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# The impact of derivatives on firm value

Evidence from Finland

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**ABSTRACT:**

Derivatives and their effects on firm value have been widely studied, but the results are mixed. The purpose of this thesis is to examine whether those companies that use any derivative instruments in their financial strategies outperform those companies that do not use derivatives measured as Tobin's Q. As derivatives are mostly used for risk management purposes, they have been proved to have positive effect on firm value according to several studies focusing on different economies. In this thesis, it is also tested whether the use of derivatives can add firm value during the downturn caused by the current Covid-19 pandemic. There is little research made related to current pandemic and hedging, so this thesis provides evidence on a timely topic. While most of the research related to derivatives and firm value is focused on larger economies, this thesis provides Finnish evidence. The sample used in this thesis includes 107 non-financial companies listed in Nasdaq Helsinki during 2016-2020. 72% of the sample companies report using financial derivatives in at least one of the observation years. Using a sample of 2073 firm-quarter observations, the implications of hedging on firm value is examined with pooled OLS regression and fixed effect models.

Univariate regression results suggest that hedgers have 13% lower firm values compared to those that do not use derivatives. The results from pooled OLS multivariate regression show that hedging is associated with 15% to 37% lower firm value depending on the model. These results are statistically significant at 1% level. Fixed effects regression model gives the opposite results as hedgers are associated with 0% to 4% higher firm values. The results from fixed effects model are not statistically significant. Earlier research claims that whether hedging adds value or not can be dependent on the country and industry the company operates in. 68% of sample companies operate in industrial, consumer service or technology. Regressions are also made after dividing the samples into these industries. Companies operating in consumer service and technology experience negative value premium of -22% and -4% related to hedging. Different results are found in industrial, which is the most popular industry in Nasdaq Helsinki, as industrial companies are associated with 22% hedging premium.

According to the results, negative hedging premium was even more pronounced during 2020, so it can be stated that hedging did not firm value during period of high volatility and uncertainty. Based on earlier research this and other implications of derivatives can be dependent on the country and industry but also the type of derivative used which is a limitation of this thesis.

**KEYWORDS:** hedging, derivative, firm value, crisis

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**TIIVISTELMÄ:**
Johdannaisinstrumentit ja niiden vaikutukset yhtiön arvoon on laajasti tutkittu aihe, mutta tulokset eivät ole yksiselitteiset. Tämän tutkielman tarkoituksena on tutkia hyötyvätkö ne yritykset jotka käyttävät johdannaisia rahoitusstrategioissaan suhteessa niihin yrityksiin, jotka eivät johdannaisia käytä. Yrityksen arvon mittarina käytetään tässä tutkielmassa Tobin's Q suhdearvoa. Suurin osa yrityksistä käyttävät johdannaisia suojautumistarkoitukseen ja riskienhallintaan ja useiden tutkimusten mukaan johdannaisten käytöllä on todistettu olevan positiivisia vaikutuksia yritysten arvoon. Tässä tutkielmassa tutkitaan myös onko johdannaisten käytöllä yhtiön arvoa kohottavia vaikutuksia globaalin Covid-19 pandemian aikana. Aiheesta ei vielä löydy kovin paljoa tutkimustietoa, joten tämä tutkielma tuo ajankohtaista näyttöä liittyen aiheeseen. Siinä missä suurin osa johdannaisiin liittyvistä tutkimusta käsittelee suurempia markkinoita, tämä tutkielma tuo näkökulmaa pienemmästä markkinasta. Data-aineisto mitä tässä tutkielmassa käytetään sisältää 107 Helsingin pörssiin listattua yhtiötä vuosien 2016-2020 aikana. Rahoitusyhtiöt on laskettu pois otannasta. 72% yhtiöistä ilmoitti käyttävänsä jotakin johdannaisinstrumenttia vähintään yhden tarkasteluvuoden aikana. Tutkielmassa käytetään 2073 yritys-kvartaali havaintoa ja johdannaisten vaikutusta yritysten arvoon testataan kahdella eri menetelmällä: pooled OLS ja fixed effects regressiomalleilla.

Yksimuuttuja-analyysin mukaan johdannaisia käyttävien yhtiöiden arvo on 13% pienempi kuin niiden yritysten, mitkä eivät johdannaisia käytä. Pooled OLS monimuuttujaregressiomallin mukaan johdannaisia käyttävien yritysten arvo on jopa 15% - 37% alhaisempi. Nämä tulokset ovat tilastollisesti merkittäviä. Fixed effects -regressiomallin antaa päinvastaisia tuloksia, sillä ne yritykset, mitkä käyttävät johdannaisia kokevat 0% - 4% positiivisen vaikutuksen yhtiön arvoon. Tämän regressiomallin tulokset eivät kuitenkaan ole tilastollisesti merkittäviä. Aikaisemman tutkimustiedon mukaan johdannaisten käytön vaikutus voi olla riippuvainen maasta ja toimialasta, jolla yritys operoi. 68% tutkielman yrityksistä operoi teollisuusalalla, kuluttajapalveluissa tai teknologia-alalla. Regressioanalyysit on myös tehty jakamalla ensiksi yritykset toimialojen mukaan. Niillä yrityksillä mitkä operoivat kuluttajapalveluissa ja teknologia-alalla on -22% ja -4% pienemmät markkina-arvot regressioanalyysien mukaan. Teollisuusyhtiöt, mikä on indeksin suosituin toimiala, tarjoavat eriäviä tuloksia sillä johdannaisia käyttävien teollisuusyhtiöiden arvo on jopa 22% korkeampi kuin niiden yritysten, mitkä eivät käytä johdannaisia.

Regressioiden tulosten mukaan johdannaisten käytön vaikutus oli korostuneempi vuoden 2020 aikana, joten voidaan todeta, että johdannaiset eivät lisänneet yritysten arvoa korkean volatiliteetin ja epävarmuuden aikana. Aikaisempien tutkimusten mukaan tämä ja johdannaisten muut vaikutukset voivat olla riippuvaisia maasta, toimialasta sekä johdannaistyypistä mikä on tämän tutkielman rajoitteena.

**AVAINSANAT:** suojautuminen, johdannaiset, yrityksen arvo, kriisi

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## Abbreviations

| | |
|---|---|
| ATM | At-the-money |
| CBOT | Chicago Board of Trade |
| CPD | Commodity price derivative |
| CDS | Credit default swap |
| FCD | Foreign currency derivative |
| ITM | In-the-money |
| IRD | Interest rate derivative |
| OTC | Over-the-counter |
| OTM | Out-of-the-money |
| ROA | Return on assets |
| VIX | Volatility index |
| Q | Tobin’s Q |

# 1 Introduction

Derivatives are financial instruments, whose value is dependent on the value of underlying assets. Derivatives can provide security on a comprehensive set of assets as the value of underlying assets can vary from stock prices to food prices and weather conditions. A stock option, for example, can provide security against decrease of stock price of a company stock. Alternatively, a stock option can also be beneficial if the company stock price increases. Whether an option, or any derivative contract, provides returns following decrease or increase of the price of specific underlying asset, is dependent on the features of the derivative contract. The amount of different type of derivative contracts is ever-increasing as is the possibilities they bring. The most common derivatives are forwards, futures and options (Hull, 2015, pp. 1-2).

The Chicago Board of Trade (CBOT), established in 19$^{th}$ century, is one of the world's oldest derivative exchanges. It was found in order to help farmers and consumers manage their risks associated with trading agricultural products. Ever since the amounts of derivative products and exchanges have increased and today almost anyone can get involved with derivative trading due technology development. Derivatives can be used by both companies and retail-investors. Most of the trading volume is made in over-the-counter markets (OTC), which is in general, market for brokers and big banks (Hull, 2015. pp. 1-5).

Derivatives were originally created to hedge against risks, which is the most usual reason for companies to trade with derivatives. In general, companies hedge against the risks associated with foreign exchanges, interest rates and commodity prices (Bartram, 2003).

According to Modigliani & Miller (1958), risk management is irrelevant because individual investors can do hedging activities themselves. However, several theories related to derivatives usage suggest that hedging can increase company value. Most of the major studies related to the topic is centralized in the United States. Allayannis & Weston (2001) find that that use of foreign currency derivatives is positively correlated with market

valuations denoted as Tobin's Q among large U.S. non-financial companies. They find that companies that hedge foreign currency risk have 5% higher company value than those companies that do not hedge. Graham & Rogers (1999) also use U.S. data in their research studying currency and interest rate derivatives and show that hedging increases company valuation by increasing debt capacity. Guay & Kothari (2003) estimate how much company's risk exposure decreases when engaging with hedging activities. They use sample of large U.S. companies and find small but positive correlation between hedging and company valuations. Nelson et. al (2005) broad research focusing on all sized companies in the U.S. denote that those companies that use hedging instruments outperform those that do not use any derivatives by 4.3% per year on average. This positive effect is limited to foreign currency derivative users, however. Their research also note that derivatives are more common in mining, oil, and chemical industries. Industry is something that have effect on whether hedging adds value or not. While Carter et. al (2005) find strong positive correlation between hedging done by U.S. airline companies and company valuation measured as Tobin's Q, Jin & Jorion (2006) find no such evidence in their study related to oil and gas companies in the United States.

There is also evidence related to hedging and company valuation outside of U.S. Belgithar et. al (2008) find highly significant and positive correlation between hedging and company valuation for both currency rate and interest rate hedgers among large UK companies in middle 1990s. They argue that foreign currency derivatives are associated with hedging premiums around 10%. Clark & Judge (2009) study the same sample of UK firms and find coherent results with Belgithar et. al (2008). They continue their research and estimate different derivative strategies and instruments and find that foreign currency forwards and options are used against short-term exposures and that they are associated with hedging premium around 20%. Swaps and foreign currency debt are more used against long-term exposures and especially swaps are positively associated with value generating hedging premiums up to 24%.

Brunzell et. al (2011) provide more Nordic evidence as they find positive correlation between hedging and company valuation. In their sample, derivative use is more common in larger firms and against the earlier evidence and expectations, firm size has a negative value effect with derivative use. They also study motivation behind the use of derivatives and show that roughly half of the sample firms use derivatives for speculative purposes.

Not all research related to hedging and company valuation show positive evidence. Lookman (2004) finds negative relationship between hedging and company valuation amongst oil and gas producers. Derivative related studies conducted by Fauver & Naranjo (2010) and Naito & Laux (2011) find negative correlation between hedging and company value amongst U.S. companies. Kwong (2015) also shows negative relationship between hedging and firm valuation in his study regarding Malaysian markets.

Earlier evidence related to hedging and company value shows that hedging can be beneficial for companies that face different risk exposures. Especially hedging foreign currency risk seems to add up value but hedging risks related to interest rates and commodity prices is not that clear.

Pandemic that started in 2019 had world-wide effects on stock exchanges. In their study regarding the impact of Covid-19 on stock markets in eight sample countries, He et al. (2020, pp. 275-288) show that the pandemic had a negative effect on all sample stock indices including China, South Korea, Japan, Italy, France, Spain, Germany and the United States. However, the impact was short-term as all markets recovered rather quickly. The authors propose spill-over effect between Asia, Europe and America but they note that there is no evidence suggesting that the pandemic would have had bigger negative effects on these countries mentioned in comparison to the global average.

This paper seeks to find whether hedging adds any company value. It is also tested whether hedging has any positive effect on firm valuation during 2020 when stock markets crashed. There are several earlier research proposing that hedging done by

companies can have positive value effects during times when stocks are heading south. In their broad international derivative-related study, Bartram et. al (2011) find that those companies that use derivatives have lower volatility of cash flows and returns, and higher values measured as Tobin's Q. After proving that hedging adds value, they test the effectiveness of derivatives during 2000-2001, when the world faced global recession. They show that hedgers have lower standard deviations and higher firm values before and during times of financial downturn. Panaretou (2014) studies UK companies and showcase that currency hedgers experience value premium of 6% in comparison to companies that do not use derivatives during 2003-2010. He also estimates if this value premium hold during the global financial crisis of 2007-2009 and finds no statistically significant results. Luo & Wang (2018) show that currency derivative users experience value premium up to 32 % compared to companies that do not hedge. This value effect, however, diminishes during the financial crisis of 2007-2009. Ahmed et. al (2020) show that currency hedgers experience positive value effect before and during the financial crisis. Interest rate and commodity price hedgers experience contrary results indicating that whether hedging adds value during period of high uncertainty is dependent on the risk that is hedged.

The data used in this paper includes companies listed in Nasdaq Helsinki. The final sample includes 107 non-financial companies operating in 10 different industries. 72% of sample companies report the use of financial derivatives in their financial statements during at least on of the years covering 2016-2020. The most popular industries in Nasdaq Helsinki are industrial, consumer service and technology as 68% of sample companies operate in one of these three industries.

