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THE USE OF DERIVATIVES AND FIRM MARKET VALUE: FINNISH EVIDENCE FROM 2010–2016

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ABSTRACT

After the recent financial crisis, the derivatives market has been hit with higher level of regulation standards to prevent and minimize the risks related to massive open derivative positions. Nevertheless, the corporate level risk management practices are widely using derivatives to hedge different market risks. Due to the counterparty default risk related to derivative products the financial markets have become more vulnerable to crises, which has also questioned the value of derivatives as risk management strategy.

This thesis contributes to the existing literature by testing the relation between hedging and firm market value in firms listed in Nasdaq OMX Helsinki. Tobin's Q is used as a proxy for firm market value in univariate and multivariate tests which divide hedgers in three categories: foreign exchange hedgers, interest rate hedgers and commodity price hedgers. In addition, a firm value effect of the relative size of firm's derivative position is tested using hedging coverage as a control variable.

The results through univariate and multivariate tests contrast with Allayannis and Weston (2001) findings as hedgers are identified with negative firm value effect. The effect is estimated to be -10,98 % for foreign currency hedgers and -5,27 % for interest rate hedgers, while general hedgers coefficient is negative but insignificant. Further research with larger international sample is required to confirm the findings and the effect of hedging coverage as the demographic of hedgers and non-hedgers in the Finnish sample is strongly driven by firm size.

KEYWORDS: derivatives usage, firm value, risk management, hedging

1. INTRODUCTION

The nominal amount of over-the-counter (OTC) derivatives in the global market increased substantially during the years 1998–2008. According to the Bank for International Settlements (BIS) statistics, during the long upward trend the peak was reached at $683.7 trillion in June 2008. At that point the financial crisis was already on its way, and the macro economic insecurity that followed caused the fluctuation in the derivatives overall value for the years 2008–2014. After a slight downturn, the nominal amount of OTC derivative contracts reached all-time high in June 2011 and again in December 2013 at $710.6 trillion. Since then the trend has been downward, resulting in the lowest value of past decade at $482.4 in December 2016. Part of this decline can be explained by exchange rate fluctuations, since depreciation of the euro against United States (U.S.) dollar causes the dollar amount of reported euro derivatives to diminish. However, the elimination of redundant contracts has been the main factor behind the fall. (BIS 2018.) Figure 1 describes the total nominal value of all OTC derivatives contracts from 1998 to 2017.

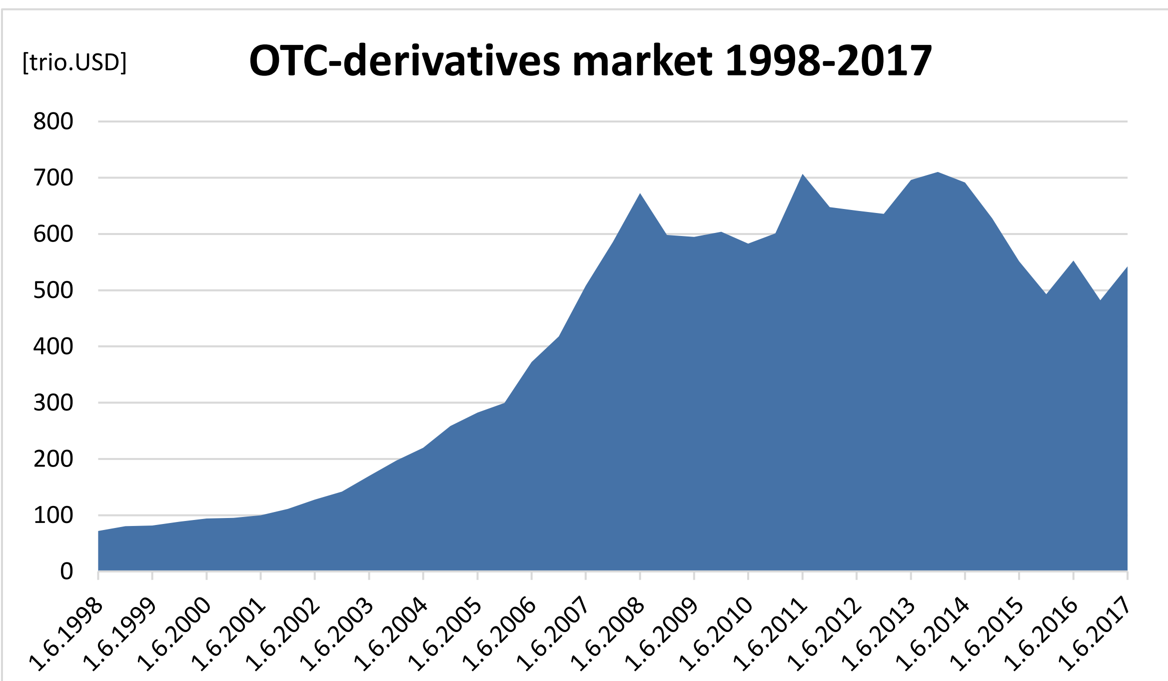


Figure 1: OTC–derivatives market 1998–2017. (BIS 2018.)

The global derivatives market consists of two main parts: Exchange traded markets and OTC markets. The open outcry system, where traders meet physically to form the contracts was originally used in the exchange traded markets, but when technology advanced and computers became a part of everyday business, electronic trading largely substituted the open outcry system. The total amount of transactions is greater in the exchange traded markets, since automatic trading programs perform transactions faster than manually possible. OTC markets include trading between banks and large institutions; hence there is a much greater total value of derivatives contracts compared to exchange traded markets. (Hull 2012; 2-4.) Because of the economic downturn of recent years, derivatives are used broadly as a tool to control firm's financial risk. In fact, the market instability after the financial crisis in 2008 has driven firms more strongly towards using derivatives as risk management tool in the pursue of more predictable cash flows and better endurance for the years after the negative interest rates are no longer present.

Overall during the last 40 years derivatives have become an important part of the financial markets worldwide, and consequently it has raised the supply of theoretical literature and empirical studies on derivatives to a whole new level. The derivative market growth can be partly explained by the rising interest in firms towards financial risk management, as derivatives are a useful tool, especially in cash flow management. Followed by the rapid expansion of the derivatives market in the 20th century, several studies have been conducted on derivatives, firm's incentives to use them and the effects of derivatives on firm market value. Allayannis and Weston (2001) study was the first one to establish a direct link between derivatives and firm market value. Their results show a significant relation between the use of foreign currency derivatives in the firm and positive firm market value measured by Tobin's Q.

1.1. Purpose and hypothesis

According to Modigliani and Miller (1958) theorem, the market value of any firm is independent of its capital structure. The M&M theorem was introduced as the first proposition of their study "The Cost of Capital, Corporation Finance, and the Theory of Investments" and it is one of the basic principles of corporate finance theory. This theorem suggests that controlling unpredictable cash flows by using derivatives has no effect on the firm market value, and that risk management is irrelevant for the firm as the shareholders can manage their risk by allocating their investment portfolio. (Allayannis & Weston 2001: 1.)

In the past decades the theorem has been frequently challenged and several studies have examined whether a positive firm value effect exists in firms that use derivatives as a risk management tool. Allayannis and Weston (2001) study can be thought as a ground study for this relationship, their sample consists of 720 large non-financial U.S. firms and it focuses on foreign currency derivatives users. They are among the first ones to study the direct link between use of derivatives and firm market value by using Tobin's Q as a proxy for the firm market value. Since then, there have been several studies on derivatives and firm value effect based on variety of different samples. Bartram, Brown and Conrad (2011) study the firm value effect with large international sample including firms from 47 countries, while Brunzell, Hanson and Liljeblom (2011) focus on Nordic firms by studying firm's motivations behind derivatives usage. In addition, Pramborg (2004) and Alkebäck, Hagelin and Pramborg (2006) study derivatives usage in Swedish firms with data from the late 90's.

The purpose of this thesis is to examine the effect of derivatives usage on firm market value among publicly listed Finnish companies during years 2010 – 2016. Due to increased regulation on derivatives and improved reporting standards the data of derivative usage in firms is widely available from the financial statements, which improves the credibility of the results presented in the study. As majority of derivatives users are now reporting the nominal position of the open derivative contracts, it is possible to test if the relative size of the derivatives position has any influence on the firm market value, which has not been included in most of the previous studies. Naito & Laux (2011) have however tested fair and nominal value of firms' relative derivatives position as control variable in their study on non-financial U.S. firms. They find indication of negative value premium for derivative users although their results were not significant and limited to the year 2009. By introducing the control variable into larger sample consisting longer time period, it is possible to get more significant results for the position size effect.

Apart from other thesis papers published in recent years, the Finnish firms are relatively untested group of derivative users when it comes to firm value effect. The size of the domestic market in Finland is substantially smaller compared to U.S., which means Finnish firms have more incentive to conduct business abroad to increase their revenue streams. This raises the need for foreign currency hedging in firms which can also be observed from the user data collected for this thesis. The hypotheses of this thesis are based on the prior empirical studies of derivatives and firm market value and on the assumption that data taken during negative interest rate environment might provide different results. The main hypothesis tests the positive firm value effect in firms that use derivatives in general by studying the levels of Tobin's Q between users and non-users, and the secondary hypotheses test whether hedging with foreign exchange derivatives or commodity derivatives specifically is associated with higher firm market value. Third hypothesis is based on more recent assumption that the negative interest rate market environment is causing current interest rate hedges to be inefficient and expensive for the hedgers. Furthermore, the fourth hypothesis focuses on what kind of effect the relative size of open derivatives position has on firm market value, if such relation can be found.

H1: Hedging with general derivatives has a positive effect on firm market value.

H2: Hedging with foreign exchange or commodity derivatives has a positive effect on firm market value.

H3: Hedging with interest rate derivatives is related with negative value premium during the negative interest rate environment.

H4: The reported relative size of open derivative position has a positive effect on firm market value.

These hypotheses are tested first in mean and median univariate tests and finally in multivariate regressions with selected control variables. The univariate tests include testing the mean and median value differences in Tobin's Q value between users and non-users, and between users of different type of derivatives. Multivariate tests are carried out with Tobin's Q as dependent variable and proxy for firm market value, and size, leverage, profitability, liquidity, growth, dividend yield and ability to access financial markets as control variables which are proven to influence the firm market value in prior literature. In addition, a control variable for derivative position size is added to the group of control variables to see if the level of hedging has any impact on the market value. Furthermore, the multivariate tests are conducted using both pooled OLS regression and fixed effect regression methods.

1.2. Motivation and structure of the thesis

The motivation for this thesis originates from the personal interest towards derivatives instruments and their part in risk management strategies in non-financial firms. We have witnessed several cases of sizeable financial losses during the financial crisis by a single firm in only short period of time caused by speculative use of derivatives and unhedged derivative positions. For instance, in 2006 a hedge fund Amaranth Advisors LLC lost 6.5 billion dollars in only one week's time because of their aggressive speculative positions in natural gas derivatives. Amaranth Advisors expected the natural gas market price to fluctuate in the spring of 2007 and 2008 and locked derivative positions which would result in profit in case the spread of the March and April contracts would increase. The opposite happened, and the hedge fund ended up in liquidation within a week as a consequence of losing over 65 percent of its value in September 2006. (Hillier, Grinblatt & Titman 2012: 201.)

