation seems to depend mainly on traditional firm characteristics such as size, leverage, profitability, liquidity, and diversification.

For the non-energy firms, the conclusions are clear. Hypothesis 0 cannot be rejected, because derivatives usage does not have a statistically significant effect on firm value. Hypothesis 1 is rejected, as no positive valuation premium is observed. Hypothesis 2 is also rejected, because the coefficient on derivatives usage is not significantly negative. Taken together, these findings suggest that the impact of derivatives on firm value depends on the industry, and that outside the energy sector, firm fundamentals play a more important role in explaining valuation.

Table 10. Multivariate regression results – Non-Energy firms.

Variable	1. model	2. model	3. model
Derivatives user	−0.185	—	—
	(−1.38)	-	-
Firm size	0.155***	0.184***	0.167***
	(9.75)	(7.85)	(8.58)
Leverage	−3.188***	−4.969***	−1.246**
	(−7.77)	(−7.56)	(−2.71)
Profitability	−10.059***	−24.063***	−4.029***
	(−16.10)	(−19.26)	(−6.49)
Growth	−0.007	−0.129	0.002
	(−0.33)	(−0.95)	(0.09)
Geographic diversification	0.003***	0.001	0.011***
	(2.07)	(0.28)	(5.57)
Liquidity	0.069***	0.097***	0.067***
	(4.82)	(2.98)	(5.15)
Dividend payer	−0.065	0.321	−0.598**
	(−0.42)	(1.72)	(−2.18)
Constant	0.612***	0.502*	0.213
	(3.97)	(1.93)	(1.20)
Observations	3508	1952	1556
R^2	0.111	0.198	0.138

This table reports pooled OLS regression results with Tobin's Q as the dependent variable. All models include firm-level control variables. Standard errors are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Observations denote the number of firm-quarter observations used in each model. Models (1)-(3) correspond to different subsamples as indicated in the column headers. In this table Model (1) includes all non-energy firms, Model (2) focuses on non-energy firms that use derivatives, and Model (3) includes non-energy firms that do not use derivatives.

5 Discussion and Conclusion

The idea of this thesis was to examine whether the use of financial derivatives is associated with higher firm value in Nordic energy companies. Firm value was measured using Tobin's Q, and the empirical analysis was conducted with univariate and multivariate pooled OLS regressions. The dataset includes firm-level observations from Finland, Sweden, Norway, and Denmark over the period 2018–2024. This chapter summarizes the main findings, links them to earlier research, and outlines the overall contribution of the study.

The univariate analysis provides the first insight into the relationship between derivatives usage and firm value. The results show that firms using derivatives do not have a significantly higher Tobin's Q than non-users. The coefficient for the derivatives user dummy is negative, but statistically insignificant. This result holds for both the full sample and the energy sector subsample. In other words, derivatives usage alone does not appear to be linked to higher market valuation among Nordic firms, or specifically among energy companies. The correlation analysis supports this conclusion. The correlation between derivatives usage and Tobin's Q is close to zero. At the same time, derivatives usage is positively related to firm size, leverage, and geographical diversification. This shows that derivative users are typically larger, more international, and financially more complex firms. Because of this, multivariate regressions are needed to control for these structural differences.

After including control variables, the multivariate results confirm the earlier findings. When firm size, leverage, profitability, growth, liquidity, geographical diversification, and dividend policy are taken into account, derivatives usage remains statistically insignificant. This result is robust across different model specifications and holds within the energy sector sample. Therefore, the empirical evidence does not support the hypothesis that derivatives usage increases firm value in the Nordic energy sector. At the same time, there is no statistically significant negative effect. As a result, the null hypothesis cannot be rejected.

These findings are in line with several earlier studies that report weak or context-dependent valuation effects of hedging. In particular, the results are consistent with Nordic-focused research, such as Brunzell, Hansson, and Liljeblom (2011) and Rokala (2023), which also find limited or mixed evidence of a value premium. The results are also similar to Yin and Jorion (2006), who show that hedging reduces risk in the oil and gas sector but does not necessarily increase firm value. On the other hand, the findings differ from studies such as Allayannis and Weston (2001) and Carter, Rogers, and Simkins (2008), which document a clear positive hedging premium. One possible explanation is the difference in context. Many studies that find positive effects focus on U.S. firms or industries where hedging directly supports growth and investment. Nordic energy companies operate in a relatively stable and regulated environment. The sector is capital-intensive and often based on long-term contracts, which may already reduce some of the risks that derivatives are meant to manage.