Figure 1 graphs the evolution of Nasdaq Helsinki index through 2020. The evidence proves V-shaped recovery in the value of the index. Before the crash, the index had its highest value at 10 738 on 11$^{th}$ of February and it hit its lowest value of 6833 on 18$^{th}$ of March meaning that the index dropped 36 percent in value in little over a month. By the end of November, the index had recovered back to the value it had before the crash.

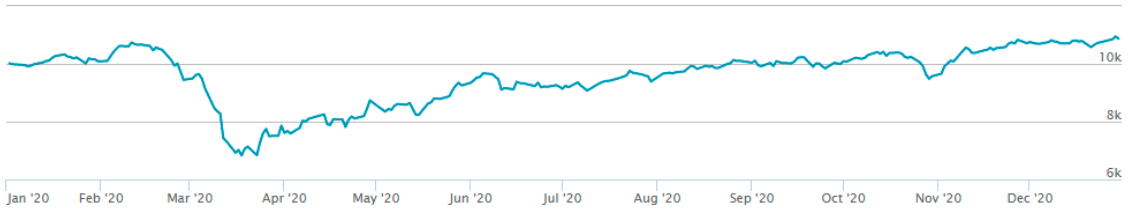



**Figure 1.** Nasdaq Helsinki during 2020 (Nasdaq OMX Helsinki, 2021).

For comparative reasons, Figure 2 shows the graph for S&P 500 index through 2020. The index has its highest value at 3386 on 18$^{th}$ of February and the index crashed to 2237 on 23th of March meaning the index declined 34 percent. The index had recovered to the value it had before the covid crash by August, so the recovery was quicker in the U.S. Both indices recovered relatively quickly as it took less than a year for them to bounce back to the value the index had before pandemic.

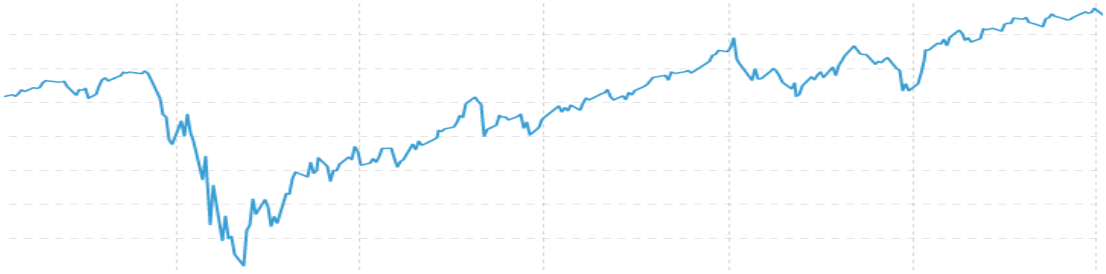


**Figure 2.** S&P 500 during 2020 (Macrotrends, 2023)

## 1.1 Purpose of the thesis

The purpose of this thesis is to seek whether companies that use derivative instruments in their financial strategies outperform those that do not use derivatives in terms of company value measured as Tobin's Q. To be more speficic, the idea is to test whether those companies that have used derivatives have experienced positive effects on firm value in comparison to those companies that do not use derivatives as part of their financial strategies and whether those results are statistically significant or not. Prevalent global Covid-pandemic is also considered and it is estimated whether those companies that use derivatives experienced any benefits in their valuations during the downturn that started in Q1 of 2020. The results show the relation between derivative usage and company value during a period of high volatility and uncertainty. The volatility index (VIX) rose rapidly during Q1 of 2020 the same time stock indices went south. Alike movements in VIX index occurred during financial crisis when stocks experienced downturn. The data used in this paper includes all non-financial companies listed in Nasdaq Helsinki during 2016-2020. While most research regarding the topic is centralized in larger economies, the purpose of this paper is to provide Finnish evidence related to derivatives and their implications on company value. Current pandemic being as one aspect of this thesis reveals timely evidence about the effectiveness of risk management in terms of market valuation. 72% of sample companies report use of derivatives in their most recent annual statements which indicates that derivatives are considered as an important part of companies' financial strategies and risk management.

With respect to earlier research regarding derivative instruments' implications on company market valuations and the current global crisis, the following hypotheses are formulated to test the implication of derivatives:

**$H_0$:** The use of derivatives has no effect on company value.

**$H_1$:** The use of derivatives is associated with higher company value.

$H_2$: The use of derivatives has a positive effect on company value during global crisis.

To test the hypotheses proposed above univariate and multivariate tests are run using Tobin's Q as dependent variable. Univariate test is made to measure the market values between derivative users and non-users to see whether derivatives provide any value. After univariate test, multivariate tests are conducted in order to separate other possible factors that could have impact on the market value other than the derivative use itself. Set of firm-characteristic related control variables are used to attack this issue. In order to test the hypothesis related to the current global pandemic, regressions are made through the whole sample period, before 2020 and also during 2020. Variable differentials of these two regressions are then compared to check the effect of the market downturn on the variables.

*Expected results:*

As derivative instruments are mostly used for risk management, or in other words, to reduce risks associated with companies, one would consider them to be beneficial to companies. There are lots of earlier research that finds derivatives usage for hedging to be beneficial, but the findings are not unambiguous as hedging can also decrease company value in certain circumstances. Most of the studies regarding derivatives and company value suggest however positive value premium especially among foreign currency derivative users. There is also some evidence supporting positive impact for interest rate and commodity price hedgers. Earlier evidence supports that large companies and companies with foreign sales benefit the most from hedging. The opposite results have also been found however. Whether hedging is beneficial of not in terms of firm value can be dependent on the industry, country and the type of derivative used. There is no clear and absolute evidence saying that derivatives add value for companies. Since the earlier evidence is unclear, the motivation for this thesis is to provide Finnish evidence regarding derivatives. Some research has been made related to derivatives and their implications on firm value during periods of high uncertainty in the markets. Current covid pandemic

however has not been widely studied in hedging point of view so this study provides evidence related to topic that is current.

With respect to the earlier research and the data of this paper – even though the evidence is mixed - it is expected that hedging is positively associated with firm value. It is also expected that company size and foreign sales is positively associated with company value as these two measures have been mostly positively connected with firm value when it comes to hedging. Earlier literature studying previous economical downturns especially the financial crisis, show that hedging can add value during times of high uncertainty. Covid pandemic being one aspect of this study it is expected that hedging has a positive impact on company value.

## 1.2 Limitations and assumptions

All the data related to derivative usage are manually collected from companies' financial statements. Since all companies do not separate the use of derivatives between different instruments, and to keep it simpler, companies are defined as derivative users if they have used any derivative instruments during the fiscal year. Thus, this paper does not separate derivative users between different derivative instruments. Foreign currency derivatives have been widely and positively connected with company value according to earlier research.

The motives for the use of derivatives are also not considered in the regressions. It would take too long to resolve whether each sample company have used derivative instruments for hedging or speculative purposes. Thus, all derivative users are considered as hedgers. Traditionally derivative instruments were created for risk management purposes, and this is by far the most common reason for the use of these instruments. It is most likely that most of the sample companies have used derivatives for hedging against risks associated with their business and investment activities.

Earlier evidence suggests that whether hedging adds company value is dependent on the industry. The sample index includes companies in 10 different industries and out of these, 68% operate in industrial, consumer service and technology. The index is thus heavily concentrated to these industries and thus the results could be biased.

## 1.3 Structure of the thesis

This paper is structured as follows: the second chapter introduces derivatives, the most common derivative instruments and strategies, derivative markets as well as some background related to them. Hedging as risk management tool is also discussed in this chapter in more speficic, different incentives to hedge and risk management during crisis. Chapter 3 previews the previous literature in the field of derivatives and their effect on company value in different countries and situations.

Chapter 4 includes the empirical part of the paper. The chapter starts with introducing the selected sample data. All the data and numbers related to the research are first presented in form of summary statistics to get insight on the characteristics of sample companies. Following summary statistics, univariate and multivariate regressions are run in order to get the results. The results of the regressions are presented in the same chapter after the regressions. The final chapter concludes the study with some future considerations. Limitations of the study are also briefly discussed considering possible afterstudies regarding the topic.

# 2 Derivatives

This chapter introduces derivatives, some background related to them, derivative strategies as well as the markets they are traded. Derivatives are financial instruments, whose value is depending on the value of some other underlying asset. Stock option's value is dependent on the value of a company's stock. This is an example of simple derivative contract. However, there are great amount of different derivative instruments, and their value can be dependent on almost any variable from stock prices to the prices of agricultural products and from stock price movements to the amount of snow in ski resorts (e.g., weather). The most common derivatives include forwards, futures and options (Hull, 2015, p. 1-2).

According to Hull (2015, p. 2-33) derivatives are traded on two primary markets. A derivatives exchange is a market where individuals can trade standardized derivative contracts defined by the specific exchange. The Chicago Board of Trade (CBOT) was established in 1848 to make it easier for farmers and commodity users to trade grains. Ever since, the amounts of exchanges have increased and now there are exchanges all over the world. At first, derivative trading happened on the premises but due ever-increasing globalization and technology, electronic exchanges have replaced original system making it easy and convenient to start trading derivatives. Even though exchanges have replaced the traditional system where traders physically need to meet, not all derivatives trading is on exchanges. Most of today's trading value related to derivatives takes place in the over-the-counter (OTC) market. Banks, fund managers and other large financial investors make their derivative trading in OTC markets. OTC market participants traditionally contact each other directly by phone or email, or via broker. Usually, banks act as market makers in OTC market trading. While exchanges provide standardized products, contracts in OTC markets are unstandardized meaning that there is higher credit risk related to these contracts.

It is often important for stakeholders to know how companies use derivative instruments. It is important as the use of derivatives can decrease or increase the risks associated with

the derivative position depending on the reasons behind the investment decisions. Risk-averse investors naturally favor those companies that use derivatives for risk management purposes. Bartram (2003) studies the reasons for derivative usage around the world. In his study, he uses great amounts of stocks in 47 different countries to find out whether the reasons behind derivative investing in companies differ between countries. The author measures risk with standard deviation, exchange rate, interest rate and commodity price risks. The results are evident as they strongly suggest that non-financial firms around the world primarily use derivatives for risk management (e.g., to reduce risks). International evidence thus suggests that companies' motives for derivative investing is to reduce risks. Consistent with findings above, Bartram also finds that those firms that have international operations experience significantly lower exchange rate risk if currency derivatives are used in risk management.

## 2.1 Derivative strategies

There are three primary strategies related to derivatives trading, hedging, speculation and arbitrage. Hedging is the most common derivative strategy and one can associate it with risk management. According to Hull (2015, pp. 49-50), perfect hedge is a situation where all the risk is completely eliminated away. Perfect hedges are rare. In general, hedging means protection against uncertainty related to investments. For instance, if retail-investor holds stocks of a listed company, she can take a position in a derivative contract that pays off if the price of the stock price of that company were to decrease. Even though hedging can provide insurance against uncertainty, it is not always beneficial to hedge. Decision to hedge can turn out to be useless (e.g., unnecessary costs) if the price of some asset does not fall (given the derivative position was taken against price fall) and for example, company's competitors have not spent money for hedging. All in all, whether it is beneficial to hedge can be dependent on company's industry, competitors, market conditions and simply individuals' or employees' understanding

about the features of derivative products (e.g., financial firms naturally have more knowhow related to financial instruments).

According to Guay & Kothari (2003, pp. 423-461), companies use currency, interest rate and commodity derivatives as risk management tools to hedge against uncertainty related to these assets. If the outcome of a derivative position is positive, the derivative position is considered to hedge the company's risk. In their research, Guay & Kothari estimate the market value changes and dollar cash flows related to interest rate, currency, and commodity derivatives in. They measure the effect of currency derivatives on exchange-rate movements, interest rate derivatives on interest rate movements and commodity derivatives on the underlying commodity prices. Authors delimit the data to 234 largest non-financial companies in the world and find that if interest rates, exchange rates and commodity prices change simultaneously by three standard deviations, the median company generates 15 million dollars in cash and 31 million dollars in value. The economic significance of these findings is modest when considering the size, operating- and investing cash flows of the sample firms. Thus, the authors claim that sample firms' derivative positions are economically small. They argue that this finding is potentially consistent with using derivatives for other purposes than traditional risk management, for speculation for instance.

While hedging traditionally means hedging against risks, derivatives can also be used for speculative reasons (e.g., to increase risks). In his international derivative usage-related study, Bartram (2003) also writes about motives behind alternative derivative strategy, speculation. According to him, speculators bet that the price of an asset will jump up or drop. As speculation is something that increases the risk associated with investing, it is important for stakeholders to have insight on companies' derivative usage. Telser (1959) compares speculators with hedgers in his theoretical study and argues, that while hedgers' profits are determined by the price of a commodity and other related commodities, speculator's profits are only defined by prices or price changes of that commodity they trade.