After the crisis various stress tests have been executed for banks worldwide to see how vulnerable they are if another financial crisis emerges. Tests were carried out for Eurozone banks as well, and in Germany the Deutsche Bank's financial stability has since been under review. Deutsche Bank failed one of the stress-tests in March 2015 and lost over 30% of its market value during the 15 months that followed. Deutsche Bank's derivative positions in 2013 were valued to be over 54 trillion euros, which is over five times bigger than Eurozone GDP (Yahoo Finance 2016.) In case of Deutsche Bank would become unable to pay its derivatives obligations it would create a massive chain effect for the firms holding the opposite positions which could possibly result in even bigger financial crisis than the one Europe is now recovering from.

This thesis contributes to the existing empirical literature by testing the firm value effect with the most recent data collected from relatively untested market environment in Finland. The results cover the "aftermath" of the financial crisis and will show how and if the Finnish firms have adjusted their open derivative positions. Furthermore, the results show if the use of interest rate, foreign exchange or commodity derivatives itself can be linked with positive market value effect, and as a fresh angle, whether the relative size of the open derivative position is a factor when the market value is considered.

The thesis is structured as follows: In the second chapter the most common derivatives types are introduced and compared while the third chapter focuses on risk management theory and the effects of hedging on firm market value including review of prior academic studies in such field. The prior studies are summarized and categorized into three groups based on to which derivative type hedging their results contribute to: interest rate derivatives, foreign exchange derivatives or commodity price derivatives firm value effect. The fourth part includes the introduction of the data sample, followed by univariate and multivariate regression estimates and the related results. The final part consists summary of results and conclusions of this thesis and suggestions for further research ideas and angles on the topic of hedging and firm market value.

2. DERIVATIVES THEORY

This section discloses the basic tools to understand the use of derivatives and their part in firm risk management strategies, including theoretical background of the general derivatives.

2.1. Derivatives background

According to one general definition, a derivative can be defined as a financial instrument, whose value depends on the value of the underlying asset or variable. The value of a derivative can also be derived from the value of basically any other variable. The asset from which a derivative's value is derived from is called the underlying asset. This underlying asset of stock option for instance, is a stock of a certain firm. Besides financial assets, the underlying asset of derivative can be practically anything from a price of a salmon to an amount of rainfall in certain city. It has become increasingly important for everyone working in the financial sector to understand how derivatives work, and even for people working outside financial sector. After all, derivatives market is estimated to be considerably larger than the stock market when measured in terms of underlying assets. (Hillier et al. 2012: 202; Hull 2012: 1.)

Derivatives can be used as simple tools for hedging, but when used as a way to make profit by speculating the market movements, the risks involved with the positions increase considerably and the firm becomes more vulnerable to losses. The most common derivatives introduced in this thesis are quite simply constructed and easy to understand, but to operate profitably with the more sophisticated derivative structures, deeper understanding is needed of the theory behind derivatives pricing and the current risk level of the underlying assets.

Derivatives market has received a lot of attention and criticism after the recent financial crisis, where derivatives played a key role in the starting stages of the crisis. The first steps towards the crisis were taken in the United States when the standards of housing mortgages were relaxed in the beginning of 20th century, which invited families that did not normally have access to a house loan, to join the housing market. This resulted in rising house prices which forced the lenders to search for more ways to relax the standards, as the house prices became too expensive for families who were just then entering the market. (Hull 2012: 185-191.)

In the process the lenders started to pay more and more attention to the possible profit that they could make from the mortgages rather than the financial solvency of the customers taking the loan. The possible profit to be made from a new loan became more important than the possible credit risk the customer would cause if the loan was granted. Out of these loans portfolios were constructed and turned into products called asset-backed securities or ABS. Basically ABS was used to transfer risk from a single portfolio and divide it into several investment branches with different interest rates, which would create profit for the investors if the underlining asset provided any cash flow. The investors were buying into a derivative product, but they had no way of knowing how risky assets it included and whether the ABS would provide any cash flow, since it was created out of risky house loans which were granted to families who would not be able to handle their loan expenses to begin with. (Hull 2012: 189–191.)

These families were lured in to the housing market by attractive lower loan interest rates for the first few years of the loan, after which the interest rates would bump up. In 2007 several mortgage holders realized that they would not be able to afford the loan payments after these lower rates ended, which caused a wave of foreclosures in the housing market. Increasing amount of foreclosures increased the losses on mortgages, which lead to ABS products created out of these mortgages to report losses larger than 80 % of their value by the end of 2007 and become totally worthless by summer 2009. As a result, several major financial institutions suffered sizeable losses because of their big positions in ABS tranches; JP Morgan took over Bear Stearns and Bank of America took over Merrill Lynch and eventually Lehman Brothers was allowed to fail. Lehman Brothers had sizeable positions in over the counter derivative markets with close to 8000 different counterparties, which explains how the crisis spread so easily across the globe. The aftermath of the crisis was followed by several new laws and global regulations on banking industry, including stricter regulations in the OTC derivative market. (Hull 2012: 4, 189–195.)

These crisis scenarios involving derivatives and the fact that negligent or speculative use of derivatives can result in practically unlimited losses has resulted in harder regulation standards concerning derivatives trading. The dynamic of financial derivatives trading is that the deals are struck between at least two parties, and so the effects of a single defaulting counterparty can trigger a wave of defaults in firms holding the opposite positions.

To control for the risks related to derivatives markets, the European Market Infrastructure Regulation (EMIR) regulation for derivatives started in August 2012. The new act was introduced as part of the post crisis regulations to ensure such scenario would not be repeated. The aim was to increase the availability of information on derivative contracts in general and to improve the risk management related to OTC-derivatives, a market which was previously rather unregulated. In addition to EMIR regulation, similar acts were issued globally as well. EMIR act consists of three pain parts: the regulation on derivatives, standardized legislation concerning central clearing counterparties and improved regulation for trade repositories to which derivative positions are reported. Based on the EMIR regulation, all derivative users are to report their open contracts as of 16th of August 2012, concerning all open trades or new trades made after that date. The EMIR act was approved by European Union commission in December 2012 and became valid later in March 2013. (Finanssivalvonta 2018.)

Since then the regulation on derivatives has increased step by step including the global regulation standards MIFID and MIFIDII concerning close to everyone working on the financial sector from sales persons to clients. According to current standards the derivative users are obliged to clear certain derivative contracts with a third counterparty, called central clearing broker, to minimize the risk of counterparty default. In addition, changing of cash collateral to cover the risk related to open OTC-derivative positions became widely mandatory to all counterparties in financial sector during 2017, focusing especially on banks, insurance companies and other large financial institutions. The new act contributing to the existing EMIR regulation required collateral movements between counterparties on daily basis based on the changes in their bilateral derivative positions. The daily collateral movements are based on the variation margin, which is the daily change in the value of all trades in the bilateral derivative position. Furthermore, as banks are required to move part of their derivative positions to central clearing brokers to minimize the counterparty default risk, daily collateral movements between the bank and the clearing broker are required to cover the variation margin changes in the cleared derivatives position. These changes in the regulation and especially the stricter requirements concerning derivatives reporting have made the firm level position data widely more available as firms are expected to disclose the risk related to their open derivative contracts in their annual fiscal reporting. Therefore, the data for open derivative positions for the sample firms is manually collected from the fiscal reports along with the information on firms' derivative usage to form the control variable to test the fourth hypothesis. (Finanssivalvonta 2018.)

2.2. The main derivative types

The main derivative types in the market can be divided in to four groups: *swaps*, *options*, *forwards* and *futures.* Figure 2 shows the gross market values of main derivatives types in OTC derivatives market according to BIS statistics. Credit default swaps and Credit derivatives are included in the figure as their own group to demonstrate how the value of credit default swaps grew in the brink of the financial crisis in 2008 and has since then diminished considerably.

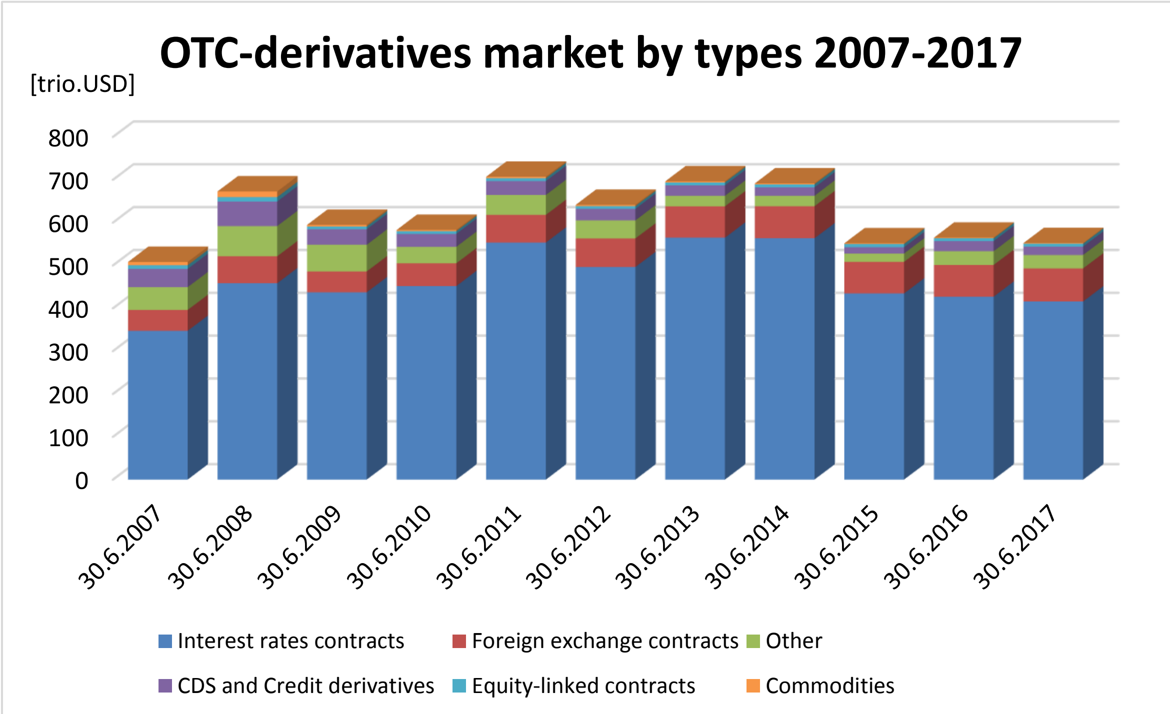


Figure 2: OTC gross market values of main derivative types 2007–2017. (BIS 2018.)

2.2.1. Swaps

Swaps are contracts between two parties that include an agreement to exchange cash flows or to change cash for certain commodity. The contract defines specific dates when the exchange takes place and how the amount due for each party is determined. Swap maturity is determined by the last date of cash flow exchange, and the notional amount of swap defines the amount of the principal on which the interest is calculated. Swaps are generally used to control risk involved with unpredictable future cash flows. Swaps, like other derivatives can be customized from the general form, but the most commonly used swaps are interest rate swaps, currency swaps and credit default swaps. (Hillier et al. 2012: 206; Hull 2012: 152.)

In 1993 the interest rate swaps covered barely 10 trillion dollars of OTC derivatives market value. Since then the interest rate swap market has grown considerably, resulting that in OTC markets interest rate swaps are presently the most commonly used derivatives type. According to BIS statistics, in 2015 interest rate swaps accounted for 319,9 trillion dollars of the OTC derivatives market, while the total

OTC derivatives market notional amount was 559,9 trillion dollars at the time. (Hillier et al. 2012: 207; BIS 2018.) Interest rate swap is an agreement where companies exchange regular payments of loan interests. A company with a floating interest rate loan can transform the floating interest into a fixed interest rate by entering to a swap contract, where the counter partner agrees to pay floating rate interest of agreed principal amount. In exchange for receiving floating rate payments, the company conducts fixed rate interest payments of the same agreed principal amount for the counterpart of the contract. The profit of interest rate swap contract is determined by calculating the net cash flow of the exchanged payments for each party. (Hull 2012: 155–156.)