An important interpretation is that derivatives usage in the Nordic energy sector mainly serves as a risk management tool rather than a value-creation strategy. The descriptive statistics show that energy firms are frequent users of derivatives and have relatively high leverage, strong international exposure, and volatile growth. In this setting, derivatives may help stabilize cash flows and reduce downside risk without leading to higher market valuation. This is consistent with theoretical arguments that hedging can reduce risk without necessarily affecting expected returns or growth opportunities.

The main contribution of this thesis is to provide sector-specific evidence on the relationship between derivatives usage and firm value in the Nordic energy market. By combining firm-level data with established valuation measures and regression methods, the study shows that derivatives usage alone does not explain differences in firm value among Nordic energy companies. The findings support the view that the value effects of hedging depend on the context and cannot be generalized across industries or regions. In conclusion, although derivatives are widely used and economically important in the Nordic energy sector, their use does not result in a measurable valuation premium as captured by Tobin's Q. The results highlight the difference between risk reduction and value creation and suggest that for Nordic energy firms, the main benefit of derivatives lies in financial stability rather than higher market valuation.

5.1 Acknowledgement

Artificial intelligence (AI) tools were used in a limited capacity during the preparation of this thesis. Specifically, AI-assisted language tools were used to translate certain sections of the text to improve clarity. The use of AI was restricted to language support and did not influence the academic substance of the study.

5.2 Limitations

This study has several limitations that should be considered when interpreting the results. First, derivatives usage is measured with a binary dummy variable that only shows whether a firm uses derivatives or not. This method is common in earlier research, but it does not capture how much derivatives are used, what types of instruments are applied, or whether they are used for hedging or speculation. Firms can differ greatly in the scale and purpose of their derivatives activities.

Another reason lies in how annual reports are used to identify derivative users. Although this improves transparency, reporting practices may vary between firms and countries. Some firms provide only limited or aggregated information about their derivative positions. Accounting standards may also allow discretion in reporting, which can reduce comparability and potentially lead to classification errors.

Third, firm value is measured with Tobin's Q, which is an indirect proxy for market valuation. Tobin's Q reflects investor expectations and overall market conditions. It can therefore be influenced by macroeconomic shocks or sector-wide developments that are unrelated to derivatives usage. For this reason, changes in Tobin’s Q cannot be attributed only to risk management decisions.

Despite having multiple key control variables in the regression models, some endogeneity issues could survive. Firms that choose to use derivatives may differ systematically from non-users, for example in terms of governance quality or management practices. While the regression framework reduces this problem, it does not fully eliminate possible reverse causality or omitted variable bias.

Finally, the sample includes only the listed Nordic companies during 2018–2024. This limits the generalizability of the findings. The results may not apply to private firms, financial institutions, or companies operating in different regulatory environments. In addition, the sample period includes years of high market volatility, such as the COVID-19 period, which may affect both derivatives usage and firm valuation.

Despite these limitations, the study still offers useful evidence on the relationship between derivatives usage and firm value in the Nordic energy sector. It also creates a basis for future research that could use more detailed data on derivatives or alternative empirical methods.

5.3 Future research avenues

Several avenues for future research emerge from the study's findings and limitations. Future studies could examine the intensity and composition of derivatives usage rather than relying on a binary indicator. While this thesis distinguishes between derivative users and non-users, firms may differ substantially in the notional amounts hedged, the maturity structure of contracts, and the specific instruments employed. Access to more detailed data on derivatives would allow researchers to examine whether the scale and intensity of hedging, rather than just whether a firm uses derivatives or not, have an impact on firm value. Such an approach could also help distinguish between hedging and speculative derivatives usage more clearly.