Third derivative related strategy is arbitrage. In general, arbitrageurs are looking for risk-free profits by simultaneously trading on two different markets. For instance, consider a stock that is traded on two exchanges, the New York Stock Exchange, and the London Stock Exchange. Suppose that a stock is trading at $150 in New York and at £100 in London. US dollars exchange rate in this example is $1.53 per British pound. If an arbitrageur buys 100 shares of the stock in New York and sells those shares at the same time in London, the investor receives $300 riskless profit. Of course, transaction costs are omitted in this hypothetical example (transaction costs would reduce the profit). Arbitrage opportunity described above cannot last for long. As buyers keep buying the stock and sellers keep selling it, the forces of supply and demand would increase the price in New York and decrease it in London. Eventually, the prices would adjust until the prices become equivalent between two markets (Hull, 2015, pp. 16-17).

In their paper, Mitchell, Pulvino & Stafford (2001, pp. 551-584) examine impediments to arbitrage in various situations when companies are undervalued in terms of market value. They note that perfect arbitrage only exists in perfect capital markets (e.g., in theory) and that in reality, market frictions, transaction costs and imperfect information limit the effectiveness of arbitrage making it difficult for investors to pursue effective arbitrage trading since the limits to arbitrage keeps prices at their fundamental values. The authors find that arbitrage is costly in equity markets and that imperfect information seems to be the most important reason that prevents arbitrageurs from exploiting possible situations related to market underpricing.

## 2.2 Derivative instruments

There are always atleast two parties between derivative contracts, buyers and sellers. Buyer is usually referred to having “long position” in a security meaning that the buyer owns the security. The buyer naturally is hoping that the price of the asset will rise in the future. The opposite of a long position is “short position”. In general, short position is the sale of an asset the party does not own. The seller is hoping that the price of the

asset in question will decrease in the future. Four main types of derivative instruments include forwards, futures, options and swaps. These are introduced briefly in this chapter.

### 2.2.1 Forwards and futures

A forward contract is one of the simplest derivative instruments. It is an agreement to buy or sell an asset at a certain time in the future for a certain price. Forwards are traded in over-the-counter market usually between two financial institutions or between financial institution and one of its clients. Between the two parties, one agrees to buy (long position) the underlying asset on a specified future date for a certain price. The other on the other hand agrees to sell (short position) the asset on the same date on the same price. Forward contracts are very popular on foreign exchange. Forwards can be used to hedge against foreign currency risk. For example, consider that the treasurer of U.S. corporation knows that the company will pay one million British pounds (GBP) in 6 months. The treasurer will want to hedge against exchange rate moves in case USD would deteriorate against GBP. Engaging into a forward contract, the treasurer agrees to buy 1 million GBP at a specified exchange rate. The company now has a long forward position on GBP and it has agreed that it will buy 1 million British pounds in six months from the bank. The bank on the other hand has a short forward position and it has agreed to sell the pounds at previously agreed price (Hull, 2018, pp. 28-29).

As mentioned above, the buyer of a derivative contract is entering into a long position and the seller into a short position. The payoff for a long position is:

$$S_T - K, \tag{1}$$

where $S_T$ is the spot price of the asset at maturity of the contract and $K$ is the delivery price. The holder of a long position is hoping that the price of the asset would rise and the profit for the buyer is the difference between the two above. Similarly, the payoff for a short position is:

$$K - S_T, \tag{2}$$

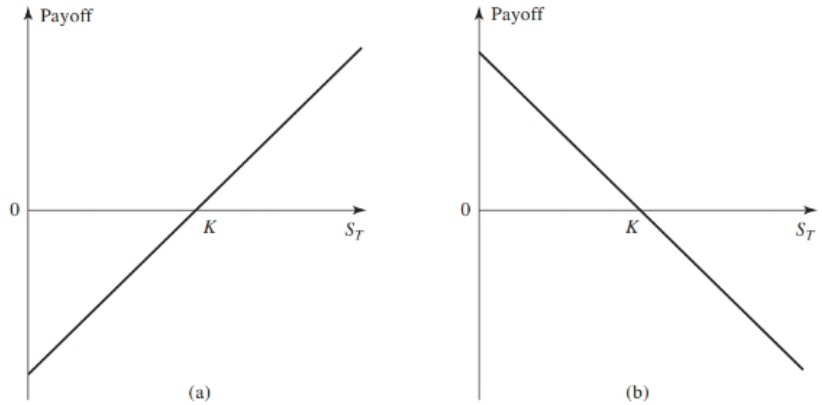



**Figure 3.** Payoffs from forward contracts: (a) long position, (b) short position. (Hull, 2018, 30)

Futures contract is similar to forwards, as it is an agreement to buy or sell an underlying asset at a certain price and time in the future. While forwards are traded in OTC-market, futures contracts are exchange traded making it possible for anyone to get involved with futures. To make trading of these possible, the exchange needs to have certain standardized features for the futures contracts (Hull, 2018, pp. 30-31).

### 2.2.2 Options

Options are derivative instruments that are traded both in the OTC-market and on exchanges. There are two types of options. A call option gives the holder the right to buy an underlying asset by a certain time for a certain price. On the contrary, a put option gives the holder the right to sell the asset by a certain time and price. Unlike forward and futures contracts, the holder of an option contract is not obligated to buy or sell. The holder has the right to buy or sell which makes options more flexible instruments. The price of an option contract is referred to as the exercise price or strike price and the date in the contract is known as maturity or the expiration date. Options are also classified by

the nature of the instrument. American options can be exercised at any time upon the expiration date and European options can only be exercised at the expiration date (Hull, 2018, pp. 31).

The intrinsic value of an option is the value of the option contract if the option would be exercised immediately. It is the part of options value which forms between price differences of underlying asset and the exercise price. The excess value over the intrinsic value of an option is the time value of an option. The total value of the option is thus the sum of the two. An option contract should be exercised only if it has intrinsic value. Based on the value of the underlying stock price, options are referred to as in the money, at the money or out of the money. If *S* is the stock price and *K* is the strike price, a call option is in the money when $S > K$, at the money when $S = K$, and out of the money when $S < K$. A put option is in the money when $S < K$, at the money when $S = K$, and out of the money when $S > K$ (Hull, 2018, pp. 234).

Four option positions are a long position for call and put and short position for call and put. If *K* is the strike price and $S_T$ the final price of the underlying asset, the payoff from a long position in a European call is:

$$\max(S_T - K, 0), \tag{3}$$

the payoff from a short position in a European call is:

$$\min(K - S_T, 0), \tag{4}$$

the payoff from a long position in a European put is:

$$\max(K - S_T, 0), \tag{5}$$

the payoff from a short position in a European put is:

$$\min(S_T - K, 0), \tag{6}$$

Figure 4 illustrates payoffs for European call and put options.

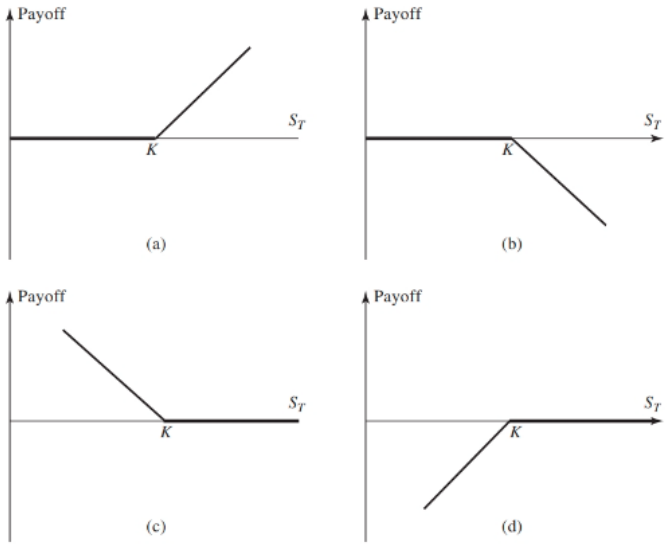



**Figure 4**. Payoffs from positions in European options: (a) long call; (b) short call; (c) long put; (d) short put. (Hull, 2018, 231)

### 2.2.3 Swaps

A swap is an over-the-counter agreement where two parties exchange cash flows or liabilities from two different financial instruments. The agreement defines the dates and terms of how the cash flows are to be paid. The most common swaps are interest rate swaps, currency swaps and commodity swaps. An interest rate swap is a swap where interest at predetermined fixed rate is exchanged for interest at floating rate. The most common floating reference interest rate in interest rate swaps is has been LIBOR. For instance, a swap negotiated earlier could be an agreement to exchange interest at 2% on a principal of 50 million USD for interest at three-month LIBOR on the same principal for the next five years with exchanges every three months (Hull, 2005, pp. 170).

## 2.3 Incentives to hedge

In this chapter, hedging is discussed in more detail as well as incentives to hedge. Hedging is primarily seen as a risk management tool to provide security against uncertainty related to the markets. To be more specific, this chapter brings out what kind of companies are most likely to use derivatives for hedging, different motives for corporate hedging and examples on when it could be suitable for companies to hedge.

Hillier et al. (2012, pp. 685-689) note that companies' use of derivative instruments on risk management has increased over the past decades. There are several reasons for increased interest towards risk management. Probably the most obvious reasons are increased volatility related to interest rates and exchange rates. Also the importance of multinational corporations has upgraded companies' investments on risk management. Education related to derivative instruments and increased knowledge towards risk management have also enhanced the use of risk management tools.

In general, corporate executives know more about the markets their businesses operate and thereby possess more information regarding risks associated with the business than their shareholders. In other words, it could be easier for large corporations to engage

with using risk management tools than it would be for individuals (Hillier et. al, 2012, pp. 658-689).

Previous research proves that smaller companies are less likely to use derivatives for risk management than larger firms. This finding is inconsistent with the fact that smaller firms face higher risks than large firms. In their international study related to corporate derivative usage, Guay & Kothari (2003, pp. 423-461) argue that earnings and cash flows are more volatile for small firms. Even though the benefits of hedging could be higher for smaller firms because the direct costs of distress do not increase proportionately with firm size, it appears that smaller firms hedge less.

The earlier research suggests that those firms with higher growth opportunities are more likely to use derivative instruments as risk management tools. In their study regarding determinants of corporate hedging among large American companies, Nance et al. (1993, pp. 267-284) state that taxes, expected costs related to financial distress and other agency costs decrease with hedging usage. Their empirical results also indicate that hedgers have significantly higher R&D expenditures and more investment options. These findings suggest that companies with better growth opportunities are more likely to hedge more. Consistent with findings above, Geczy et al. (1997, pp. 1323-1354) examine the use of currency derivatives among large U.S. corporations and find that those companies with higher growth opportunities are most likely to use currency derivatives. Allayannis & Weston (2001, pp. 243-276) continue earlier studies, including ones mentioned above, and estimate the impact of foreign currency derivative (FCD) usage on firm value, measured as Tobin's Q. They use a sample of 720 large non-financial U.S. companies between 1990-1995 and show that there is statistically significant and positive correlation between FCDs and firm value. With respect to earlier studies, the authors use investment growth (capital expenditures to total sales) as one of the explanatory variables and find that firms with higher growth opportunities have higher value.

While previous research proves that large firms and those companies with higher growth opportunities are more likely to engage with risk management instruments, leverage is also shown to be defining feature. Block & Gallagher (1986, pp. 73-78) study the use of interest rate futures among large U.S. companies and find little evidence about the correlation between higher debt ratios (e.g., leverage) and hedging. They also prove strong positive relation between company size and the use of interest rate futures. Wall & Pringle (1989, pp. 59-73) also find positive relationship between leverage and derivatives. In their analysis, they study the development of interest rate swap usage among companies listed on major U.S. stock exchanges during 1986. According to the authors, the use of interest rate swaps grew rapidly during 1980s and the key idea behind the use of them is to control for the repricing interval of company's debt that is already outstanding.

There are various reasons for companies to use financial derivatives for risk management. Whether to use derivatives to reduce uncertainty, for tax benefits or to control for financial distress costs depends on the company and its markets. In the real world there are various benefits that can be achieved through risk management. However, in their theoretical study regarding the cost of capital, Modigliani & Miller (1958, pp. 261-297) propose that in efficient markets (when there are no taxes, asymmetric information, or transaction costs), the market value of a firm is independent of its capital structure (e.g., the amount of debt or equity) because otherwise there would be arbitrage opportunities. As investors would exploit the arbitrage opportunities, the prices of overpriced shares would fall, and the prices of underpriced shares would go up until the market values of companies are the same. Thus, the value of levered company equals the price of a company that has no debt in its capital structure. Modigliani & Miller also state that risk management of companies is irrelevant because investors can do the hedging by themselves.

According to Smith & Stulz (1985, pp. 391-405), there are multiple incentives for companies to engage with risk management. Hedging can reduce the variation in company values before tax payments and thus, the expected tax liabilities. This increases the

expected firm value after taxes if the hedging costs are not unreasonable in relation to its benefits. Variation related to expected profits also affects the expected utility of wealth of company managers. Thus, executives have incentives to hedge as hedging reduces uncertainty related to expected profits. Costs related to bankruptcy can also encourage companies to hedge because companies can reduce their probability to experience bankruptcy through risk management. There are also incentives for shareholders to pursue their companies in interest to start to hedge. Firstly, hedging can increase companies' reputation in the eyes of debtors which can allow companies to issue cheaper debt. Secondly, hedging can reduce the amounts of strict terms in covenants related to bonds (e.g., can reduce the costs of financial distress).