Currency swaps enable firms to issue bonds in any chosen currency and to exchange the returns into any currency required at the time. Moreover, multinational companies are now able to hedge the exchange rate risk associated with global transactions in different currencies, and to exploit the possibility to secure the lowest borrowing rates from the global capital markets. For instance, a currency swap can be used to transform U.S. dollar financial instrument into one denominated in euros, by exchanging principal and interest payments in these two currencies. The rapid growth in Eurobond market is also partially due to the fast-growing currency swap market. (Hillier et al. 2012: 47, 207.)

In fixed-for-fixed currency swap, principal amounts are first exchanged at the initiation of swap using the market exchange rate. For instance, in exchange for USD principal amount a company receives euro principal amount from the counterparty. The other party conducts annual or semi-annual euro interest payments at an agreed fixed rate and in return receives USD amount fixed rate interest payments from the counterparty. When the swap reaches maturity, the companies exchange the principal amounts once again, using the fixed exchange rate determined in the contract. (Hillier et al. 2012: 47, 207; Hull 2012: 168.) Furthermore, currency swaps can be executed using fixed rates, floating rates or one of each. For instance, a floating-for-floating currency swap can be understood as portfolio containing fixed-for-fixed currency swap and one interest rate swap in each currency. (Hull 2012: 175.)

Credit default swap is the most commonly used of the credit derivatives. The idea of credit default swap (CDS) is to provide insurance against risk of default by a certain firm. In CDS the firm in question is referred as reference entity and the event of default is called credit event. A CDS gives the buyer the right to sell their bonds issued by the reference entity in exchange of periodical payments to the seller of CDS. In case the reference entity does not default during the CDS contract time, the seller can keep the periodic payments as a profit. (Hull 2012: 572.) The gross market value of CDS:s in the OTC-market was highest during 2008 and 2009 which can be explained by the market uncertainty that followed after the financial crisis. When firms or investors have concerns about a certain firm's survival they can enter a CDS contract which then covers some of the losses in case the reference entity defaults. (BIS 2018.)

2.2.2. Options

Options are generally divided in to two types: call options and put options. A *call option* gives the holder the right to purchase a certain underlying asset at an agreed date and for at agreed price, which are both stated in the option contract. A *put option* on the other hand gives the holder the right to sell a certain underlying asset at an agreed date and at an agreed price. The underlying asset of an option is usually a publicly traded stock valued at a certain price in the market, and the price for the asset is defined in the option contract and it can be referred to as exercise price or strike price. The date when the option contract ends, and the possible transaction happen is called expiration date or maturity. (Hull 2012: 8–9, 213.)

American options can also be exercised at any given day before the option reaches maturity, whereas European options can only be exercised at the maturity. The name refers to the type of the option and has nothing to do with the geological location. Both options are traded in the exchanges and the OTC-markets, but most of the options traded in exchanges are American options. European options are used in the following examples in order to simplify the payoff calculations. The formulas are based on perfect capital markets assumption where transaction costs do not exist. The first model explains the payoff of a simple European call option. (Bingham & Kielsel 1998: 2–3; Hull 2012: 8–9, 213.)

(1) $S(T) - K$, *if* $S(T) > K$ *and 0 otherwise,*

where

S(T) = The price of the underlying asset at the maturity
K = Strike price
T = Maturity

Option payout scenarios are called in-the-money, at-the-money and out-of-the-money. If a call option reaches maturity when S(T) > K the option expires in-the-money and the payout for the holder is S(T) – K. If S(T) = K the option expires at-the-money and does not make profit for the holder, the holder usually does not use his right to exercise the option. Out-of-the-money payout happens if S(T) < K at the maturity, in this scenario the holder does not exercise the option and the amount of loss is defined by the amount of commission paid of the option. The commission is paid for the seller of the option and it is usually tied to the amount of the underlying asset in the contract. The opposite party or seller in option contract can also be called writer. In contrast to forward and futures contracts, holder of the option can decide whether to exercise the option at the maturity. In futures and forwards which will be presented next the holder is obligated to complete the transaction at the maturity, but entering the contact is free of commission. (Hull 2012: 8–9, 214.)

The players in the option markets can be divided into four groups: Buyers of calls, writers of calls, buyers of puts and writers of puts. The buyers are also referred to as long position holders, and the writers of options have so called short position. One position would not be available without the other, and thus it is crucial for options markets to have enough players willing to take short positions, as well as long positions. Options are used in firms for several purposes. The firms can use options as part of their risk management strategy to minimize investment losses for instance in the stock market in case of expected decline in the market. By securing a long put position a firm is able to sell the underlying asset at strike price, and possibly able to avoid larger losses in case the value of the underlying asset in the market would drop below the strike price. Long call positions on the contrary should be taken when the value of underlying asset is expected to rise, in which case the firm would be able to buy the underlying asset at a previously agreed price and make a profit if the market price of the asset at maturity is higher than the strike price. (Hull 2012: 10–12, 214–217.)

2.2.3. Forwards

Forward contract is an agreement between two parties where the other engages to buy a certain underlying asset at a certain time in the future for a certain price and the counterparty engages to sell the asset in question with the same terms. Buyer in forward contract is considered to have a long position whereas seller's position is referred to as short position. Forwards are traded in the OTC market and most commonly the trade transpires between financial institutions and their clients. The ending date of forward contract is referred to as delivery date. Price for the asset in the forward contract is called delivery price and spot price is the price of the asset in the market at delivery date. Whereas options have commissions, entering to a forward contract is commission-free for both parties involved and the profit or loss of the contract is defined by the difference between spot price and delivery price. The following states a payoff from a simple long forward position. (Bingham & Kiesel 1998: 3; Hull 2012: 6–7.)

$$S(T) - K, \qquad (2)$$

where

S(T) = Spot price of the asset at the maturity of the contract
K = Delivery price

Once a forward contract is signed the transaction is obligatory for both parties at the maturity which makes the payoff structure of a forward simpler than payoff from an option contract. The payoff from short position in forward contract is the opposite of a payoff from a long position forward.

(3) $$K - S(T),$$

where

K = Delivery price
S(T) = Spot price of the asset at the maturity of the contract

Companies can use forwards to control foreign currency risk which is also the most usual motivation behind a forward contract. Consider a situation where an American firm has a payment of 1 million due in euros in six months and the current exchange rate of Euro/USD is 1.2. One way to shelter the firm from the financial risk caused by the possible exchange rate fluctuations is to enter to a long position in forward contract, which allows the firm to buy 1 million euros with 1.2 million in USD at the day of the payment. If the euro strengthens against USD and the exchange rate rises to 1.3 during the six-month contract period, the firm has saved 0.1 million with the forward contract. The risk associated with the forward contract is realized if the exchange rate declines before the delivery date, forcing the firm to buy the foreign currency with higher exchange rate than offered in the market. (Bingham & Kiesel 1998: 3; Hull 2012: 6–7.)

The problems associated with forward trading come to exist due to the following reasons: Forwards are traded in the OTC market which means that there are no regulations concerning the contents of a forward contract. In addition, there are no guaranties for either side of the contract in case counterparty defaults and fails to make the agreed transaction at delivery date. This leads to the fact that even though the forward contract itself is commission-free for both parties involved, the negotiations and background analysis that are necessary in finding a creditworthy partner can require a lot of time and money and therefore the overall costs of finding a suitable forward contract can rise and devour the future profits of the contract. (Bingham & Kiesel 1998: 3.)

2.2.4. Futures

Futures contracts are similar to the forward contracts discussed above, but the trading of futures commences in exchange traded markets and thus the contracts are standardized and insured by these exchanges. In a way futures contract can be thought of as a special type of forward contract that only trade in the exchange traded markets. The standardization of futures contracts eliminates the default risk from both sides and makes trading viable for parties that are not necessarily familiar with each other's financial backgrounds. Futures are traded in exchanges around the world; the largest of which are Euronext.liffe, Eurex, TOCOM and CME group, formed in fusion of former Chicago Board of Trade and Chicago Mercantile Exchange. In these exchanges it is possible to trade futures based on large variety of financial commodities as well as agricultural commodities such as wheat. The financial commodities futures include currency futures, interest rate futures, bond futures, soft commodity futures and equity futures among others, like stock index futures. (Hillier et al. 2012: 204–206.)

One of the defining differences between forward and futures contracts is the exchange of cash flows. In forward contracts cash flows are exchanged only at the maturity and so the possible shortage of sufficient cash in the firm is not unveiled until the end of the contract. However, in futures contract this problem is solved by automatic daily transactions between the contract parties. This method known as marking to market transfers cash flows from accounts where the counterparties were obligated to deposit the full value of the contract as a security payment in case of a default. These so-called margin accounts are established by the brokers and by following the daily transactions it is possible to spot the lack of sufficient funds before the end of the contract and therefore avoid the risk of total default. (Hillier et al. 2012: 204–206.)

3. RISK MANAGEMENT, HEDGING AND FIRM VALUE

This chapter includes review on for what purposes firms are using derivatives and what are the most common risks they are hedging. In addition, prior studies and academic literature are analyzed to find out how derivatives can have a positive effect on firm value in theory and whether the results from prior studies support the hypotheses in this thesis.

3.1. Derivatives and risk management

According to the Modigliani-Miller theorem, in the absence of taxes and transaction costs hedging decisions on the corporate level do not affect the firm value. This is based on the statement that the capital structure of the firm does not affect firm value; ergo financial decisions do not make a difference to firm value. For decades the theorem has been acknowledged as one of the basic principles of corporate finance, but its assumptions have also been re-evaluated in various academic studies conducted during the recent years. (Hillier et al. 2012: 685–689.)

There are three commonly recognized types of traders in the derivative markets; hedgers, speculators and arbitrageurs. Hedgers use derivatives to reduce risk they face from possible fluctuations of market price of a certain asset. Speculators on the other hand seek to make profit by predicting market movements and taking derivative positions based on their assessments of whether the price of an underlying asset is going to rise or fall. Without the speculators there can be no hedgers, since speculators are usually the ones taking the riskier position and thus enabling hedging positions. The third group of traders is arbitrageurs, who pursue riskless profit by entering into derivative positions in two or more markets and trying to make profit on the possible price difference of an underlying asset between the markets. All three types of traders are essential for functional derivative markets, as they ensure the high liquidity of the derivative contracts. Hedge funds for instance have become widely active in all three categories. However, this thesis concentrates only on hedging activities in firms while examining the market value effect, as it is difficult to divide users to these categories if based only on the information provided by the firms in their fiscal reporting. (Hull 2012: 11–17.)

One of the assumptions behind the M&M theorem is that individual investors have the same opportunities to hedge financial risk as corporations, and thus hedging on the corporate level is not necessary. This might be accurate if the perfect capital markets assumption is met, but in reality, corporations have far better premises to start hedging than individual investors. Individual investors do not have access to the same information as the corporate executives have about the firm's risk exposure; ergo the individual investors do not have the sufficient information to hedge the corporate risk efficiently. In the past the responsibility of hedging and managing the financial risk in the firm might have been assigned to a single executive, but nowadays many corporations have an entire department dedicated to hedging with derivatives. Acquiring the same amount of knowledge about derivatives and hedging is time consuming and costly for an individual investor or institution, which points to the fact that the corporations are in better position to make hedging decision. (Hillier et al. 2012: 685–689.)