Future research could explore instrument-specific effects, particularly in the energy sector. Energy firms use a wide range of derivatives, including commodity, interest rate, foreign exchange, and weather derivatives. Breakdown derivatives by type could reveal whether certain instruments are more effective in supporting firm value than others. For example, commodity price hedging may have different valuation implications than financial hedging, especially in periods of heightened energy price volatility.

Finally, extending the analysis to longer time horizons or alternative market settings could improve generalizability. Including private firms, expanding the sample beyond the Nordic region, or focusing on periods of extreme market stress may reveal different dynamics. Future research could examine whether the value of derivatives becomes more pronounced during crises, when risk management may be especially critical.

References

Ahmed, H., Fairchild, R., & Guney, Y. (2020). Is corporate hedging always beneficial ? A theoretical and empirical analysis. European Journal of Finance. https://doi.org/10.1080/1351847X.2020.1785909

Allayannis, G., & Weston, J. P. (2001). The use of foreign currency derivatives and firm market value. The review of financial studies, 1481), 243-276. https://doi.org/10.1093/rfs/14.1.243

Al-Ramadan, N., S., A., & Hasan, M., F. (2022) Using Options Futures Derivatives Weather in Hedging. Technium Social Sciences Journal, 31, 430-436. https://heinonline-org.proxy.uwasa.fi/HOL/Page?collection=journals&handle=hein.journals/techssj31&id=430&men_tab=srchresults

Aytürk, Y., Gürbüz A. O., & Yanik, S. (2016). Corporate derivatives use and firm value : Evidence from Turkey. Borsa Istanbul Review, 16(2), 108-120. https://doi.org/10.1016/j.bir.2016.02.001

Bachiller, P., Boubaker S. & Mefteh-Wali S. (2021). Financial derivatives and firm value: What have we learned? Finance Research Letters, 39. https://www.sciencedirect.com/science/article/abs/pii/S1544612320300945

Bartman, S. M., Brown, G. W., & Conrad, J. (2021). The Effects of Derivatives on Firm Risk and Value. Journal of Financial and Quantitative Analysis, 46(4). https://doi.org/10.1017/S0022109011000275

Bartman, S. M., Brown, G. W., & Frank R. Fehle (2009). International Evidence on Financial Derivatives Usage. Financial Management 38(1), 185-206. https://doi.org/10.1111/j.1755-053X.2009.01033.x

Black, F. & Scholes, M. (1973). The Pricing of Options and Corporate Liabilities. Journal of Political Economy, 81(3), 637-650. https://www.jstor.org/stable/1831029

Brunzell, T., Hansson, M., & Liljeblom, E. (2011). The use of derivatives in Nordic firms. The European Journal of Finance, 17(5-6), 355-376. https://doi.org/10.1080/1351847X.2010.543836

Butt, A. A., Rizavi, S. S., Nazir, M. S., & Shahzad, A. (2022). Corporate derivatives use and firm value : conditional role of corporate governance. South Asian Journal of Business Studies, 13(2), 262-281. https://doi.org/10.1108/SAJBS-02-2021-0059

Capelle-Blancard G. (2010). Are derivatives dangerous ? A literature survey. International Economics, 123, 67-89. https://doi.org/10.1016/S2110-7017(13)60014-1

Carter, A. D., Rogers, D. A., & Simkins, B. J. (2008). Does hedging affect firm value ? Evidence from the US airline industry. Financial Management, 35(1), 53-86. https://doi.org/10.1111/j.1755-053X.2006.tb00131.x

Clark, E. & Ghosh, D. K. (2004). Arbitrage, Hedging, and Speculation: The foreign Exchange Market. Bloomsbury Publishing USA, 1-3. https://books.google.fi/books?hl=fi&lr=&id=tFDeEAAAQBAJ&oi=fnd&pg=PP6&dq=hedgers+speculators+and+arbitrageurs&ots=IkopNqnPzX&sig=dLanoRODKAm_yAyZAlax7A2W4Qw&redir_esc=y#v=onepage&q&f=false