Graham & Smith (1999, pp. 2241-2262) studies tax liabilities and their relation to hedging decisions. They find that those companies that face convex tax function, can decrease the volatility of their taxable income and thus, expected tax liability, through hedging activities. Their simulations reveal that five percent reduction in the volatility related to taxable income can result in over 5 percent savings of expected tax liabilities.

Consistent with evidence related to growth opportunities mentioned earlier in this paper, Geczy et al. (1997, pp. 1323-1354) study the use of currency derivatives among large American companies and find, that firms use currency derivatives to reduce the variation in their earnings or cash flows. Obviously, engaging with new projects requires cash so use of currency derivatives can be important factor on companies' possibilities to get started with new and valuable growth opportunities.

Nelson et. al (2005) study the effect of derivative use of stock prices among wide selection of U.S. firms during 1995-2000. With respect to the efficient market hypothesis suggesting that all information is reflected to stock prices, the authors test this by implementing Fama and French four factor model and including first time hedging firms in the Fama French portfolio for the 24-month window around the hedging activity. They find monthly abnormal returns of 0.478% for all new hedgers.

Whether hedging is beneficial or not can also be dependent on the industry company operates. Carter et al. (2006) state in their airline-related research that jet fuel makes significant amount of airline companies' total expenses. Airline companies thus have incentive to hedge fuel price risk so they can protect their ability to meet previously contracted commitments. Hedging provides firms with the opportunity to buy underpriced assets from those airline companies that experience financial distress when fuel price is going up. Especially larger airlines can exploit this and manage their cash flows. In their paper studying hedging activities conducted by oil and gas producers, Jin & Jorion (2006) find that hedging does not make significant difference in terms of company valuation between hedgers and non hedging companies. They conclude that it is possible that commodity price exposure such as oil and gas can be hedged away by retail investors themselves, which makes hedging performed by companies that operate in those industries useless.

Thus, earlier research in the field of hedging and company valuation (evidence from U.S.) would suggest that hedging done by companies is useful when hedging against foreign currency risk exposure. Hedging risk exposure related to commodity prices is another thing and it is dependent on the industry company operates in. Crucial element seems to be what can be done by individual investors and what is the added value created by companies when hedging different risk exposures.

As noted earlier in this thesis, companies use derivative instruments to hedge against the risks related to foreign currency, interest rates and commodity prices, for example.

*Foreign exchange risk* (Hillier, 2012. pp. 761-763), also known as exchange rate risk, is the risk of financial impact due to exchange rate fluctuations. It is the risk associated with the exchange rate changes between currencies. It is vital for multinational corporations to manage their currency risk as the changes in currency rates affect firms' cash flows, accounting profits and companies' market and book values. Risks associated with

exchange rates can be categorized in three groups: transaction risk, translation risk and economic risk. Transaction risk represents the immediate effect on cash flow of an exchange rate change. Transaction risk arises when a company buys or sells something that is priced in foreign currency, on credit. Transaction risk is something that is relatively easy for companies to hedge as the companies could for example demand payment in certain currency. Translation risk occurs because foreign subsidiary's financial statements must be translated into the home country's currency as part of the consolidated statements of the parent. Economic risk is the risk of losing competitive advantage because of exchange rate movements. This is more pronounced with multinational companies, but small local firms that import their products abroad or that have foreign competitors are also subject to economic risk.

*Interest rate risk* is the risk associated with interest rate fluctuations in assets. Interest rate risk exist in assets that come with interest such as loans and bonds. If the interest rates would rise, a loan would become more expensive for the debtor and the value of a bond would decline in the secondary market. Interest rate risk is measured by a bond's duration with longer-term bonds having a bigger price sensitivity to changes in interest rates (Bodie, 2017).

*Commodity price risk* (Hull, 2018. pp. 772-775) is the risk associated with price fluctuations in commodities that are important for the company. Commodities are categorized as agricultural (e.g., wheat, corn, cotton, etc.), metal (e.g., gold, silver, platinum, etc.) and energy (e.g., oil, gas, electricity, etc.) commodities. Fluctuations in the prices can have massive effects on companies' performance due to their impact on prices of the products, production costs and earnings. For example, transportation companies would benefit from the decrease of the prices of gas/oil because they are consumer in large amounts in the business. Conversely, increase in the prices would have negative effect on the business.

# 3 Literature review

According to broad research related to risk management through hedging tools, there are several benefits companies can achieve by using derivative instruments in their financial strategies. This chapter presents earlier research regarding corporate derivatives usage and its implications on company value in various markets. As already presented in this paper, Modigliani & Miller (1958, pp. 261-297) suggest in their capital structure-related theory, that risk management related to hedging is irrelevant. However, since market imperfections allows it for hedgers to add positive value through risk management, several research prove positive relationship between hedging activities and company value. With respect to papers discussed earlier in this paper, Graham & Rogers (1999) show positive relationship between firm market value and leverage, firm size, and growth opportunities. Their empirical analysis includes random sample of 531 U.S. companies through 1995. They find that high costs related to underinvestment and financial distress are key reasons for corporations to use hedging instruments for risk management. They show that hedging increases company value up to 2.2%-3.5% by increasing debt capacity and interest deductions.

Allayannis & Weston (2001) use Tobin's Q as proxy for firm value and estimate the relationship between foreign currency derivatives and company value. They use a sample of 720 large U.S. companies between 1990-1995 and find that use of currency derivatives increases alongside with foreign sales. They also find that there is statistically significant hedging premium when estimating company values between derivative users and non-users. To be more exact, the authors find that, on average, those companies that use currency derivatives and face currency risk have roughly 5% higher company value than those companies that do not use FCDs. They continue with the subject and conduct time-series analysis using event study method to discover whether hedging causes increase in company value when the hedging policy inside a company changes over time. Their findings are consistent with earlier evidence related to hedging and company value, as they show that those companies that start to use derivatives experience positive effect in company value that is higher than the effect of those companies that remain

unhedged. Also, companies that quit hedging activities experience decrease in their respective company values.

Guay & Kothari (2003) use 234 large U.S. firms during 1995-1997 and study financial derivatives and their importance in risk management. To be more specific, their aim is to reveal how much companies' risk exposure possibly decreases by using hedging instruments. They find that companies use of derivatives is small when considering their full risk profiles. Their regression results indicate small but positive relation between corporate derivative usage and company valuation. However, given the relatively modest derivative use of sample companies, these results do not indicate such strong evidence.

Hagelin & Pramborg (2004) use sample of Swedish firms to investigate foreign exchange exposure. They study the relationships between hedging practices and foreign exchange exposure of 130 Swedish small, medium, and large firms during 1997-2001. Their study is motivated by the awareness towards different shareholders and their interest on hedging by companies of their interest. The authors' focus is on currency derivatives and foreign debt, and whether companies are able to utilize them as risk management tools. Their findings indicate that companies' FX exposure increase alongside with the difference between costs and revenues denominated in foreign currency, and that there is negative relationship between FX exposure and firm size. Their findings also show significant reduction in FX exposure among firms that use financial derivatives for hedging. Thus, their findings are clear stating that currency derivatives and foreign denominated debt can both be used to reduce FX exposure.

In their research studying the implications of hedging on stock performance, Nelson et. al (2005) use broad sample of U.S. firms including all-sized companies to give more impartial results regarding the topic. According to the authors earlier studies have concentrated more on large firms and that they contribute by studying also smaller companies in several industries. Their final sample includes 5770 firms and 14 261 firm-year observations during 1995-1999. Their descriptive statistics reveal that out of these, only 21%

uses derivative instruments of any kind. They also add industry perspective into their study and find that derivatives are more common in mining, oil, and chemical industries. Retail stores report the lowest derivative use respectively. To estimate the implications of derivative usage, the authors conduct Fama and French four-factor regression method using portfolio returns in excess form and practically adding momentum factor to the three-factor model. Their results reveal that those companies that use financial derivatives face significantly lower systematic risk. What is new in this research is that the authors use companies of all size. The regression results are more concentrated in the larger firms, however which is consistent with earlier studies related to derivatives and company value. Their regression results also reveal that hedging companies outperform non-hedgers by 4.3% per year on average. However, they find that this outperform reported by hedgers is limited to those hedgers that use currency derivatives. The authors also compare the mean Tobin's Q of hedging firms to the mean Tobin's Q of non-hedging companies and find positive correlation between currency hedgers and company valuations.

Evidence suggests that hedging may be beneficial for companies operating in the airline industry because jet fuel covers significant amount of airline companies' total expenses. Research conducted by Carter et. al (2006) studies the hedging of jet fuel price risk exposure by U.S. airlines. They analyze 28 airline companies using 259 firm-year observations during 1992-2003. The authors report that, on average, jet fuel covers over 13% of airline company's total expenses in the sample. Out of the 28 companies, 18 report derivative use during the sample period. The authors find that Tobin's Q is positively correlated with hedging and that those companies with more productive investment opportunities also tend to hedge more. Leverage however is reported to have negative correlation with hedging, which could indicate that hedging is conducted by airlines with fewer financial constraints. The most important thing to take from this research is that those airline companies that employ with hedging derivatives trade at 12%-16% premium. Hedging adds value since it is economically significant to reduce exposure related to fuel price risk.

Airline industry is one example where hedging can provide serious benefits if fuel prices increase. Hedging can also be beneficial for companies in oil industry. In their paper, Yin & Jorion (2006) study hedging done by 119 U.S. oil and gas producers between 1998-2001. Their final sample includes 339 firm-year observations, and their final hypothesis estimates whether hedging companies eventually earn higher Tobin's Q values. Their univariate tests preveal no statistically significant difference in valuations of hedgers and non-hedging firms. Since Q is affected by several factors, the authors implement control variables in their regression model to give more explanatory power to their model. After adding firm size, profitability, investment growth, leverage, and production costs into their model, the authors still find no significant differences in market value between hedging firms and those firms that do not hedge their oil/gas price risk. The research is an example of a situation where hedging generates costs but eventually makes no difference in terms of valuation. The authors argue that one possible explanation for the non-existence of hedging premium could be explained by the fact that commodity risk exposure can be easily hedged away by individual investors. Since investors can do the hedging by themselves it does not add value for the companies to get involved with hedging activities. This conclusion is close with irrelevance theory proposed by Modigliani & Miller introduced in earlier parts of this thesis.

While most major studies related to hedging and company value is centralized in the United States, Belghitar et. al (2008) use UK data to provide with empirical evidence related to foreign currency and interest rate hedging made by companies. Their final sample includes 412 non-financial firms that was ranked in the top 500 UK firms ranked by their market values in 1995. Out of their sample, approximately 70% of companies used currency derivatives and 45% used interest rate derivatives. They use regression method strongly related to study conducted by Allayannis & Weston (2001), where Tobin's Q is used as a proxy for market valuation. This is then regressed on a set of variables used in this earlier paper. The findings are unambiguous as hedging is associated with higher Tobin's Q valuations for both currency and interest rate hedgers and the results are highly statistically significant. To be more exact, the authors find that foreign currency

derivatives is associated with hedging premiums between 8.5% and 15.3% whereas hedging premium associated with interest rate hedgers as large as 62%. The authors argue that the high value premiums generated by hedging firms in the UK could be biased since UK firms have higher foreign sales ratios compared to the U.S. The results also include, that research & development costs are positively related to valuations for both currency and interest rate hedgers. Leverage is negatively associated with hedging, respectively.

Clark & Judge (2009) continue research presented above and use the exact same sample of UK stocks to compare different hedging strategies. They seek to find out which derivative instruments are mostly used against short- and long-term exposures. The authors investigate forwards, options, foreign currency debt and swaps separately and with various combinations and find that foreign currency forwards and options are used to hedge against short term exposures while foreign currency debt and swaps are used more to hedge against long-term exposures. They find that foreign currency derivatives are associated with higher company valuation. However, such result was not found when estimating foreign currency debt except when combined with foreign currency derivatives. The method used in their paper follows the same methodology implemented by Allayannis & Weston (2001). The findings reveal that value premiums generated after the use of long-term swap contracts is associated with value premiums between 18% and 24%. Options and forwards are associated with value premiums between 13.2% to 14.2%. The findings here are consistent with Belgithar et. al (2008) implying that hedging can generate serious value among foreign currency hedgers.

Brunzell et. al (2011) contribute to previous literature with Nordic evidence from derivatives market. They use sample of 112 publicly listed firms from Finland, Denmark, Iceland and Sweden in 2006 and conduct partly qualitative research using questionnaires to find out the motives behind investing in derivatives as well as their implications on market valuation. Their findings show that hedging is positively associated with company value in general. They also find that the use of derivatives is more common in large firms

and in those firms that are less risky. Their findings also include motives behind the use of derivatives, and they note that while most of the companies use derivatives for risk management, almost half of their sample companies use them also for profit-seeking purposes. Long term debt negatively associated with hedging and surprising, or at least against expectations, size is negatively associated with hedging indicating small firms earn premiums with hedging.