During the past decades hedging with financial derivatives has increased globally in corporations and it has become a standard part of their risk management strategies. This thesis concentrates on the derivatives side of risk management tools to examine the value creation hypothesis, with the acknowledgment that derivatives are not the only way to hedge interest rate, foreign currency or commodity price risk exposure. Weiss Center for international financial research in Wharton School organized large surveys in the years 1994–1997 for non-financial US firms about their derivatives usage, and the results of their most recent survey were analyzed by Bodnar, Hayt & Marston (1998). Their data consists of answers from 399 firms, out of which 200 reported using derivatives. The percentage of firms using derivatives (50 %) was higher than in previous surveys, 41 % in 1995 and 35 % in 1994, which implicates a mild increase in derivative usage among firms. However, part of the sample firms changed between the surveys and the reported percentage of derivative users among firms who provided answers to both 1994 and 1998 surveys was 44%. Out of the firms who reported derivative usage in the 1998 survey, 42%

answered that the usage has increased compared to the previous year, which means that the intensity of derivative usage had grown among these firms.

In the more recent study Bartram, Brown & Fehle (2009) analyze international derivative users with a considerably larger sample, consisting total of 7319 firms from 50 countries, which accounts for almost 80% of global market capitalization of non-financial firms. They divide the users by the underlying asset in to three groups; Foreign exchange derivative, interest rate derivative and commodity price derivative users. Out of the total sample over half of the firms (60.3 %) reports using some type of derivatives, with foreign exchange derivative users (45.2 %) being the largest group. The smallest group being commodity derivative users (10 %) and interest rate derivative users (33.1 %) being the second largest.

Brunzell et al. (2011) study the use of derivatives in Nordic firms by analyzing data from their survey, and although the sample size was noticeably smaller (112 answers) than in the Bartram et al. (2009) study, the results on derivative users indicated towards the same direction. Close to 62 % of the firms answered positively to derivative usage question, and interestingly more than half of the users gave some weight to additional income as a motive behind derivative usage, although hedging was clearly the strongest motive. The general assumption is that derivatives are more commonly used as hedging tools, and since firms are not required to report the purpose behind their derivative contracts, it is difficult to determine the real incentives behind use of derivatives in firm level. Brunzell et al. (2011) find also weak support for positive value effect among derivative users, the value increase being caused by either reduced risk or by the profits made from derivative usage.

3.2. Increasing firm value with derivatives

There are several ways how the use of financial derivatives can influence the firm value, and while the positive firm value effect has been indicated in several studies, the results have not always been strong or significant. Bartram et al. (2011) find evidence that firms that use derivatives have lower cash flow volatility, lower standard deviation of returns and lower systematic risk. They also find that derivative users have 15 %–31 % lower betas than matching firms which do not use derivatives. Further they were able to link derivative users with higher Tobin's Q values, and higher market values, although the support for higher market value effect was weak and the Tobin's Q results were not throughout significant.

Managing cash flow volatility and therefore expected cash flows is fundamentally important for firms regardless of the industry or business model. Cash flow irregularities can raise the firm's risk level and therefore decrease value since for instance, negative cash flows can force the firm to look for more expensive outside funding instead of self-financing the possible growth. Hedging can also reduce expected tax payments, as profits and losses are taxed differently. By hedging the firm can control the changes in expected cash flows and minimize irregular tax obligations. In addition, hedging increases expected cash flows by reducing the costs of financial distress. (Hillier et al. 2012: 685–691.)

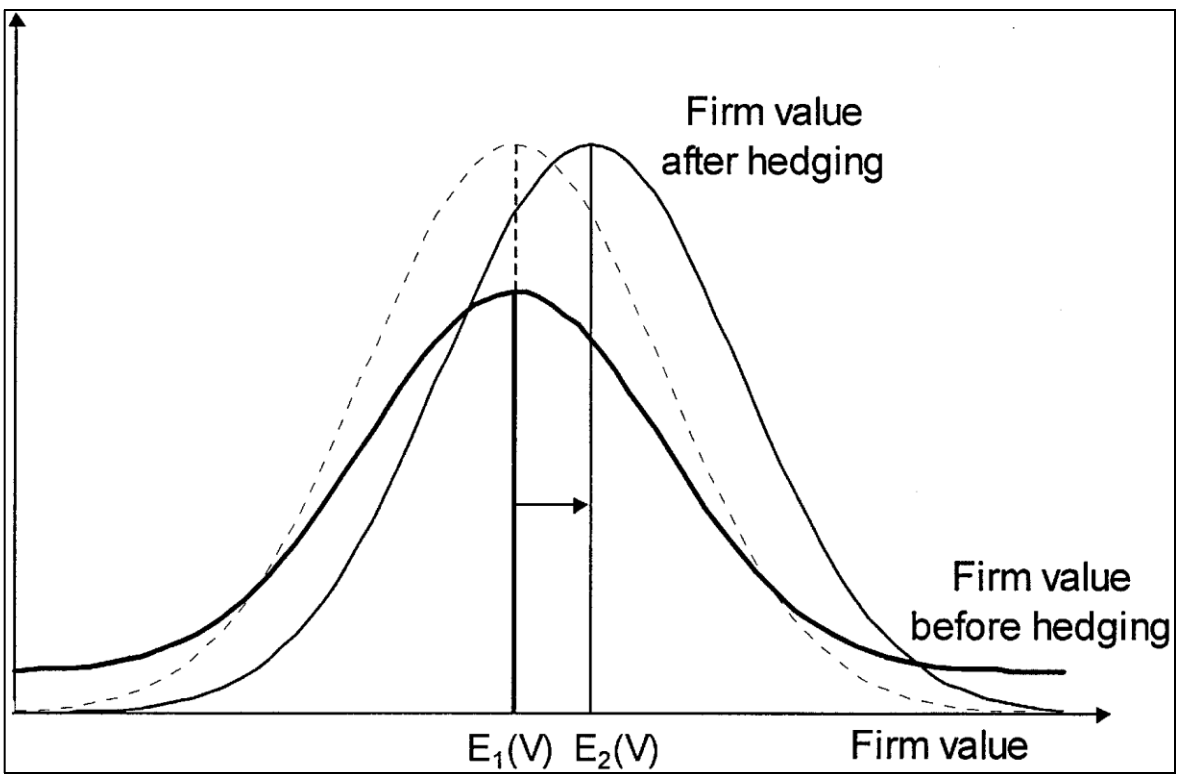


Figure 3: Effects of hedging on firm market value. (Bartram 2001.)

Reducing the corporate cash flow volatility leads to lower variance of firm value as well which is demonstrated in the Figure 3. When the firm's cash flow volatility decreases, more cash is released to be distributed to the owners which in return increases the firm market value and moves the value curve from $E_1(V)$ to $E_2(V)$ as seen in Figure 3. (Bartram 2001.)

3.2.1. Commodity price risk

Commodity price risk that the firms are facing differs between industries, as in some industries the commodity price changes have a larger impact on the firm's cash flows and profits, whereas in banking industry, for example, controlling the interest or currency rate fluctuations is usually more crucial for the company's success. In theory, the biggest incentives to manage risks by using commodity derivatives are in companies that are selling or producing commodities that can be used as underlying assets, like oil or gas. The price volatility of a commodity is linked to the fact whether the commodity in question can be stored after harvesting, or whether the oversupply must be sold immediately. Examples of these situations would be wheat as a storable commodity and electricity as non-storable, as the oversupply of electricity must be sold to another market, and the amount of this oversupply will determine the market price for electricity. It means that electricity prices are quite volatile and therefore the price risks in that industry are relatively high, as the electricity demand is also directly linked to climate temperature in the region. Wheat grains on the other hand can be stored for years in case of excessive oversupply, and so the producers have a slightly better control of the market price even without derivatives. (Hull 2012: 775–778.)

Current derivative markets offer wide range of commodity linked derivative products, and nowadays it is possible to find derivatives for almost any underlining asset ranging from agricultural commodities to weather related assets. However, according to BIS (2018) the amount of commodity linked derivatives in the OTC-market is substantially smaller if compared to interest rate and foreign exchange derivatives, as seen in the second chapter in Figure 2. Commodity price fluctuations are not the main concern of risk for all firms and so the hedging for commodity price risk is more important in industries where the firm's profits are directly linked to price of some commodity, as in mining industry for instance. Nevertheless, Haushalter (2000) find that in the U.S. oil and gas industry the producers tend to hedge only less than 28 % of their production, while the majority of the production is left vulnerable to market price changes.

Jin & Jorion (2007) study the derivative firm value effect in North American gold mining industry with a sample from years 1991–2000 including 44 firms. They find evidence that hedging decreases the firm's stock exposures to gold price changes, but further analysis did not show support for the positive firm value effect when using Tobin's Q as a proxy for firm value. Carter, Rogers and Simkins (2006) find hedging premium in U.S. airline industry for jet fuel price hedgers. They state the result is due to the high volatility of the jet fuel price and that firms are willing to hedge the price risk since the price of jet fuel accounts for sizable percentage of the operational costs in airline companies. Consequently Tufano (1996) examined gold mining industry as well and finds that managers make hedging decision quite strongly based on their own incentives. He finds that the length of CFOs tenure impacts hedging decisions and that managers who hold copious amounts of firm's equity have a higher tendency to hedge the gold price risk in the firm. (Hillier et al. 2012: 709.)

3.2.2. Foreign exchange risk

Foreign exchange risk or currency risk affects companies that are engaged in business transactions in some foreign currency in addition to transactions in domestic currency. Especially multinational corporations are exposed to currency risks, as changes in currency rates affect firm's cash flows and accounting profits. Currency rate changes can also influence firm's market and book values as demonstrated in the following risk categories. Foreign exchange risks can be generally divided into three categories: transaction risk, translation risk and economic risk. Next, we concentrate on how firms can hedge risks in these categories and whether positive value effect of foreign exchange derivatives can be found in prior academic studies.

Transaction risk is the immediate effect that exchange rate changes have on firm's cash flows. Buying or selling a good priced in foreign currency exposes the firm to transaction risk, since the changes in the currency rate between the trade date and date of settlement will influence the cash received or paid in domestic currency. However, it is relatively easy for firms to hedge these cash flow uncertainties by altering the agreement or by using currency derivatives. In case the counterparties agree that payment of the sale will be carried out in the domestic currency, no hedging is needed for the currency risk. Alternatively, one or both of the counterparties can enter into a forward contract which allows the firm to lock the exchange rate to certain level to minimize the foreign currency risk. Constructing hedges for this kind of individual transactions is quite straightforward but managing the economic risk of foreign currency changes requires risk management beyond transaction risk. (Hillier et al. 2012: 702–704.)

Translation risk is the risk associated with foreign subsidiary's book value depreciation in the parent company's balance sheet. While decrease in the book value of the subsidiary might not result in straight losses, additional costs to the firm can occur through loan covenant contracts. A certain minimum level of book value is often included in loan contracts and if the firm's book value drops below such level, a loan covenant violation has occurred. These violations can lead to penalty fees, and so it might be relevant for firms to consider hedging the translation risk. (Hillier et al. 2012: 702–704.)

Hedging *economic risk* is far more complex than hedging risks from the two categories introduced above. Where transaction risks and translation risks include short-term risks associated with individual transactions and risks from translation of financial statements, the economic risk category comprises more long-term risks that must be considered to have a continuous effect on the firm's financials. Economic risks can be defined as risks linked with losing competitive advantage because of exchange rate fluctuations. To understand the risk management of economic risks in theory, we first need to consider the factors that define what kind of effect exchange rate changes have on a firm's business. According to Hillier et al. (2012) these factors include; differences between the location of production operation and where the product is sold, the location of competitors and finally whether the input prices are determined in international or local markets. Through foreign competitors' economic risks can influence firm's success even if the firm is only selling their product in the local market. Transaction and translation risks are commonly hedged in multinational firms at least to some extent, but hedging long-term economic risk is nonexistent in these firms. To hedge the long-term economic risk effectively, a firm would have to estimate both the current and the long-term effects on firm's cash flows caused by exchange rate fluctuations. (Hillier et al. 2012: 702–705.)