Fauver, L., & Naranjo, A. (2010). Derivative usage and firm value : The influence of agency costs and monitoring problems. Journal of corporate finance, 16(5), 719-735. https://doi-org.proxy.uwasa.fi/10.1016/j.jcorpfin.2010.09.001

Froot, K. A., Scharfstein, D. S., & Stein, J. C. (1993). Risk management : Coordinating corporate investment and financing policies. The Journal of Finance, 48(5), 1629-1658. https://doi.org/10.2307/2329062

Fung, H. G., Wen, M. M., & Zhang, G. (2012). How does the use of credit default swaps affect firm risk and value ? Evidence from U.S. life and property/casualty insurance companies. Financial Management, 41(4), 979-1007. https://www.jstor.org/stable/23324884

Graham, J. R. & Rogers, D. A. (1999) Is Corporate Hedging Consistent with Value Maximization ? An Empirical Analysis https://dx.doi.org/10.2139/ssrn.170348

Gujarati, D. N., & Porter, D. C. (2009). Basic Econometrics (5th ed.). McGraw-Hill. https://cbpbu.ac.in/userfiles/file/2020/STUDY_MAT/ECO/1.pdf

Howton, S. D., & Perfect, S. B. (1998). Currency and interest-rate derivatives use in U.S. firms. Financial Management, 27(4), 111-121. https://doi.org/10.2307/3666417

Hull, J. C. (2015). Options, Futures and Other Derivatives. Pearson Education, 10-310.

Ji, P., & Wei, L. (2023). Hedging with derivatives to increase firm value. Finance Research Letters, 55, 103981. https://doi.org/10.1016/j.frl.2023.103981

Kwong Lau, C. (2016. How corporate derivatives use impact firm performance. Pacific-Basin Finance Journal, 40, 102-114. https://doi.org/10.1016/j.pacfin.2016.10.001

Lang, L., Stulz, R., & Walkling, R. (1989). Managerial performance, Tobin's Q and the gains from succesful tender offers. Journal of Financial Economics, 24(1), 137-154. https://doi.org/10.1016/0304-405X(89)90075-5

Lau, C. K. (2016). How corporate derivatives use impact firm performance ? Pacific-Basin Finance Journal, 40, 102-114. https://doi.org/10.1016/j.pacfin.2016.10.001

Luo, H. R., & Wang, R. (2018). Foreign currency risk hedging and firm value in China. Journal of Multinational Financial Management, 47, 192-143. https://doi.org/10.1016/j.mulfin.2018.11.002

Modigliani, F., & Miller, M. H. (1958). The cost of capital, corporation finance and the theory of investment. The American economic review, 48(3), 261-297. https://www.jstor.org/stable/1809766

Naito, J., & Laux, J. A. (2011). Derivatives usage : value-adding or destroying ? Journal of Business & Economic Research, 9(11), 41-50. https://dx.doi.org/10.2139/ssrn.1864034

Panaretou, A. (2014). Corporate risk management and firm value : eivdence from the UK market. The European Journal of Finance, 20(12), 1161-1186. https://doi.org/10.1080/1351847X.2013.766625

Perez-Gonzalez, F., & Yun, H. (2013). Risk management and firm value : Evidence from weather derivatives. The Journal of Finance, 68(5), 2143-2176. https://doi.org/10.1111/jofi.12061

Smith. Jr C. W., Smithson C. W. & Wakeman L. M. (1988). The Market for Interest Rate Swaps. Financial Management, 17(4), 34-44. https://www.jstor.org/stable/3665765

Usmen, N. (1994). Currency Swaps, Financial Arbitrage, and Default Risk. Financial Management, 23(2), 43-57. https://www.jstor.org/stable/3665738?read-now=1#page_scan_tab_contents

Wooldridge, J. M. (2010). Econometric Analysis of Cross Section and Panel Data (2nd ed.). MIT Press. https://ipcid.org/evaluation/apoio/Wooldridge%20-%20Cross-section%20and%20Panel%20Data.pdf

Yin, Y., & Jorion, P. (2006). Firm value and hedging : Evidence from U.S oil and gas producers. The Journal of Finance, 61(2), 893-919. https://doi.org/10.1111/j.1540-6261.2006.00858.x