Several studies indicate that derivatives use can have positive effect on company market valuation. Not all research suggest this positive relationship. Lookman (2004) studies oil and gas producers during 1992-2000 and finds that amongst undiversified companies, where commodity price is a primary risk, hedging decreases firm valuation. Fauver & Naranjo (2010) study derivative usage on 1746 U.S. firms during 1991-2000 and find that firms with greater agency costs and monitoring problems are associated with lower Tobin's Q values. Naito & Laux (2011) study 434 large non-financial U.S. firms during February of 2011 and find negative and statistically significant relationship between hedging and company valuation. Kwong (2015) also finds negative relationship between derivatives and company market valuation. He studies 620 non-financial companies listed in Malaysian markets during 2003-2012 and his univariate results show that derivative users perform better than non-users when Tobin's Q is used as a proxy for market value. However, when control variables leverage, company size, access to financial markets, growth opportunities, ROA, industry and time effects are added to the model, contrary results are found as multivariate model suggest lower firm market value for derivative users. This study bordered in the Malaysian markets also claim that company market value is significant determinant of derivatives use in the first place.

The results related to hedging with derivatives and firm valuation are not unambiguous. Bachiller et. al (2021) conduct a meta-analysis of 51 research made during 2001-2018 on financial derivatives and company valuation to find out what have been learned about derivatives and their possible benefits. Their study is motivated by the absence of consistent evidence regarding hedging with derivatives. They begin by concluding that

inconsistent evidence is explained by the data and time period used in different studies, model specifications, methodologies and country specific reasons. They use Fisher's Z transformation of correlation coefficients between hedging and firm value measured as Tobin's Q as the dependent variable in their regression. Control variables include the nature of derivatives (foreign currency, interest, commodity), the country law origin, developed vs. developing country and endogeneity. The multivariate tests showcase that derivatives use increases firm value. The results also suggest significant hedging premium depending on the nature of the derivative instrument and that the use of derivatives is more valuable in developed countries. The authors conclude their meta-study by stating that more research is needed to improve general understanding of derivative instruments and their impact on firm valuation during financial crisis.

One aspect of this thesis is to study the effectiveness of hedging during current global crisis. Bartram et. al (2011) study derivative use in 47 countries between 1998-2003. They find that companies that use derivatives have lower cashflow volatility and standard deviation of returns and higher market values. Firms that use derivatives in their financial strategies have 1% to 7% higher Tobin's Q values than those firms that do not use these instruments. After finding that the use of derivatives can have multiple benefits for companies, the authors examine the effectiveness of derivatives during global recession of 2000 and 2001. During those years, majority of large stock markets experienced significant downturns. To test the hypothesis related to the recession years, they calculate the annual differences in risk adjusted betas and standard deviations from 1998 to 2003. The results show that hedgers have lower standard deviation in each year. The differences in results are also larger between 2000-2001. Results for market beta are congruent as derivative users have lower risk levels during the whole estimation period. The authors conclude that hedgers have clearly lower risk than non-hedgers and that this lower risk can add more value during times of financial or economic downturn.

Panaretou (2014) studies corporate risk management and company value during financial crisis of 2008. He uses non-financial companies listed on FTSE 350 during 2003-2010

and out of all sample companies, 86% reported using financial derivatives in their strategies. Tobin's Q is used as a proxy of company value in the regressions and the results show that currency hedgers experience statistically significant positive impact up to 6% on firm value during the whole sample period. The results indicate that the impact is not statistically significant for interest rate and commodity hedgers. To measure the effectiveness of hedging during the financial crisis, the author includes indicator variable in the regressions indicating the financial crisis period 2007-2010 (variable equals 1 for the target period and 0 otherwise). The regression results showcase that the results are not statistically significant indicating that the hedging premium does not change during the economic downturn. The author also creates sub-sample to capture only the year of 2007 and the results indicate that the premium for currency hedgers is lower during the year the financial crisis started.

Luo & Wang (2018) study foreign currency derivatives and their implications on market value of Chinese companies during 2000-2013. They find that companies that hedge risk related to foreign risk exposure have higher market valuations measured as Tobin's Q. Roughly 15% of sample companies reportedly used foreign currency derivatives during the time period of the study and the results show that these companies have almost 32% higher Tobin's Q values than companies that do not use foreign currency derivatives. The authors also estimate the effectiveness of the use of FCD during the financial crisis 2008-2009. They introduce binary dummy variable that equals 1 during those years and include that in their regression model. The coefficient noting the effect of FCD's on market value during the financial crisis is negative and statistically significant which means that the positive effect foreign currency derivatives have will diminish during the crisis period.

Ahmed et. al (2020) examine derivative use among non-financial UK firms listed on FTSE during 2005-2017. Their aim is to find out what is the effect of derivative usage on firm value measured as Tobin's Q among those companies that use derivatives to hedge against foreign currency rate, interest rate and commodity price risks before, during, and after the global financial crisis. Out of the 378 sample companies, 72%, 62% and 17%

use foreign currency, interest rate and commodity price derivatives, respectively, Overall, 84% of sample companies hedge against at least one of the listed risks with derivatives during the estimation period. The authors implement difference-in-differences method, where they use treatment group (derivative users) and control group (non-users). In this method, they "*compare the outcome of a sample of treatment and control firms in hedging financial risks by considering the possibility that the impact of exogeneous factors on performance and value might vary across times that coincide with 'before, during and after' the 2007-2009 global financial crisis".* The results showcase that hedging foreign currency risk is beneficial during pre-crisis, crisis and post-crisis (positive and statistically significant effects on firm value of 10.5%, 3.1% and 1.2%, respectively. Coefficients for interest rate and commodity price hedgers are all negative and statistically significant. Thus, when considering value effects derivative instruments might have on company valuation during crisis period, these results would suggest that the type of risk hedged matters.

**Table 1.** List of studies regarding derivatives and their implications on company value

| Authors | Years | Sample | Effect | Type |
|---|---|---|---|---|
| **Modigliani & Miller (1958)** | | | no | All hedging |
| **Graham & Rodgers (1999)** | 1995 | 531 U.S. firms | Positive | FCDs + IRDs |
| **Allayannis & Weston (2001)** | 1990-1995 | 720 large U.S. firms | Positive | FCDs |
| **Guay & Kothari (2003)** | 1995-1997 | 234 large U.S. firms | minimal | All |
| **Hagelin & Pramborg (2004)** | 1997-2001 | 130 Swedish firms | Positive | FCDs |
| **Lookman (2004)** | 1992-2000 | 125 oil and gas producers | Negative | CPDs |
| **Nelson et al. (2005)** | 1995-1999 | 5770 U.S. firms | Positive | All |
| **Carter et al. (2006)** | 1992-2003 | 28 airline firms | Positive | CPDs |
| **Jin & Jorion (2006)** | 1998-2001 | 119 oil and gas producers | No effect | CPDs |
| **Belgithar (2008)** | 1995 | 412 UK firms | Positive | FCDs + IRDs |
| **Clark & Judge (2009)** | 1995 | 412 UK firms | Positive | FCDs |
| **Fauver & Naranjo (2010)** | 1991-2000 | 1746 U.S. firms | Negative | All |
| **Brunzell et al. (2011)** | 2006 | 112 Nordic firms | Positive | All |
| **Bartram et al. (2011)** | 1998-2003 | 6888 firms | Positive | All |
| **Naito & Laux (2011)** | 2011 | 434 U.S. firms | Negative | All |
| **Panaretou (2014)** | 2003-2010 | 350 UK firms | Positive | All |
| **Kwong (2015)** | 2003-2012 | 680 Malaysian firms | Negative | All |
| **Luo & Wang (2018)** | 2000-2013 | 70000 firm-quarter obs. | Positive | FCDs |
| **Ahmed et al. (2020)** | 2005-2017 | 378 UK firms | Differs | All |

# 4 Data and methodology

The empirical part of this research begins by introducing the sample data. After the sample is introduced, the dependent variable as well as control variables used in the regressions are presented. After the variables are introduced, summary data is collected to capture the mean and median values for all variables. Methodology-section at the end of this chapter includes univariate and univariate regression tests as well as discussion of the results.

## 4.1 Data

The purpose of this thesis is to test whether hedging adds value to companies or not. The data used in this research includes non-financial companies listed in Nasdaq Helsinki during 2016-2020. Time period of five years is chosen because it gives a reasonable time period to evaluate the implications of derivatives on company value. It also captures the effect of the current global pandemic that started early in 2020. Nasdaq Helsinki is chosen because it represents comprehensive sample of Finnish firms operating in different industries. It is also the most followed index in Finland. While most research related to derivatives and firm value are focused on U.S. markets and other larger economies, this paper provides Finnish evidence. Finnish market is significantly smaller than many other markets that have been studied related to the subject so this data will give results from smaller economy.

The sample includes non-financial companies listed in Nasdaq Helsinki during 2016-2020. Financial companies are excluded from the sample because they are usually market makers in derivative markets and their motives differ from non-financial companies. Companies that got listed in 2019 or later are excluded from the sample to get results from longer time period, and to keep it simpler. The final sample includes 107 companies 2073 firm quarter observations. The data used in the regressions is gathered from the Thomson Reuters Datastream database. Data related to derivative usage and dividend policy

(dummy variables that are introduced in more detail later in this chapter) however, are manually collected from companies' annual statements.

The sample includes the year 2020 to capture the effects of downturn that started in Q1 of 2020 due to the global Covid-19 pandemic. During this downturn, Nasdaq Helsinki lost 36% of its value in little over one month. So called "fear index" the volatility index (VIX) rose from 13 to 82.69 at the same time. Figure 5 captures the movements of Nasdaq Helsinki and VIX. The drop of Nasdaq Helsinki and the jump of VIX index occurred during Q1 of 2020.

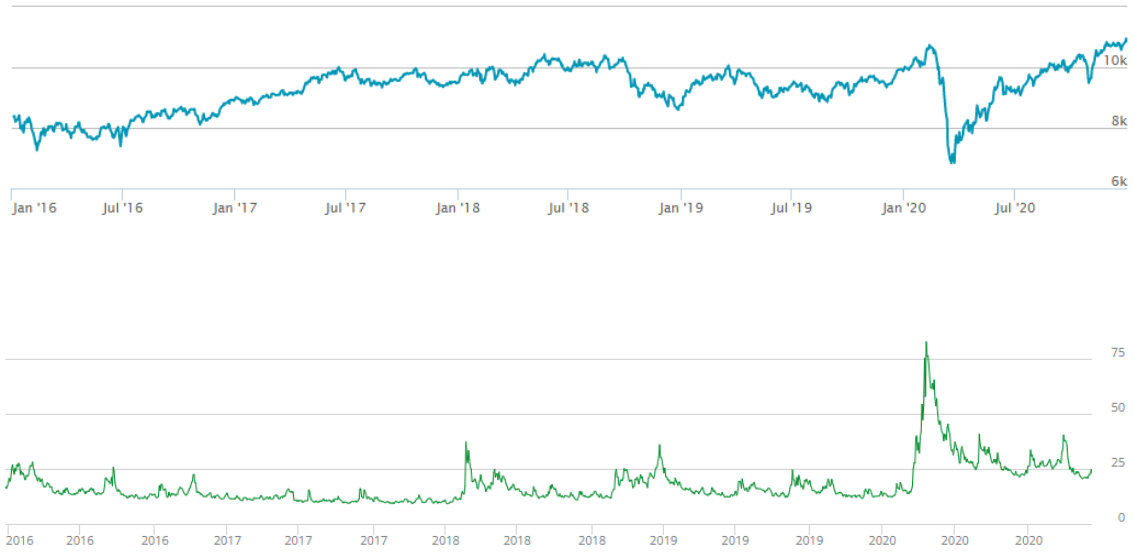



**Figure 5.** Nasdaq Helsinki (above) and VIX (below) during 2016-2020. (Nasdaq OMX Helsinki, 2023, CBOE 2023)

Figure 6 graphs the VIX through 2007-2020 including several financial and economic crises. The graph shows that the index had similar movements during the financial crisis and Covid pandemic indicating high levels of uncertainty during both times. Several earlier research related to hedging during the financial crisis suggests that the use of derivatives have a positive effect on company value during periods of high uncertainty.