The exchange rate changes in the market can be caused by real changes in exchange rates or by inflation rate differences between two countries. If the price of a product rises in Finland due to 5 % inflation while the inflation in the U.S. is 0 %, the euro would likely weaken 5 % against the U.S. dollar and the product can still be bought in the U.S. for the same number of euros as before; this is called the nominal exchange rate change. In this situation the real exchange rate which measures the relative price of U.S and Eurozone products stays the same. The problem in hedging the long-term economic risk of currency changes arises from the fact that it is challenging to determine when the currency rates changes are due to nominal or real rate changes. If the changes in exchange rates are nominal, then forward and futures contracts provide only imperfect hedges, leaving the firm subject to exchange rate risks. (Hillier et al. 2012: 702–705.)

The study of Allayannis and Weston (2001) on foreign exchange derivatives and firm value provides strong results to support positive value effect on firms which are exposed to foreign exchange risk and are hedging with foreign exchange derivatives. They use Tobin's Q as a proxy for firm value and find significant results that derivative users have 4,87 % higher firm value than the nonusers. In addition, a small positive firm value effect was found with firms that have no direct foreign exchange risk but may be exposed to such risk through export or import operations. However, the results were statistically insignificant. Allayannis and Weston (2001) also conduct an event study to analyze whether the decision to change hedging policy has any effect on firm market value and find evidence that firms which decide to start hedging experience a value increase compared to the firms that remain unhedged. Moreover, the evidence shows that firms which decide to stop hedging experience a decrease in market value when compared to firms that continue with their hedging policy. Overall the results of Allayannis and Weston (2001) show support on positive firm value effect with firms that are using foreign exchange derivatives to hedge their risk associated with foreign currency transactions.

Besides Allayannis and Weston (2001), Belghitar, Clark and Judge (2008) find foreign currency derivative hedging to have a statistically significant Tobin's Q value premium of 14.7 % and for hedging to be more value creating when including all foreign currency hedging methods. The foreign currency hedgers in their UK sample include firms which hedge also interest rate risk, which may partially drive their results. Also, Clark and Judge (2009) find 23.7 % significant hedging premium for foreign currency derivative hedgers, especially driven by the use of currency swaps.

3.2.3. Interest rate risk

According to BIS (2018) statistics, interest rate derivatives account for most of the OTC-derivatives market. When the market rates turned negative in 2015, interest rate contracts covered over 70% of the OTC-derivatives market measured in gross market values, in comparison foreign exchange and commodity derivatives together accounted for only 18% of the market. Therefore, it is expected these interest rate derivative contracts are currently expensive for the hedging parties, whereas market makers have profited of the difference in market rates and offered fixed rates. This assumption is tested by the third hypothesis in the univariate and multivariate part. Interest rate risks concern both lender and debtor firms, as lender's income from a loan and the debtor's loan payments are both always linked to some applicable interest rate. Furthermore, interest rates are used in pricing of several financial products, including derivative instruments, where the risk-free rate is usually a government treasury rate or London Interbank Offered Rate (LIBOR) which is commonly used as borrowing rate between banks. (Hull 2012: 77–78.)

Derivative instruments offer tools for corporate managers to control interest rate risk, and according to BIS (2015) interest rate swap is the most used form of derivatives in the OTC derivative market, as introduced earlier in the second chapter. Hakkarainen, Kasanen and Puttonen (1997) examined interest rate management in large Finnish firms and find that hedging decisions are influenced by market view, but interest rate policies seem to be risk aversive. However, they found no evidence of leverage affecting the interest rate hedging decisions, instead firm size appears to be one influencing factor.

Choice of capital structure defines how widely the firm is exposed to interest rate risk, since increasing debt financing will increase interest costs as well. The motivation to hedge interest rate risk comes usually from controlling these interest costs, and there are some studies supporting the assumptions that firms with high leverage ratios tend to hedge more than low leveraged firms. Block and Gallagher (1986), Wall and Pringle (1989) and Nance, Smith and Smithson (1993) find weak evidence supporting the higher use of derivatives among firms with higher leverage ratio. The decision of how to balance the firm's capital structure is the first step in interest rate risk management, following the decisions whether to take debt in foreign or domestic currency and if the debt has fixed rate or floating rate interest payments. These actions affect the firm's liability stream, which is the stream of interest payments generated from the liabilities. Furthermore, the liability stream can be controlled after these choices are made, by using derivatives to balance the expected liability stream. In addition, Hakkarainen et al. (1997) find that besides risk aversion, firms are also motivated to use derivatives to maximize their interest income. (Hillier et al. 2012: 700–703, 785.)

There are different options of liability streams, which a firm can create by using short-term or long-term debt and by deciding whether to hedge the interest rate risk. To clarify the differences in these liability streams the examples show only two kinds of maturity, short-term debt as due in one year and long-term as due in five years. The first equation shows liability stream of short term debt where t indicates that short-term rates and firm's credit rating change during maturity:

(4) $$i_{st} = r_{st} + d_{st},$$

where

i_{st} = The firm's short term borrowing cost for period t

r_{st} = The risk-free short-term rate for period t
d_{st} = The default spread for period t

The next liability stream involves floating-rate loan, which firms can acquire straight from financing institutions or by using interest rate swaps like demonstrated in chapter 2.3. The equation of the stream is as follows:

(5) $$i_{ft} = r_{st} + d_1,$$

where

i_{ft} = Firm's period t interest rate on the long-term floating-rate loan.
r_{st} = The risk-free short-term rate for period t
d_1 = The default premium

The stream described above leaves the firm exposed to interest rate risk but not to credit rating risk. The fourth possibility is the hedged liability stream where the changes in interest rate are hedged but the firm is exposed to credit rating risk.

(6) $$i_{ht} = r_1 + d_{st},$$

where

i_{ht} = hedge borrowing cost for period t
r_1 = the long-term interest rate
d_{st} = default spread for period t

The equation (7) demonstrates how interest rate derivative instruments enable firms to create alternative liability streams which are not possible without derivative instruments. The liability stream structure in the equation can be divided in to two parts; the risk-free interest rate part and the credit rating part. Prior to the introduction of interest rate swaps and futures, firms had basically two possible outcomes of liability streams when deciding whether to borrow long term or short term. Borrowing short term left the firm exposed to both credit risk and interest rate risk, while borrowing long term with fixed rate the firm could avoid both risks. With derivative products firms can separate the risks, so that changes in credit rating no longer cause interest rate risk. By hedging the interest rate risk with interest rate swap for instance, a firm can separate interest rate risk exposure and credit rating risk and is only exposed to the credit rating risk. (Hillier et al. 2012: 700–703.)

Belghitar et al. (2008) in their study on UK sample find that interest rate derivative hedging creates substantially more firm value from debt capacity than foreign currency hedging. Their Tobin's Q analysis also generates larger coefficients for interest rate derivative hedgers than other hedgers of interest rate risk. Furthermore Hakkarainen et al. (1997) results show that interest rate swap was the most used derivative instrument in interest rate risk management in Finnish firms, alongside with forward rate contracts and OTC options. Hakkarainen et al. (1997) and Bodnar, Hayt, Marston and Smithson (1995) find also firm size to be positively related to the use of derivatives.

However, due to the unusual market environment of negative interest rates the old strategies of interest rate hedging and the value effect of hedging interest risk exposure should be re-evaluated. As the market rates declined below zero in April of 2015, most of the interest rate hedges constructed during past years are currently strongly out of the money for the firms buying the hedges. As firms use interest rate derivatives to shield their loan portfolios from interest risk exposure and high interest costs, it is possible that if the period of negative interest rates continues the active interest rate derivative positions start to affect negatively to firm values through increased cost of hedging. This effect is further tested with the third hypothesis.

3.3. Previous literature on derivatives and firm value

Table 1 summarizes the body of previous studies on derivatives and firm market value and shows the derivative type tested in each study. GEN stands for general hedgers, IRD for interest rate hedgers, FCD for foreign currency hedgers and COM for commodity price hedgers respectively. As discussed earlier the results are mainly supporting the positive value premium in Allayannis & Weston (2001), but few studies like Nguyen & Faff (2007) and Naito & Laux (2011) suggest that there might be negative value premium instead for derivative hedgers.

Most of the studies in Table 1 are conducted with sample period before the financial crisis and the negative market rate environment, with the exception of Naito & Laux (2011) and their data from 2009. In addition, Tobin's Q is used widely as dependent variable and proxy for firm value in these studies which makes the results quite comparable between different samples. This thesis provides the latest information on how the use of derivatives has changed among Finnish firms during years after the financial crisis. Following that the sample period in this thesis is close to decade later when compared to the studies in Table 1, it is possible that the results are not in line with the base studies in this field. The empirical part will further reveal what kind of firm value effect can be observed for hedgers in Nasdaq OMX Helsinki.

Table 1: Summary of previous literature on hedging and firm value effect.

Study	Sample	Time period	Derivative type	Value premium
Graham & Rogers (1999)	531 U.S firms	1995	FCD & IRD	+2.2-3.5 %
Allayannis & Weston (2001)	720 large U.S. firms	1990-1995	FCD	+4.9 %
Pramborg (2004)	455 Swedish firms	1997-2001	GEN	Positive
Carter, Rogers & Simkins (2006)	28 U.S. airline firms	1992-2003	COM	5.5-10 %
Jin & Jorion (2006)	119 U.S. oil and gas firms	1998-2001	COM	No support
Jin & Jorion (2007)	44 U.S. gold mining firms	1991-2000	COM	Negative
Nguyen & Faff (2007)	428 Australian firms	1999-2000	GEN	Negative
Belghitar, Clark & Judge (2008)	412 UK firms	1995	IRD/FCD	+8.5-18.6 %
Khediri & Folus (2010)	320 French firms	2001	GEN	Negative
Bartram, Brown & Conrad (2011)	6888 International firms	1998-2003	GEN	Positive
Brunzell, Hansson & Liljeblom (2011)	112 Nordic firms	2006	GEN	+1.8-2.1 %
Naito & Laux (2011)	434 U.S. firms	2009	GEN	-12.8 %

4. EMPIRICAL RESEARCH

The empirical part of the thesis introduces the data sample, dependent variable and independent variables used in the regressions. Furthermore, the methodology of univariate and multivariate regressions is revealed, and results of primary regressions and robustness checks are examined.

4.1. Data

The data is collected of firms listed in OMX Helsinki stock exchange between years 2010 and 2016. The Finnish sample is chosen since it is rather unstudied sample in the line of hedging and firm value studies, and the relatively small number of listed firms in OMX Helsinki allows us to include all the firms in the sample and thus avoid any doubts of data mining. Prior studies like Allayannis and Weston (2001) with U.S. sample and Bartram et al. (2009) with international sample have studied firms in considerably larger markets and therefore the results from the Finnish market do not necessarily follow the same line. The demographic of Finnish sample differs from U.S. sample used by Allayannis and Weston (2001) in several ways, the first being the size of the domestic market. As Finland is part of the eurozone and the growth opportunities in firms with only domestic sales are limited, the Finnish firms are more prone to look for additional revenue abroad and thus facing the need to hedge their foreign exchange exposure. Due to large domestic market the U.S. firms have more homeland growth opportunities without the necessity to enter the international markets. Evidence of this can be found comparing the derivative user statistics from this study to previous findings in academic studies conducted on U.S. sample.

The sample period from 2010 to 2016 catches the years of recovery after the financial crisis in 2008-2009, as well as the period of slow and steady growth supported by macroeconomic easing in the eurozone. The unusual market environment of first low and then negative interest rates that has lasted for several years already have also driven the firms to re-evaluate their interest rate risk hedging policies. By analyzing the derivative user data of the Finnish sample, we can observe if any relation between the low interest environment and level of derivative usage can be found.

4.1.1. Sample description

The number of observations varies slightly through the sample period, as de-listed firms are deleted from the sample and newly listed are added. For the purposes of comparability and the availability of data only firms that were listed at the end-of-year each year are included in the sample. Due to cross-sectional characteristics of the data, firms do not need to be listed at the end of every observation year to be included in the sample, as the sample for each year will be formed independently. Therefore, the data set is identified to have pooled cross-section characteristics, as well as panel data features as yearly observations are collected repeatedly for the same firms, apart from the ones dropped from the sample because of de-listing. (Woolridge 2011: 5–7.)

Databases Orbis and Datastream are used as sources for the financial firm data. The derivative user data along with derivative position data is manually collected from the financial statements of the sample firms. International Accounting Standards (IAS) declare that the firms are to report their open derivative positions which has made the derivative user data widely available. Following the IAS demands firms have started to report their derivative positions even if they do not use IAS standards in their fiscal reporting. Each year firms are classified as derivative users and non-users based on whether information on hedging activities and open positions is found on the financial statement. Additionally, the derivative users are divided into three sub categories by the derivatives types: commodity price derivatives, foreign exchange derivatives and interest rate derivatives. If a firm has an open position in at least one of the derivative sub categories, it is added to the correct sub category and to general derivative users group. As a large part of the sample firms have open positions in more than one of the derivatives types, the firms in sub categories are partially overlapping.

The financial statements of the sample companies were also examined to fill the gaps in the Orbis and Datastream datasets. Financial firms are often market makers in derivative markets and their motive for derivative usage differs from the non-financial firms, thus all financial firms are excluded from the sample. Firms with insufficient information of their derivative usage, or missing data for Tobin's Q or any of the main regression variables, excluding the derivative position variable, are deleted from the sample. After removing financial firms and all firms with missing data for any of the main regression variables, the main sample consists in total of 748 firm year observations ranging from 98 observations in 2010 to 123 observations in 2016. The total of 748 observations include also firms that did not report the size of their derivatives position but declared if they had open derivates contracts at the end of the fiscal year. For the multivariate regressions where the derivatives position size is added as independent variable those firms are deleted leaving 737 firm year observations for the multivariate regression sample.

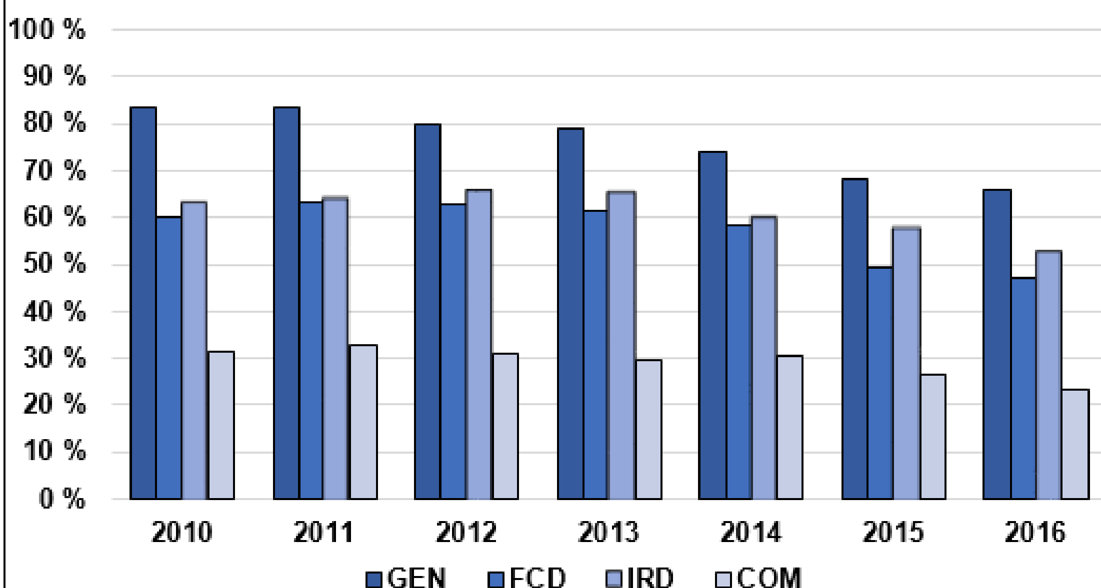
Table 2 shows how the use of derivatives has changed during the sample period from 2010 to 2016. The firms are divided yearly into three sub categories based on the reported open positions at the end-of-year financial statements: foreign currency derivative users (FCD), interest rate derivative users (IRD) and commodity price derivative users (COM). GEN denotes general derivative users and includes all the firms which have open position in any of the three sub categories. Table 2 statistics show that IRD is the largest derivative user sub category each year with a peak of 66 of out 100 firms in 2012 reported using interest rate derivatives. As can be seen from the table, the combined user amount in the three sub categories is greater than the general derivative user category each year which indicates that most of the sample firms have open position in more than one of the sub categories. In fact, through the sample period on average 85% of the firms with foreign currency derivatives have an open position in also interest rate or commodity price derivatives, while 73% of firms with interest rate derivatives and 94% of firms with commodity price derivatives have an open position in at least one other sub category.

The percentage level of derivative users has decreased from 84 % in 2010 to 66 % in 2016 which would indicate that the use of derivatives has decreased among OMX Helsinki companies. However, the actual number of derivative users has stayed relatively stable through the years with minimal variance and therefore the decrease in the user percentage level can be partly explained by the growth in the number of listed companies and by the absence of derivative positions among the most recently listed firms in OMX Helsinki. Inside the sub categories the derivative user levels have also slightly declined, with number of FCD users dropping from 64 in 2013 to 58 in 2016, IRD users from 68 to 65 and COM users from 33 in 2014 to 29 in 2016. During the same period number of firm year observations increased from 104 in

Table 2: Derivative user statistics by year and derivative type.

Derivative users by year and type from 2010 to 2016

			GEN	%	FCD	%	IRD	%	COM	%
2010	Total firms	98								
	Users		82	84 %	59	60 %	62	63 %	31	32 %
2011	Total firms	98								
	Users		82	84 %	62	63 %	63	64 %	32	33 %
2012	Total firms	100								
	Users		80	80 %	63	63 %	66	66 %	31	31 %
2013	Total firms	104								
	Users		82	79 %	64	62 %	68	65 %	31	30 %
2014	Total firms	108								
	Users		80	74 %	63	58 %	65	60 %	33	31 %
2015	Total firms	117								
	Users		80	68 %	58	50 %	68	58 %	31	26 %
2016	Total firms	123								
	Users		81	66 %	58	47 %	65	53 %	29	24 %



2013 to 123 in 2016, indicating that the new additions to the sample are mostly non-users. Even though there is no significant drop to be observer among interest rate hedgers, the negative interest rate environment can be one of the reasons why adding the newly listed companies to the sample has not increased the derivative user level in that sub category.

However, as we compare the user statistic in Table 2 to previously published studies the user levels in the Finnish sample of this thesis are found to be considerably higher. Bartram et al. (2009) study derivative users' motives with a large international sample of 7,319 firms in 2000 – 2001. They find 60,3 % of the total sample firms to be derivative users, with user levels in sub categories of 45,2 % foreign exchange derivatives, 33,1 % interest rate derivatives and 10 % in commodity price derivatives. Bartram et al. (2009) find user level among Japanese firms to be 81.3 % which is closest to the levels in this thesis, but for OECD firms they find 64.3 % user level. Brunzell et al. (2011) study derivative users in 2006 with Nordic sample and find 61.6 % derivative user level with their survey sample including 112 firm responses which is close to the yearly sample size in this thesis. If the higher derivative user levels are not only limited to Finnish sample in this thesis, these results indicate that if a larger study with international sample would be conducted with more recent data, we could also see increase in derivative user levels outside Finnish sample during the past decade. In addition, Dahlberg (2012) studies derivative users in her thesis with Finnish sample and finds level of general derivative users increasing from 63 % in 2005 to 76 % in 2010 which supports the user level findings of this thesis. Furthermore Bartram et al. (2009) supported by Brunzell et al. (2011) find that use of commodity price derivatives is more common among firms in traditional industries like oil, metal, mining and utilities, which can explain the demographic of commodity price derivative users in the Finnish sample.

4.1.2. The dependent variable

The dependent variable for the univariate and multivariate regressions is chosen based on evidence from prior studies and on the availability of data for the sample firms. In prior literature Tobin's Q has been widely used as a proxy for firm market value in the field of derivatives and firm market value studies, in addition the data for calculating Tobin's Q is easily available from the databanks as it is calculated from the balance sheet figures. Therefore, Tobin's Q is chosen as dependent variable.

$$\text{(7)} \qquad \text{Tobin's Q} = \frac{\text{Market value of assets}}{\text{Replacement cost of all assets}}$$

Market value of assets is calculated as book value of total assets subtracted by book value of equity plus market value of equity while book value of assets represents the replacement cost of all assets. Market value of equity is calculated by using total number of preferred shares at the end-of-year reporting and year-end market price for that share. Tobin's Q values are calculated independently for each firm at end-of-year through the sample period and thus firms with missing information for share market price are identified as de-listed firms and are deleted from the sample. The median of Tobin's Q 1.23 is below the mean value 1.55 (Table 3) which indicates that the distribution is skewed and in line with Allayannis & Weston (2001) findings. To control for the skewness, we use natural logarithm of Tobin's Q instead of the standard version and therefore we can show the results as percentage changes in firm market value as in Allayannis & Weston (2001).

The function of Tobin's Q is that it measures the market value of firms' assets to the replacement cost of these assets. There are several versions introduced in prior literature of how to define these components in Tobin's Q as for instance using simplified measure of market value of firm to book value of total sales or more sophisticated model like Allayannis & Weston (2001) in line with Lewellen and Badrinath (1997) method on how to calculate the replacement cost of all assets. However, as the more advanced methods set higher requirements for the data availability, Allayannis & Weston (2001) along with Nguyen & Faff (2007) demonstrate that the results are only slightly affected by the chosen Tobin's Q method as Allayannis & Weston (2001) find 0.93 correlation in results by testing advanced and simplified Tobin's Q methods. Therefore, choosing a simplified method for measuring Tobin's Q is justified.

4.1.3. Dummy variables

Independent variables in the regressions include dummy variables for derivatives users and control variables for the known factors affecting firm market value. Derivative users are identified from the sample by applying dummy variables. First dummy variable for general derivative users (GEN) is used to define if a firm belongs to the derivative users group or not. If a firm states that they used derivatives or reported open position in any of the derivative types during that year, the dummy gets a value of one, otherwise zero. In addition, general derivative users are classified to sub categories by introducing three more dummy variables based on what type of derivatives the firm is using: foreign currency derivatives (FCD dummy), interest rate derivatives (IRD dummy) or commodity price derivatives (COM dummy). If a firm is using foreign exchange derivatives, the FCD dummy gets a value of one, zero otherwise. If a firm is using interest rate derivatives the IRD dummy gets a value of one, zero otherwise. And finally, if a firm is using commodity price derivatives, the COM dummy gets a value of one, zero otherwise.