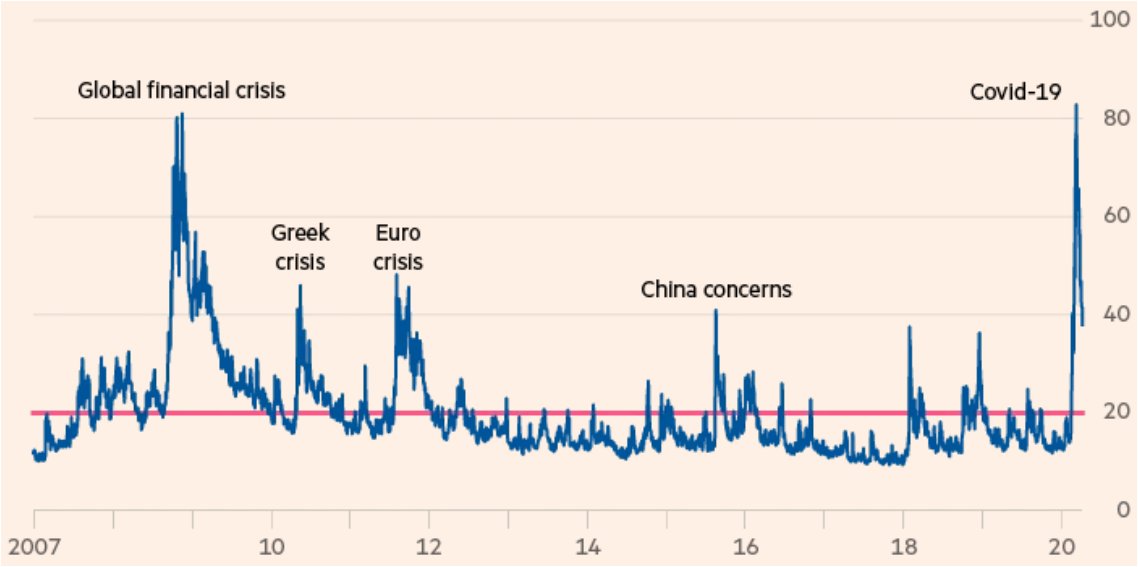



**Figure 6.** VIX index through 2007-2020 including different crises. Credit Suisse Global Investment Returns yearbook 2020. VIX data from CBOE.

### 4.1.1 Dependent variable

The dependent variable used in univariate and multivariate regressions is chosen based on the previous research related to derivatives and their implications on firm value. As introduced earlier in this paper, several research consider Tobin's Q as reliable proxy for company value (e.g., Allayannis & Weston, 2001; Nelson et al., 2005; Luo & Wang, 2018), so it is also used in this thesis. Tobin's Q is also easy to calculate since the values needed for the calculations are found in companies balance sheets. Tobin's Q is simply calculated by dividing the market value of total assets by replacement cost of total assets. Market value of total assets is calculated by adding total liabilities to market capitalization. Market capitalization is the price of a stock multiplied by the total number of outstanding shares. Book value of total assets is used as the replacement cost of total assets since the replacement cost would require more detailed data. Also, book value of assets has been used in several research. The formula for calculating Tobin's Q is as follows:

$$Tobin's\ Q = \frac{MV\ of\ Total\ Assets}{Total\ Assets} \quad (7)$$

In their study considering derivative usage in Chinese markets, Luo & Wang (2018) state that Q values above 1 means that stock of the company is overpriced as its market value is higher than the replacement cost of its assets. Vice versa, values below 1 suggest that the company is underpriced.

### 4.1.2 Independent variables

Set of firm characteristics has been proven to have effect on company value (i.e., Tobin's Q). Variables used in this paper are based on earlier research related to the subject. Studies conducted by Allayannis & Weston (2001), Nelson et al. (2005) and Luo & Wang (2018), for example, use set of firm characteristics that are also implemented in this thesis. The variables used are introduced in the following.

*Firm size* (SIZE) has been shown to have an effect on firm valuations. As noted in this paper based on earlier research, large firms are more likely to use derivatives (e.g., Allayannis & Weston 2001; Guay & Kothari, 2003). Large firms are also associated with higher company valuations based on earlier evidence (Guay & Kothari, 2003; Belgithar, 2008). Firm size is measured as natural logarithm of company's total assets. Logarithm is used to control for the size effect. Size is expected to have a positive effect on firm value.

*Leverage* (LEV) is used as companies' capital structure possibly have an effect on its value. Leverage is the ratio of the book value of long term debt to total assets. Evidence related to leverage and hedging is mixed. Graham & Rodgers (1999) find positive relationship between hedging and leverage while Belgithar (2008) shows the opposite results.

*Profitability* (PROF) is calculated by dividing net income with total assets. It is the return on assets (ROA). A profitable company is likely to trade at a premium in comparison to a

less profitable one (Allayannis & Weston, 2001). Thus, this variable is expected to have a positive impact on Tobin's Q.

*Growth* (GROWTH) is the ratio of capital expenditures to total sales. Capital expenditures are investments for the future, and it is proven to have a positive effect on firm value. Companies with better growth opportunities are also shown to hedge more (Géczy et al. 1997).

Geographical diversification (GEOG) is the ratio of foreign sales to total assets. Earlier research suggest that international companies tend to create value and that foreign sales is positively associated with firm value (Belgithar, 2008; Luo & Wang, 2018). Hence, the sign of this variable is expected to be positive.

Dividend (DIV) is a dummy variable which takes value of 1 if a company distributed any dividends during the year. If a company did not pay any dividends during the year, the dummy variable takes value of 0. According to Allayannis & Weston (2001) and Jin & Jorin (2006), if companies that hedge abandon projects because they are not able to obtain necessary financing, their Q values may remain high because they only engage with projects that have positive net present values. In other words, companies that have restricted access to capital markets can only accept positive NPV projects. Dividend payments thus is expected to be negatively associated with company value.

Covid (COVID) is a dummy variable that takes on value of 1 during Q1 of 2020. All other quarters take value 0. This dummy variable captures the effect of downturn that was caused by the covid pandemic. it is expected that the crisis period have negative effect on company valuation.

Hedger (HEDGER) is also a dummy variable that takes on value of 1 if company used any derivative instruments during the year. The reasoning behind the use of derivatives is irrelevant here as all companies that use derivatives for any purposes are considered as

hedgers. The type of derivative is also not separated as company is considered as a hedger if it used any derivative instruments.

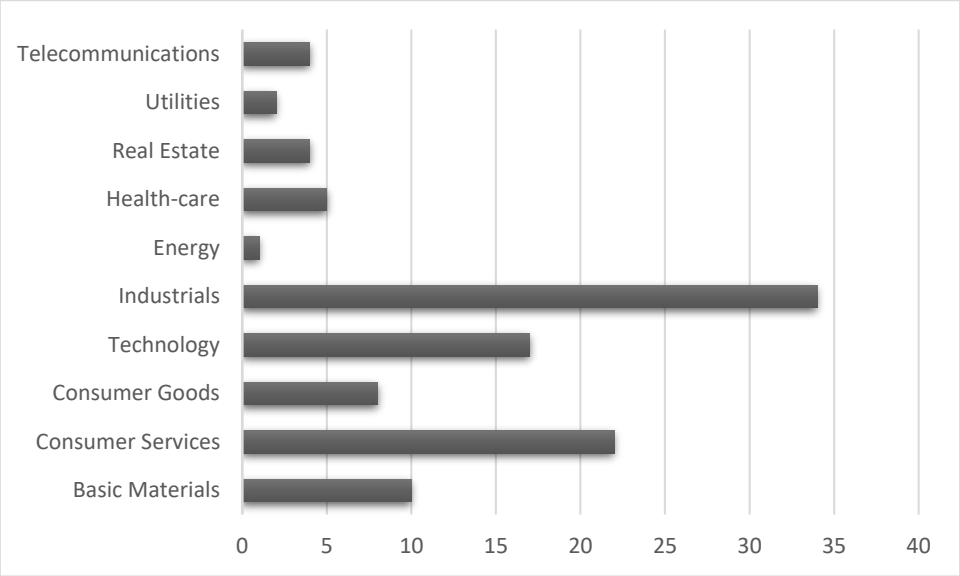
In addition to variables above, industry and time effects are controlled in the regressions. Industry dummies (INDUSTRY) include 10 industries: industrial, real estate, technology, health care, telecommunications, utilities, consumer services, basic materials, consumer goods and energy. Time effects (TIME) are also controlled using yearly dummies.

**Table 2.** Summary of variables

| Variables | Predicted sign | Definition |
|---|---|---|
| **Tobin's Q** | | MV of total assets / BV of total assets |
| **Firm size** | + | Natural logarithm of total assets |
| **Leverage** | - | BV of long term debt / total assets |
| **Profitability** | + | Net income / total assets |
| **Growth** | + | Capital exenditures / total sales |
| **Geog. Diver.** | + | Foreign sales / total sales |
| **Dividend** | - | Dummy variable for dividend payers |
| **Hedger** | + | Dummy variable for derivative users |
| **Covid** | - | Dummy variable for Q1 2020 |

Nasdaq Helsinki includes companies from 11 different industries. Since financial companies are excluded from the sample, the final sample includes companies from 10 industries. Out of the 107 sample companies, 34 operate in industrial which is the most popular industry in the index. Figure 7 charts industries in Nasdaq Helsinki.

**Figure 7.** Nasdaq Helsinki industries



### 4.1.3 Summary statistics

Summary statistics of main variables used in the univariate and multivariate regressions are presented in Table 3. Panel A lists the statistics of variables of all 107 sample companies including 2093 firm-quarter observations. Panels B and C list the same variables for hedgers and non-hedgers, respectively. Mean value for hedger-dummy variable is 0.63 which means that 63% of firm-quarter observations includes the use of any derivative instruments. Mean and median of Tobin's Q is above 1 (panel A) indicating that the market value is higher than the replacement cost of assets. Hence, the stocks of Nasdaq Helsinki can be considered over-valued, on average.

Panels B and C show that hedgers have lower Q values than non-hedgers. The first hypothesis of this thesis says that hedging is associated with higher firm valuation. According to summary statistics, we would reject this hypothesis. However, regressions should be made to get more sophisticated data.

Another thing that can be reasoned from Table 3 is that larger companies use more derivatives since the value for size variable is 13.64 for hedgers in comparison to value 11.09 of non-hedgers. This finding is in line with earlier research. The mean and median values of leverage are 0.20 and 0.16 indicating that most of the sample companies have more equity than debt in their capital structure. It is also notable that foreign sales is positively associated with hedging as the mean value for geographical diversification is 0.50 for hedgers and 0.22 for non-hedgers.

**Table 3.** Summary statistics

| Variable | N | Mean | Median | Std. Dev. | Min | Max |
|---|---|---|---|---|---|---|
| **Panel A: All firms** | | | | | | |
| **Tobin's Q** | 2073 | 1.92 | 1.42 | 1.82 | 0.56 | 23.19 |
| **Hedger** | 2073 | 0.63 | 1.00 | 0.48 | 0.00 | 1.00 |
| **Firm size** | 2073 | 12.71 | 12.42 | 2.15 | 8.57 | 19.41 |
| **Leverage** | 2073 | 0.20 | 0.16 | 0.26 | 0.00 | 9.35 |
| **Profitability** | 2073 | 0.01 | 0.01 | 0.12 | -2.22 | 2.48 |
| **Growth** | 2073 | 0.07 | 0.02 | 0.57 | 0.00 | 23.22 |
| **Geographical div.** | 2073 | 0.40 | 0.37 | 0.38 | 0.00 | 1.12 |
| **Dividend** | 2073 | 0.69 | 1.00 | 0.46 | 0.00 | 1.00 |
| | | | | | | |
| **Panel B: Hedgers** | | | | | | |
| **Tobin's Q** | 1351 | 1.62 | 1.36 | 0.94 | 0.56 | 8.72 |
| **Hedger** | 1351 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 |
| **Firm size** | 1351 | 13.64 | 13.73 | 2.04 | 9.31 | 19.41 |
| **Leverage** | 1351 | 0.20 | 0.17 | 0.28 | 0.00 | 9.35 |
| **Profitability** | 1351 | 0.01 | 0.01 | 0.03 | -0.43 | 0.34 |
| **Growth** | 1351 | 0.05 | 0.03 | 0.10 | -0.18 | 1.11 |
| **Geographical div.** | 1351 | 0.50 | 0.58 | 0.37 | 0.00 | 1.12 |
| **Dividend** | 1351 | 0.82 | 1.00 | 0.39 | 0.00 | 1.00 |
| | | | | | | |
| **Panel C: Non-hedgers** | | | | | | |
| **Tobin's Q** | 789 | 2.44 | 1.55 | 2.70 | 0.75 | 23.19 |
| **Hedger** | 789 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Firm size** | 789 | 11.09 | 11.02 | 1.14 | 8.57 | 14.05 |
| **Leverage** | 789 | 0.20 | 0.14 | 0.21 | 0.00 | 1.41 |
| **Profitability** | 789 | 0.01 | 0.01 | 0.19 | -2.22 | 2.48 |
| **Growth** | 789 | 0.11 | 0.01 | 0.93 | -0.23 | 23.23 |
| **Geographical div.** | 789 | 0.22 | 0.00 | 1.14 | 0.00 | 1.00 |
| **Dividend** | 789 | 0.48 | 0.00 | 0.50 | 0.00 | 1.00 |

The main purpose of this study is to test whether the use of derivatives is positively associated with firm value. The possibly effect of covid downturn which started in Q1 of 2020 is also estimated. Table 4 shows variables of all companies during the whole time period 2016-2020 and for the year 2020. Mean and median Tobin's Q values decreased during the downturn which is not that surprising. Leverage increased during the downturn indicating that companies took more debt during the crisis period. The values also indicate that companies used more derivatives during 2020.