Using the four dummy variables above the sample firms are divided to derivative users by main types and to non-users. The data for the dummy variables is collected manually from end-of-year financial statements of the sample firms. If a firm clearly states to have open derivative contracts at the end of fiscal year, the dummy gets a value of one and, zero otherwise. If a firm did not mention the use of derivatives in the financial statement of that year, but information regarding backdated start of derivatives usage is found from the financial statements of the following years, the firm is classified as user according to when the use of derivatives started. If a firm reports that their risk management policies include derivatives, but does not currently have an open position, the dummy GEN gets a value of zero and the firm is classified as nonuser. If a firm does not provide any information concerning use of derivatives, it is deleted from the sample.

4.1.4. Control variables

Control variables are chosen based on the previous literature in the field of firm value studies and further a new modified control variable is introduced related to derivatives position size. Based on the previously known factors in the firm market value, we will control for firm size, leverage, growth, profitability, liquidity and ability to access financial markets. In addition, control variables for hedging coverage and time effects during negative interest rate period are tested, which has not been included in the previous literature as such.

Size is included as control variable in most of the relevant studies on firm market value, but the evidence on its effect to Tobin's Q has not always been strong. Bartram et al. (2011) and Brunzell et al. (2009) find that large firms are more prone to use derivatives and Allayannis & Weston (2001) along with Belghitar et al. (2008) find that size has negative impact on Tobin's Q. These results support the assumption that small firms have more value than large firms and that derivative users are large firms and therefore it is expected for size to have positive correlation with derivative usage but negative with firm value. These results are regardless that Tobin's Q measure is comparable between different firm sizes which indicates that firm size might affect firm value in number of ways. Here size is measured as natural logarithm of firms' total assets in line with Allayannis & Weston (2001).

Leverage is included because the capital structure of a firm can affect the firm value and highly leveraged firms are more exposed to interest rate risk and therefore might find a need to hedge their exposure. Jin & Jorion (2006) found a positive relation between leverage and Tobin's Q as opposed to Allayannis & Weston (2001) who find a negative relation. The common assumption being that firms that have low debt levels are more valuable than firms which have had to use debt as main financing method, as high leverage ratio can imply a higher firm risk. (Bartram et al. (2011.) Along with Allayannis & Weston (2001) leverage is here measured as long-term debt to shareholders' equity.

Growth opportunities can result in positive firm value as investments made on tangible assets are associated with future profits in case the investment pays off and thus lead to higher firm value in the future. Capital expenditures show the size of investments on assets that a firm has made for the future and when compared to firm's total revenue we can see what portion of sales a firm is ready to invest on the future growth. Following Allayannis & Weston (2001) and Jin & Jorion (2006) growth is calculated by capital expenditures divided by total sales, they also find a positive relation between growth opportunities and Tobin's Q which leads us to expect a positive relation as well.

Profitability as measured by net income to total assets, or more commonly known as return on assets (ROA) is controlled since profitable firms are associated with higher firm value. ROA demonstrates how efficiently a firm is generating income from its assets and is widely used as a measure for firm value. Allayannis and Weston (2001) state that profitable firms are expected to trade with premium and therefore have a higher Tobin's Q compared to not profitable firms. Along with Allayannis & Weston (2001), Bartram et al. (2009) and Jin & Jorion (2006) a positive relation between profitability measure and Tobin's Q is expected.

Liquidity is controlled since the availability of cash can affect firm value through increased risk or higher operating costs. On the other hand, firms with lower excess cash are more prone to invest only on lower risk projects with positive net present value and thus resulting in higher Tobin's Q in the future as opposed to firms with high liquidity. (Pramborg 2004.) Also, Bartram (2000) finds that firms with low liquidity are more likely to hedge than high liquidity firms. In line with Pramborg (2004) and Bartram (2000) current ratio is used as a proxy for liquidity.

Access to financial markets is expected to have negative relation to Tobin's Q since according to Allayannis & Weston (2001) and Jin & Jorion (2007) firms with cash flow problems are more likely to pass on negative net present value projects and therefore have higher Q's. On contrary Jin & Jorion (2007) see that decision to pay dividends is a positive indicator from the management and therefore relation can be also positive. Access to financial markets can be measured with dividend payment decision or alternatively with dividend per share value. Here dividend dummy is chosen to proxy access to financial markets, the dummy gets a value of one if a firm has paid dividend during that year and zero otherwise in line with Allayannis & Weston (2001) and Jin & Jorion (2007).

Negative rates is the dummy variable used to separate the observations during time period of negative interest rates in years 2015 and 2016 from the whole period and to test the third hypothesis. The possible effect of negative interest rate market environment to value effect of hedging is a new addition to control variables which has not been included in previous literature as the market rates in Europe have never been noted below zero before the April of 2015. Table 2 also shows that the level of derivative users has steadily declined going into 2015 and therefore it is interesting to see if any hedging premium can be found during these years.

Hedging coverage as measured by the relative size of firm's open derivative position was first introduced as control variable in Naito & Laux (2011) study on non-financial US sample. They test relative size of derivative position divided by total assets, using fair and nominal values independently for the derivative position as control variables. They find weak indication that the relative nominal position size has positive impact on Tobin's Q, but the results are not significant. Naito & Laux (2011) suggest testing with larger sample in pursue of stronger results as their sample consists of only 434 observations. Therefore, it is interesting to see whether stronger significance can be achieved using 737 observations of the Finnish market and if the derivatives position size has any effect on the Tobin's Q value.

If hedging creates positive firm value, a higher level of hedging should create more firm value, unless hedging is only value creating until certain level of coverage. As large firms are expected to have larger derivative positions than small firms, a relative method is used to standardize the firm size effect. Hedging coverage is proxied by end-of-year nominal value of open derivative contracts divided by firm's total assets following Naito & Laux (2011). Comparing the nominal position to total assets indicates how big the open derivative position is compared to the firm size which gives us information of the risks related to the position. Reporting of OTC derivatives and ETDs position to a trade repository became mandatory in February 2014 as part of European Market Infrastructure Regulation (EMIR) which has further improved the availability of data. However, the corporate position data is still poorly available from any databanks and thus the position data is collected manually from the firms' financial statements. Firms which declared the use of derivatives but do not report the size of their open position are removed from the final sample, which concerns eleven out of the 748 firm year observations leaving 737 firm year observation for the final multivariate regressions.

Many of the previous studies in the field have focused mainly on the effects of one derivative type. Allayannis & Weston (2001) study the effect of foreign currency derivatives, while Belghitar et al. (2008) include also interest rate derivative users in their study on UK sample. Jin & Jorion (2007) and Clarke et al. (2006) on the other hand focus on commodity derivative effects on firm value in different industries. Due to the small size of the Finnish market and the high correlations expected between derivative user sub categories, we will keep the sub categories during descriptive statistics and univariate analysis phase for informational purposes and to understand how widely firms are using different derivative types.

For the multivariate regressions the firms will be only categorized as general hedgers, foreign currency hedgers, and interest rate hedgers. Commodity price hedgers are not tested as their own group in multivariate regressions as Table 2 statistics show that majority of commodity price hedgers are included in the other hedger groups. Further it allows us to minimize the effect of high correlations between users of different derivative types.

Table 3: Variables summary.

Variables	Predicted sign	Definition
Tobin's Q (ln)		The natural logarithm of total assets minus book value of equity plus market value of equity divided by total assets
General hedgers (d)	+	Dummy variable for general derivative users
Foreign currency hedgers (d)	+	Dummy variable for foreign currency derivative users
Interest rate hedgers (d)	-	Dummy variable for interest rate derivative users
Commodity price hedgers (d)	+	Dummy variable for commodity price derivative users
Size (ln)	-	The natural logarithm of total assets
Leverage	-	Total liabilities divided by shareholder's equity
Profitability	+	ROA = Net income divided by total assets
Growth	+	Capital expenditures divided by total sales
Liquidity	-	Current ratio = Current assets divided by current liabilities
Access to financial markets (d)	-	Dummy variable for firms with dividend payment
Negative rates (d)	+	Dummy variable for time period of 2015-2016
Hedging coverage	+	Nominal derivative position divided by total assets

We also acknowledge in line with Brunzell et al. (2011) that derivative users can include both hedgers and speculators, but since they find that most large non-financial firms use derivatives mainly for hedging purposes we can refer to derivative users as hedgers. Belghitar et al. (2008) study whether separation of operational hedgers from nonusers has an effect to the firm value results but find no significant meaning, thus we can acknowledge that nonusers group can include some operational hedgers. Table 3 summarizes the variable definitions and result predictions for the variables introduced above with predicted sign showing the expected relation between the variable and the dependent variable of natural logarithm of Tobin's Q.

4.1.5. Summary statistics

Table 4 presents descriptive statistics of sample firms including figures for the key regression variables. Panel A shows details of the full sample of 748 firm year observations whereas Panel B shows the same figures for general derivative hedgers which amounts to 567 firm year observations. 181 firm year observations are left to Panel C and these are the firms categorized as non-users. In addition, Panel D shows the differences in Tobin's Q between the different sub samples including the main derivative types and non-users.

Mean value of Tobin's Q for the whole sample is 1.55 with median value of 1.23 which confirms that the Tobin's Q distribution is skewed and therefore it is justified to use the natural logarithm of Tobin's Q as dependent variable in the multivariate regressions. As Tobin's Q values are generally larger than one it indicates that the stocks in OMX Helsinki are currently overvalued as the companies are worth more than the cost of their assets.

By looking into the Tobin's Q values in Panels B and C we can see that the non-users have higher mean and median values compared to derivative users which would lead us to reject the first hypothesis. The Q mean value of 2.03 for non-users is significantly higher than 1.39 for derivative users, with median values of 1.37 and 1.19 respectively. The significant difference between the two categories leads to assumption that the use of derivatives does not solely explain the difference between the samples. However, as we compare the maximum Q value for non-users (13.03) to the derivatives users (4.63) the large cap suggests that considering the sample size there are possibly few extreme values which are driving the difference, as minimum values 0.60 and 0.64 are almost equal for both samples.

Table 4: Sample descriptive statistics.