**Table 4**. Comparison of variables between 2020 and the whole time period

| | **Whole period N = 2073** | | **2020 N = 428** | |
|---|---|---|---|---|
| **Variable** | **Mean** | **Median** | **Mean** | **Median** |
| Tobin's Q | 1.92 | 1.42 | 1.68 | 1.24 |
| Hedger | 0.63 | 1.00 | 0.64 | 1.00 |
| Firm size | 12.71 | 12.42 | 12.88 | 12.64 |
| Leverage | 0.20 | 0.16 | 0.22 | 0.18 |
| Profitability | 0.01 | 0.01 | 0.00 | 0.00 |
| Growth | 0.07 | 0.02 | 0.05 | 0.02 |
| Geographical div. | 0.40 | 0.37 | 0.41 | 0.42 |
| Dividend | 0.69 | 1.00 | 0.68 | 1.00 |

## 4.2 Methodology

Tobin's Q has been widely used as a proxy of company value in several studies related to hedging and company valuation. To examine if hedging adds value for companies, univariate and multivariate regressions are run to test the implications of hedging. Several studies report positive relationship between derivative usage and company value (e.g., Allayannis & Weston, 2001; Bartram et al. 2011; Panaretou, 2014). The main hypothesis of this study is tested with univariate test, to see whether hedging is associated with higher company valuations or not. After univariate test, multivariate tests are used to get more explanatory power.

### 4.2.1 Univariate analysis

In univariate analysis, Tobin's Q is used as dependent variable. This analysis uses only one explanatory variable, hedger, to see if the users of derivatives experience positive effect on firm value. Industry and time dummies are used in the model, however. As this regression only includes hedger as explanatory variable, it shows direct effect of derivative usage on Tobin's Q. The results will give clear implication on how hedgers succeeded

compared to non-hedgers in terms of firm valuation. The formula used in the univariate regression is as follows:

$$Tobin's\ Q = \beta_0 + \beta_1 HEDGER_{it} + u \quad (8)$$

Table 5. shows results for univariate test. Value for hedger is negative and statistically significant at 1% level indicating that derivative users have 13% lower company values than companies that does not use any derivative instruments. This result would lead to rejecting the null hypothesis because it states that the use of derivatives has no effect on firm value. However, the $R^2$ of the univariate test is 0.26 which is low meaning that the model has only little explanatory power. Hence, more variables are needed in the regression model in order to get more powerful results. It is expected that multivariate regression that is run next will yield higher explanatory power.

**Table 5**. Univariate pooled OLS regression results

| **Variable** | **Tobin's Q** |
|---|---|
| Constant | 0.40 |
| | *(1.208)* |
| Hedger | -0.13*** |
| | *(-5.479)* |
| Industry dummies | Yes |
| Time dummies | Yes |
| N | 2093 |
| $R^2$ | 0.26 |

***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Before multivariate regression tests, the variable used in the model should be tested for multicollinearity. Woolridge (2016, pp. 83-86) states, that the correlation between variables used in regressions should be low. If the variables used in the model are highly correlated however, multicollinearity becomes an issue. Pearson correlation coefficient is a measure of linear correlation between two sets of data. It is the covariance of two variables divided by their standard deviations. In other words, it shows how two variables move in relation to each other. The correlation value range between -1 and 1. -1 implies completely negative correlation and 1 indicates completely positive correlation. In case of highly correlated variables, the model itself is still reliable. However, the individual explanatory variables become biased (independent variables are not truly independent), and the analysis is not that strong. Table 6 presents Pearson correlation matrix of main variables used in the multivariate regression model. Hedging, company size and leverage seem to have statistically significant negative correlation between Tobin's Q according to the matrix. Profitability and geographical diversification have positive and statistically significant correlation. However, as noted earlier correlation between dependent and independent variables are not an issue in multivariate regressions. Firm size, foreign sales and dividend payments are positively correlated with the use of derivatives. This is also in line with earlier literature which state that large companies and those companies that have international operations hedge more. Size and hedging are variables that have the highest correlation (0.57) according to the matrix.

There are several statistically significant correlations between the variables. However, the correlations are rather low. Out of 36 correlations, 31 range between -0.21 and 0.14. Highest correlations occur between size and hedging (0.57) as already mentioned, foreign sales and hedging (0.37), dividend payments and hedging (0.34), foreign sales and company size (0.44) and dividend payments and company size (0.34). Thus, multicollinearity should not be a problem in the multivariate regressions.

**Table 6.** Pearson correlation matrix

| | Q | Hedger | Size | Lev | Prof | Growth | Geog | Div | Covid |
|---|---|---|---|---|---|---|---|---|---|
| **Q** | 1 | | | | | | | | |
| **Hedger** | -0.21*** | 1 | | | | | | | |
| **Size** | -0.21*** | 0.57*** | 1 | | | | | | |
| **Lev** | -0.09*** | 0.00 | 0.03 | 1 | | | | | |
| **Prof** | 0.06*** | 0.01 | 0.02 | -0.13*** | 1 | | | | |
| **Growth** | -0.01 | -0.06*** | -0.03 | 0.11*** | -0.04* | 1 | | | |
| **Geog** | 0.11*** | 0.37*** | 0.44*** | -0.09*** | -0.01 | -0.04** | 1 | | |
| **Div** | -0.04* | 0.34*** | 0.34*** | -0.11*** | 0.12*** | -0.08*** | 0.14*** | 1 | |
| **Covid** | -0.03 | 0.00 | 0.02 | 0.01 | -0.02 | -0.01 | -0.01 | -0.02 | 1 |

***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

### 4.2.2 Multivariate analysis

Univariate test indicates negative relationship between derivative usage and company value. Clear conclusions cannot be made however because of the weak explanatory power in the model. It is possible that other variables introduced earlier in this chapter have an effect on the dependent variable. Hence, multivariate analysis is needed to specify the effects of other variables. In this thesis, these variables are size, profitability, leverage, growth, geographical diversification and dividend payments. Details of these variables are presented in Table 2. Industry and time effects are also controlled in the model. Multivariate regressions are made using two different approaches, pooled OLS regression and fixed effects regression.

In statistics, Ordinary Least Squares (OLS) is a common technique for estimating coefficients of linear regression equations which describe the relationship between one or more independent variables and a dependent variable. Pooled OLS regression means that the observations in the data are pooled, and thus it ignores the structure of the panel data. The data used in this thesis is unbalanced panel data. According to Woolridge (2011, pp. 265-278), panel data consists of observations on the same cross-section (e.g., individuals, cities, firms) over a period of time. Having data over time for the same cross section units is beneficial for several reasons. For one, it allows us to look at dynamic relationships. It also allows for controlling unobserved cross section heterogeneity.

Similar to the univariate regression, the dependent variable used in multivariate regression is Tobin's Q. With respect to earlier research (e.g., Allayannis & Weston, 2001; Luo & Wang, 2018) related to hedging and company value, the model for the multivariate tests is as follows:

$$Tobin's\ Q = \beta_0 + \beta_1 HEDGER_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 LEV_{i,t} + \beta_4 PROF_{i,t} + \beta_5 GROWTH_{i,t} + \beta_6 GEOG_{i,t} + \beta_7 DIV_{i,t} + \beta_{8-17} INDUSTRY + \beta_{18} TIME + u \quad (9)$$

Table 7. presents results for pooled OLS multivariate regression. In the first model, the regression model is estimated using all sample companies including 2073 observations. When looking at the first model (left column), the sign of hedger is -0.15 and statistically significant at 1% level indicating that hedging companies are associated with 15% lower firm value. Surprisingly, or at least against expectations, size has a negative effect on firm value. The result is statistically significant at 1% level. Similar "surprising" results were found by Brunzell et. al (2011) in their research studying Nordic firms. Foreign sales and dividend payments are positively associated with firm value according to this model as both have positive signs, and they are statistically significant at 1% level. Leverage, profitability and growth have no statistically significant effects. The first model indicates that

companies with more foreign sales have better firm valuations. This is in line with earlier research related to the topic. Especially the use of foreign currency derivatives is associated with higher company valuations according to several research (e.g., Hagelin & Pramborg, 2004; Belgithar, 2008). In the second model, the same multivariate regression is made by using only companies with foreign sales. The number of observations is 1375, meaning that roughly 65% of companies have foreign sales. The results of the second model indicate that hedging is even more negatively associated with firm value as the value for hedger is -0.37. The result is also highly statistically significant. Size has a negative effect and the effect is the same as in the first model. Implications of dividend payments and foreign sales are positive, but even more pronounced in the second model in comparison to the first. What separates the first and the second model in terms of results is leverage, as it is negatively associated with company value and the result is highly statistically significant. This is also in line with expectations (Table 2). The third model includes all 107 sample companies, but size and foreign sales variables are omitted from the model. This is because those variables have the highest correlations with the dependent variable and hedger variable (see Table 6.). Earlier research also suggests, that firm size and international operations are an important aspect and positively associated with firm value. According to the results from the third model, hedgers are associated with 15% lower company values.

The R-squared, which indicates the explanatory power of the model range between 19% and 31%. This indicates that the pooled OLS regression model used here is affected by autocorrelation and heteroscedasticity. Woolridge states that fixed effects model could generate better results. He reminds that in addition to fixing the autocorrelation and heteroscedasticity problem, the fixed effect model can correct multicollinearity. The model is also a better fit for a sample with many cross-sectional units and a small number of time periods. The results from pooled and fixed effects regressions should essentially be similar, but the statistical power of using fixed effects model should be better. The fixed effects model captures time-constant factors that might have an effect on the dependent variable (Woolridge, 2011, pp. 265-278).

**Table 7.** Pooled OLS multivariate regression results

| Variables | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| Constant | 0.93** | 0.99** | 0.35 |
| | *(2.691)* | *(8.861)* | *(1.053)* |
| Hedger | -0.15*** | -0.37*** | -0.15*** |
| | *(-5.517)* | *(-9.371)* | *(-6.200)* |
| Size | -0.04*** | -0.04*** | |
| | *(-5.437)* | *(-4.728)* | |
| Leverage | -0.06 | -0.51*** | -0.09** |
| | *(-1.478)* | *(-4.767)* | *(-2.046)* |
| Profitability | 0.13 | 0.18 | 0.11 |
| | *(1.466)* | *(1.456)* | *(1.207)* |
| Growth | 0.02 | -0.08 | 0.02 |
| | *(1.400)* | *(-1.532)* | *(1.234)* |
| Geog. Div. | 0.26*** | 0.36*** | |
| | *(7.909)* | *(7.356)* | |
| Dividend | 0.10*** | 0.19*** | 0.09*** |
| | *(4.009)* | *(5.112)* | *(3.431)* |
| Covid | 0.17 | -0.02 | 0.10 |
| | *(0.359)* | *(-0.035)* | *(0.203)* |
| Industry dummies | Yes | Yes | Yes |
| Time dummies | Yes | Yes | Yes |
| R2 | 0.31 | 0.19 | 0.27 |
| N | 2073 | 1375 | 2076 |

***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Table 8 presents multivariate regression results using fixed effects. Model 4 includes the whole sample period and all variables, model 5 firms with foreign sales and model 6 omits size and foreign sale variables. According to the fourth model, hedging is positively associated with firm value as hedgers have 4% higher firm values. The result is statistically significant at 10% level, so the result is not as strong as it was with pooled OLS. What is notable however, is that the sign differs as the effect was negative when using pooled OLS regression method. Size is negatively associated with firm value and the result is highly statistically significant. Foreign sales have a positive effect and it is highly statistically significant. What is different in these results is that profitability is negatively

associated with firm value and that this finding has 1% statistical significance. The same with company size, this finding is surprising given the earlier research and the expected results. Model five uses the same regression formula but only using those sample companies with foreign sales. According to the results, hedging has no effect on firm value. The value is zero and it has no statistical significance. This differs from pooled OLS regression results which stated that companies with foreign sales are strongly associated with lower firm values. Size is negatively associated with firm value and the result is highly statistically significant. The model also gives negative results for profitability, just like in model four. These results related to size and profitability are more pronounced here when only using companies with foreign sales. The sixth model, which omits size and foreign sales variable gives no significant results related to hedging variable.

What is notable from the results from table 8 is that leverage has no significant effect with any of the models. The result related to hedging is also mixed with the pooled OLS regression model. Also, the explanatory power of the models is better compared to pooled OLS as the R-squared range between 87% and 91%.

What can be concluded from these multivariate regressions (pooled and fixed) is that according to all models, size is negatively associated with firm value. This is the most surprising result given the earlier research related to the topic. Foreign sales have a positive relationship between firm value and this result is the same in all models tested. This finding is in line with the expected results and earlier research. Even though the results related to hedging are mixed, the results suggest negative relationship between hedging and firm value have stronger statistical significance.

**Table 8**. Multivariate regression results with fixed effects

| **Variables** | **Model 4** | **Model 5** | **Model 6** |
|---|---|---|---|
| Constant | 2.71*** | 3.70*** | 0.44*** |
| | *(11.835)* | *(12.658)* | *(13.454)* |
| Hedger | 0.04* | 0.00 | 0.03 |
| | *(1.856)* | *(0.027)* | *(0.735)* |
| Size | -0.19*** | -0.26*** | |
| | *(-10.223)* | *(-11.688)* | |
| Leverage | 0.00 | -0.07 | -0.01 |
| | *(0.190)* | *(-4.767)* | *(0.699)* |
| Profitability | -0.11*** | -0.16*** | 0.11*** |
| | *(-2.958)* | *(-3.709)* | *(-2.829)* |
| Growth | 0.01 | -0.04** | -0.01 |
| | *(-1.322)* | *(-2.053)* | *(-1.568)* |
| Geog. Div. | 0.18*** | 0.15** | |
| | *(4.406)* | *(2.246)* | |
| Dividend | 0.00 | 0.07 | -0.01*** |
| | *(0.017)* | *(3.125)* | *(-0.753)* |
| Covid | -0.23 | -0.22 | -0.26 |
| | *(-1.185)* | *(-1.272)* | *(-1.308)* |
| Industry dummies | No | No | No |
| Time dummies | Yes | Yes | Yes |
| R2 | 0.89 | 0.91 | 0.87 |
| N | 2073 | 1375 | 2076 |

***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

According to earlier research, whether it is beneficial to hedge can also be dependent on the industry. Table 9 captures multivariate regression results with fixed effects using the most popular industries in Nasdaq Helsinki. The final sample includes 107 companies in different industries and out of these, 34 operate in industrials, 22 in consumer service and 17 in technology. These three industries include overall 73 companies which means that 68% of sample companies operate in these industries. The sample index thus is highly concentrated within these industries, and these could affect the results. In Table 9, model 7 represents industrial, model 8 consumer service and model 9 technology. The regression model used here is the same as in previous multivariate regressions, the sample is just adjusted according to the industries. According to the results, hedgers have 22% higher firm values among industrial firms. The result is statistically significant at 1% level. Value for profitability is 1.62 and highly statistically significant indicating that profitability is strongly associated with higher firm valuation among industrial companies. In consistent with earlier results in this study, size is negatively associated with firm value. Model 8 captures the results for companies that operate in consumer service. Hedgers are associated with 21% lower firm value and this result has 10% statistical significance. Size is positively associated with firm value and this finding is highly statistically significant. Profitability is also positive and strongly significant. According to model 9, hedging is negatively associated with firm value among technology firms. The result is not statistically significant, however. The value for size is negative and the result is highly statistically significant. In consistent with the result of models 8 and 9, profitability is also positively associated with company value. The value for foreign sales is positive and highly statistically significant. What is notable here in table 9 is that the explanatory power of the models is strong.

What can be concluded from Table 9 is that hedging is positively associated with firm value among industrial firms and that hedging is negatively associated with firm value among companies operating in consumer service. The result for technology is not statistically significant. Size is negatively associated with firm value among industrial and

technology companies. Profitability is positively associated with company value among all three industries.

**Table 9**. Multivariate regression results with fixed effects (industry)

| Variables | Model 7 | Model 8 | Model 9 |
|---|---|---|---|
| Constant | 1.01** | 3.31*** | 5.06*** |
| | *(2.465)* | *(5.059)* | *(7.097)* |
| Hedger | 0.22*** | -0.21* | -0.04 |
| | *(4.697)* | *(-1.758)* | *(-0.454)* |
| Size | -0.06* | 0.09*** | -0.411*** |
| | *(-1.858)* | *(-4.128)* | *(-5.990)* |
| Leverage | -0.04 | 0.08 | -0.44*** |
| | *(-0.468)* | *(0.506)* | *(-3.017)* |
| Profitability | 1.62*** | 1.05*** | 0.34** |
| | *(5.763)* | *(3.218)* | *(2.337)* |
| Growth | 0.01 | 0.18 | 0.04 |
| | *(1.201)* | *(1.085)* | *(0.217)* |
| Geog. Div. | 0.06 | -0.05 | 0.46*** |
| | *(0.862)* | *(-0.602)* | *(2.608)* |
| Dividend | 0.02 | 0.01 | -0.06 |
| | *(0.832)* | *(0.159)* | *(-1.215)* |
| Covid | | | |
| Industry dummies | No | No | No |
| Time dummies | Yes | Yes | Yes |
| R2 | 0.85 | 0.87 | 0.86 |
| N | 680 | 426 | 320 |

***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

The null hypothesis of this study states that the use of derivatives has no effect on firm value. Since most of the models used in this study provide statistically significant results for the hedging variable, it is proved that the use of derivatives do have an effect on firm value. Thus, the null hypothesis of this study is rejected. Hypothesis 1 states that the use of derivatives is positively associated with company value. According to pooled OLS multivariate regression results, hedging is negatively associated with firm value. One of the models used in multivariate regression with fixed effects provides the opposite result.

However, the statistical significance is lower in the latter one. Regressions covering industry review show that hedging is negatively affected with firm value among companies that operate in consumer service and technology. The results for industrial companies are different. Thus, just like the earlier research regarding the topic, the results are mixed. However, most of the models including univariate test indicate that hedging is negatively associated with firm value and thus, hypothesis 1 is rejected.

Most of the models above indicate that hedging and size is negatively associated with firm value among Nasdaq Helsinki companies. Table 10 provides pooled OLS regression results before covid, during the whole sample period, and during 2020. The results for, before crisis period, and during the whole sample period are alike, as in both models hedging is negatively associated with firm value. Size also has a negative relationship with firm value. Foreign sales and dividend payments are positively associated with firm value. The rightmost column captures the results for the year 2020 and the value for hedging is lower than before indicating that the effectiveness of hedging was even lower during 2020. As discussed already in this paper, the explanatory power of pooled OLS is not very strong here. Similar results were found by Panaretou (2014) and Luo & Wang (2018) in their research studying the implications of the use of derivatives on firm value during financial crisis of 2007-2009.

**Table 10.** Multivariate pooled OLS regression results (time periods)

| **Variables** | **Before crisis** | **Whole period** | **2020** |
|---|---|---|---|
| Constant | 0.96*** | 0.93** | 0.73** |
| | *(2.807)* | *(2.691)* | *(2.51)* |
| Hedger | -0.15*** | -0.15*** | -0.16** |
| | *(-5.033)* | *(0.027)* | *(-2.484)* |
| Size | -0.04*** | -0.04*** | -0.04** |
| | *(-4.858)* | *(0.007)* | *(-2.400)* |
| Leverage | -0.06 | -0.06 | -0.13 |
| | *(-1.538)* | *(0.041)* | *(-0.752)* |
| Profitability | 0.08 | 0.13 | 1.26*** |
| | *(0.869)* | *(0.087)* | *(2.775)* |
| Growth | 0.02 | 0.02 | 0.46*** |
| | *(1.025)* | *(0.017)* | *(2.652)* |
| Geog. Div. | 0.28*** | 0.26*** | 0.16** |
| | *(7.713)* | *(0.032)* | *(2.074)* |
| Dividend | 0.05* | 0.10*** | 0.27*** |
| | *(1.903)* | *(0.025)* | *(4.265)* |
| Covid | | 0.17 | -0.13** |
| | | *(0.46)* | *(-2.302)* |
| Industry dummies | Yes | Yes | Yes |
| Time dummies | Yes | Yes | Yes |
| R | 0.31 | 0.3 | 0.31 |
| N | 1645 | 2073 | 428 |

***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Finally, Table 11 presents the same regression models but with fixed effects. The explanatory power of the regression model with fixed effects is strong. According to the results, hedgers have 8% higher firm value before 2020. This result is strongly statistically significant. During the whole sample period hedgers are associated with 4% higher value. The result capturing 2020 is not statistically significant. Thus, very strong conclusions cannot be made from the results presented in Table 11.

**Table 11**. Multivariate regression model with fixed effects (time periods)

| **Variables** | **Before crisis** | **Whole period** | **2020** |
|---|---|---|---|
| Constant | 3.82*** | 2.71*** | -0.91 |
| | *(14.678)* | *(11.835)* | *(-0.078)* |
| Hedger | 0.08*** | 0.04* | 0.10 |
| | *(2.183)* | *(1.856)* | *(0.691)* |
| Size | -0.28*** | -0.19*** | -0.03 |
| | *(-13.133)* | *(-10.223)* | *(-0.583)* |
| Leverage | 0.01 | 0.00 | 0.13 |
| | *(0.718)* | *(0.190)* | *(0.818)* |
| Profitability | -0.15 | -0.11*** | 0.03 |
| | *(-4.330)* | *(-2.958)* | *(0.130)* |
| Growth | -0.01 | 0.01 | 0.10 |
| | *(-1.531)* | *(-1.322)* | *(1.125)* |
| Geog. Div. | 0.22*** | 0.18*** | 2.76 |
| | *(5.127)* | *(4.406)* | *(0.100)* |
| Dividend | -0.06*** | 0.00 | -0.06 |
| | *(-2.813)* | *(0.017)* | *(-0.421)* |
| Covid | | -0.23 | 0.43*** |
| | | *(-1.185)* | *(2.988)* |
| Industry dummies | No | No | No |
| Time dummies | Yes | Yes | Yes |
| R | 0.91 | 0.89 | 0.96 |
| N | 1645 | 2073 | 428 |

***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

The hypothesis 2 tests if the use of derivatives is associated with higher company value. Same with the results from earlier regressions, the results here are not unambiguous. According to pooled OLS regression results the value for hedging decreased when estimating during 2020 in comparison to the time before crisis and during the whole

observation period. The results for fixed effects regression model are not statistically significant, so strong inferences cannot be made. Given these results, the hypothesis 2 is rejected since those results with any statistical significance indicate even more negative relationship between hedging and firm value compared to the time before 2020.

# 5 Conclusions

This thesis studies non-financial companies listed in Nasdaq Helsinki. The final sample includes 107 companies that operate in 10 different industries. The observation period was between 2016 and 2020. The main purpose of this thesis was to test whether those companies that use derivatives have higher company values measured as Tobin's Q. Out of the sample companies, 72% report the use of derivative instruments in their financial statements during at least one of the observation years. Summary statistics present that large firms, firms with foreign sales, and firms with more dividend payments are more likely to use derivative instruments.

To examine the hypotheses univariate and multivariate regressions are conducted. The results from univariate regression suggest that hedgers have 13% lower firm value measured as Tobin's Q. After univariate test, multivariate tests were made using pooled OLS regressions and regressions with fixed effects. Explanatory variables used in the regressions were size, leverage, profitability, growth, geographical diversification and dividend payments. The results from pooled OLS multivariate regressions suggest that hedging is associated with 15%-37% lower firm value depending on the model. Results from fixed effects regression model give the opposite results as hedging is associated with 0%-4% higher firm valuation. In terms of statistical significance, the results from pooled OLS regressions are stronger.

The sample was also divided into sub-samples based on the industry companies operate. 68% of the sample companies operate in industrial, consumer service or technology. Consistent with findings from univariate and multivariate regressions, companies that operate in consumer service and technology experience negative relationship between hedging and firm value as the value premiums are -22% and -4%, respectively. However, hedging is associated with 21% higher company valuations among industrial companies. These results would suggest that whether hedging adds value or not is dependent on the industry.

The implications of Covid-19 and the economic downturn that started in early 2020 was also examined. As most of the models used in the regressions suggest negative relationship between hedging and firm value, the effect was even more pronounced during 2020 indicating that hedging did not add value during period of high uncertainty. This finding is consistent with research conducted by Panareotu (2014) and Luo & Wang (2018). However, different results have also been found as Ahmed et. al (2020) find positive relationship between hedging and firm value before, during, and after among foreign currency hedgers in UK. Hence, it is possible that the type of derivative matters and this is also one of the limitations of the thesis as noted in the beginning of the study.

To conclude, even though the results are not clear, the findings of this thesis suggest that hedging does not add value among companies listed in Nasdaq Helsinki. Industrial companies are an exception however and this finding should not be left out since it is the most popular industry in the index.

In this paper, derivative users were not divided into groups based on the type of the derivative but classified as hedgers if the company used any derivative instrument during the year. Majority of the earlier research regarding the topic find positive relationship between hedging and firm value especially among foreign currency derivative users. For further research, dividing derivative users into groups based on the type of derivatives used could possibly generate more accurate results. Also, the findings of this thesis indicate that industry is a contributing factor when it comes to effectiveness of hedging. Hence, more accurate industry-based approach could also give stronger results.

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