Panel A: All firms						
Variables	**Obs,**	**Mean**	**Median**	**Maximum**	**Minimum**	**Std. Dev.**
Tobin's Q	748	1,55	1,23	13,03	0,60	1,15
Market value of equity	748	1195447,00	188312,90	28985960,00	938,40	3173147,00
Total sales	748	1465690,00	254675,50	42446000,00	1,00	3580266,00
Total assets	748	1661464,00	251747,00	44901000,00	1428,00	4293932,00
Leverage	748	0,44	0,36	7,24	-6,02	0,66
Growth	748	0,11	0,03	16,20	0,00	0,71
Profitability	748	0,67	3,50	97,11	-255,67	20,55
Liquidity	748	1,57	1,36	10,08	0,09	1,12
Dividends per share	748	0,35	0,18	3,27	0,00	0,43
Hedging coverage	556	0,25	0,18	1,60	0,00	0,23
Panel B: Derivative users						
Variables	**Obs,**	**Mean**	**Median**	**Maximum**	**Minimum**	**Std. Dev.**
Tobin's Q	567	1,39	1,19	4,63	0,60	0,63
Market value of equity	567	1549258,00	332835,40	28985960,00	1272,76	3572524,00
Total sales	567	1901536,00	529600,00	42446000,00	609,00	4015516,00
Total assets	567	2162046,00	515200,00	44901000,00	5753,00	4825689,00
Leverage	567	0,47	0,41	4,69	-3,04	0,53
Growth	567	0,08	0,03	2,66	0,00	0,24
Profitability	567	2,58	3,52	48,63	-65,85	10,21
Liquidity	567	1,47	1,33	8,86	0,09	0,89
Dividends per share	567	0,41	0,25	3,27	0,00	0,46
Hedging coverage	556	0,25	0,18	1,60	0,00	0,23
Panel C: Non-users						
Variables	**Obs,**	**Mean**	**Median**	**Maximum**	**Minimum**	**Std. Dev.**
Tobin's Q	181	2,03	1,37	13,03	0,64	1,98
Market value of equity	181	87101,67	31154,51	1340124,00	938,40	154517,20
Total sales	181	100360,10	49178,00	858887,00	1,00	144603,90
Total assets	181	93339,98	43854,00	1260788,00	1428,00	171843,60
Leverage	181	0,33	0,23	7,24	-6,02	0,96
Growth	181	0,21	0,02	16,20	0,00	1,37
Profitability	181	-5,33	3,08	97,11	-255,67	37,11
Liquidity	181	1,87	1,45	10,08	0,11	1,62
Dividends per share	181	0,15	0,04	0,95	0,00	0,21
Hedging coverage	181	0,00	0,00	0,00	0,00	0,00
Panel D: Tobin's Q						
Sample group	**Obs,**	**Mean**	**Median**	**Maximum**	**Minimum**	**Std. Dev.**
All firms	748	1,55	1,23	13,03	0,60	1,15
General hedgers	567	1,39	1,19	4,63	0,60	0,63
Currency hedgers	427	1,39	1,19	4,63	0,60	0,63
Interest rate hedgers	457	1,33	1,16	3,69	0,63	0,56
Commodity hedgers	218	1,38	1,17	3,76	0,63	0,64
Non hedgers	181	2,03	1,37	13,03	0,64	1,98

Market value of equity along with total sales and total assets provides information if the firm size can be driving the significant differences in Tobin's Q as shown in Allayannis & Weston (2001). The mean value for equity market value for the whole sample is 1195 million euros and as we compare it to 1549 million of derivative users and 87 million of non-users it is clear, that small firms are the majority in the non-user category and derivative users are identified as large firms in line with Allayannis & Weston (2001) and Brunzell et al. (2011). This can be confirmed by the total assets (total sales) mean of 1661 (1465) million for the whole sample as the mean for derivative users is 2162 (1901) and 93 (100) million for the non-users. These figures also show how diverse the firms are by size in OMX Helsinki.

Support for the predicted negative correlation of leverage and firm value is also found from Table 4 as mean (median) for the whole sample is 0.44 (0.36) with derivative users mean 0.47 (0.41) driving the whole sample average. Non-user mean of 0.33 (0.23) indicates that small firms have also lower leverage, and as Bartram et al. (2011) report leverage values of 0.30 (0.25) for their large international sample it shows that Finnish firms are more leveraged and therefore more exposed to interest rate risk which can explain the high percentage of interest rate hedgers in the sample. This negative relation between Tobin's Q values and leverage is also supported by Allayannis & Weston (2001) and Belghitar et al. (2008).

Mean growth of 0,21 for the non-users is considerably higher than 0.08 for derivative users which indicates that the small firms in the non-user sample are investing relatively larger amounts of their sales in seek of growth. This also supports the predicted positive sign for growth opportunities on firm value following Jin & Jorion (2006) and Allayannis & Weston (2001) findings. Profitability is also predicted to show positive relation to firm value, but instead the Finnish sample has mean ROA of 2.58 for derivative users with lower Tobin's Q values as opposed to non-users with higher Q values and ROA of -5.33. However, the negative profitability can be explained by the growth firms in the non-user sample for which low income and high investments in assets is quite normal relation. Also, the minimum value of -255.67 ROA in the non-user sample shows that considering the sample size there are few firms with extremely low ROA figures which bias the mean in the non-user sample.

Liquidity and ability to access capital markets measure the firm value through cash flows and liquid assets. For liquidity the mean (median) of 1.87 (1.45) for non-users is higher than 1.47 (1.33) and 1.57 (1.36) for derivative users and the whole sample respectively in line with previous literature as Bartram (2000) finds that firms with low liquidity are more prone to use derivatives. Dividend yield or dividend per share is expectedly larger for the derivative users than non-users, given that we have acknowledged that the samples are quite strongly characterized by the differences between large and small firms. For the regression analysis a dividend dummy is used instead to standardize the differences in small and large firms as dividend payers. This is following Allayannis & Weston (2001) as firms that pay dividend are considered to have better cash balance and therefore able to undergo negative net present value projects which then leads to lower Tobin's Q value. Thus, negative correlation is expected for the dividend dummy and Q value, the analysis part will show if findings from Table 4 can be updated. In addition, the mean (median) of hedging coverage for derivative users is 0.25 showing that the average open derivative positions are 25 % of the value of firms' total assets.

Panel D in Table 4 compares the Tobin's Q values between derivative user subsamples and non-users. As expressed earlier it is challenging to find significant differences in Q values between diverse types of hedging as most firms in every hedger sub group have also open position in at least one other group. This is shown in Panel D as currency hedgers have the same mean and median values as the general hedgers sample. Slight differences are found with interest rate hedgers which have the lowest mean of 1.33 compared to 1.39 of the general hedgers, which indicates possible support for the third hypothesis of negative value premium caused by negative market rate environment. Following that the interest rate hedgers are also the biggest sub sample group with 457 firms out of 567 having open position in interest rate derivatives, it appears the reported values for different type of hedgers are influenced by hedging multiple risk exposures simultaneously. However, the high leverage values introduced in Panel B are in line with Allayannis & Weston (2001) and Belghitar et al. (2008) as leveraged firms are expected to have lower Tobin's Q values. These correlations are further examined in the following analysis part of the thesis.

4.2. Methodology

Following the prior literature in hedging and firm value studies the main hypothesis is tested by reviewing differences in Tobin's Q values for derivative users and non-users. The positive value premium found by Allayannis & Weston (2001) and Bartram et al. (2011) is tested first in univariate tests including comparisons between different years during the sample period and derivative sub categories against non-users. Simple mean and median tests are carried out as well as correlations comparisons between the regression variables introduced in Data section.

As firm value is affected by multiple factors the analysis is continued in multivariate regression tests where the control variables are added to rule out value effects from other variables than use of derivatives. To see if Allayannis & Weston (2001) value premium can be found using the Finnish sample a pooled OLS regression method is applied added with fixed effects OLS regressions. In addition, a new control variable for hedging coverage is introduced and tested to see if a wide hedging strategy supports the possible value benefits gained by hedgers.

4.2.1. Univariate analysis

The univariate analysis part presents results from Tobin's Q mean and median tests to see if the findings from OMX Helsinki firms are following previous literature like Allayannis & Weston (2001) and Belghitar et al (2008). For the mean and median tests, the sample is divided into two time-windows to see if the negative interest rate market environment provides diverse results compared to positive rate environment, as prior literature results are all from the era of positive interest rates. Hedgers are further categorized into subgroups based on the main derivative types: foreign exchange hedgers, interest rate hedgers and commodity price hedgers. The results will indicate how the Tobin's Q values presented in Table 4 are formed and if the time effects or hedging with specific derivative type are driving the results. Additionally, mean and median tests are applied to see if firms which used only either foreign currency derivative or interest rate derivatives separately fared better when compared to non-users. Finally, findings from the correlation matrix for the multivariate regression variables are also examined.

Table 5 divides the sample into to two according to the market interest rate environment. As the Euribor rates were first noted below zero in April 2015, the period of positive rates accounts for firm observations from the year 2010 to 2014, whereas negative rates period includes the data from the final years in the sample period, 2015 and 2016. As the data is based on end-of-year figures collected annually, the year 2015 can be included in the negative rates period regardless that the first months of 2015 were still under positive rate environment. Table 5 results include all 748 firm year observations with 240 observations during negative rates and 508 during positive rate environment in Panel A and for Panels B to D the number of observations changes as other hedgers than the one tested in each Panel are not included in the sample. Due to the skewness in Tobin's Q distribution noted earlier, both mean and median values are included in the analysis. Mean and median tests determine if the Tobin's Q mean and median values of hedgers differ from the Q values of non-hedgers. The significance levels are determined based on p-values obtained from t-test in mean tests, while median test p-values are collected using Wilcoxon-Mann-Whitney test. T-statistic under 1.645 is considered significant at 10 % level, while t-statistic of 1.96 or higher denotes 5 % significance and t-stat of 2.58 or higher is highly significant at 1 % level.

Panel A shows how general hedgers performed against non-hedgers during negative and positive rate periods. Tobin's Q value presented in Table 4 for the whole sample were 1.55 and 1.39 (2.03) for the general hedgers (non-hedgers) respectively. The results from Panel A show that mean difference between general hedgers and non-hedgers during the positive rates period is considerable lower -0.23 compared to -0,64 difference from the whole period in Table 4, though highly significant at 1% while difference in median values is also negative but insignificant. However, mean difference during negative rates is -1,12 with high significance at 1% including highly significant negative difference in median values as well. These findings suggest that the negative value premium for general hedgers is mainly driven by the negative rates period which contrasts with Allayannis & Weston (2001) and is more in line with Khediri & Folus (2010) and Nguyen & Faff (2007). Panels B to D provide information on if the mean and median differences noted in Panel A vary between different derivative type hedgers and further provide evidence for the second and third hypothesis. However, the result for the general hedgers is considered more reliable as the observations in hedger sub categories are overlapping as discussed before. Due to the sample separation between positive and negative interest rates, results of interest rate hedgers versus non-hedgers is expected to show higher negative premium for hedgers in line with the third hypothesis.

Table 5: Tobin's Q mean and median tests by market environment and derivative type.

Tobin's Q		Positive rates			Negative rates		
		Mean	Median	Obs	Mean	Median	Obs
Panel A: General							
	Hedgers	1,36	1,16	406	1,47	1,29	161
	Non-hedgers	1,59	1,23	102	2,59	1,71	79
	Difference	-0,23	-0,07		-1,12	-0,42	
	p-value	0,0040***	0,1894		0,0000***	0,0000***	
	Total obs			**508**			**240**
Panel B: Foreign currency							
	Hedgers	1,36	1,15	311	1,48	1,32	116
	Non-hedgers	1,59	1,23	102	2,59	1,71	79
	Difference	-0,23	-0,08		-1,11	-0,39	
	p-value	0,0082***	0,1748		0,0000***	0,0004***	
	Total obs			**413**			**195**
Panel C: Interest rate							
	Hedgers	1,30	1,15	324	1,40	1,21	133
	Non-hedgers	1,59	1,23	102	2,59	1,71	79
	Difference	-0,29	-0,08		-1,19	-0,50	
	p-value	0,0003***	0,0645*		0,0000***	0,0000***	
	Total obs			**426**			**212**
Panel D: Commodity							
	Hedgers	1,34	1,10	158	1,49	1,31	60
	Non-hedgers	1,59	1,23	102	2,59	1,71	79
	Difference	-0,25	-0,13		-1,10	-0,40	
	p-value	0,0192**	0,0500**		0,0019***	0,0031***	
	Total obs			**260**			**139**

***,** and * imply 1%, 5% and 10% significance levels, respectively.

Following the negative difference found for general hedgers, foreign currency hedgers in Panel B have slightly lower Tobin's Q values with -0,23 value difference significant at 1 % level during positive rates, but for the negative rates period the mean difference is noted at -1,11 and median difference at-0,39 with both highly significant. The foreign currency hedger and non-hedger groups are more balanced in number of observations during negative rates while in the positive rate sample the hedgers outweigh non-hedgers by three to one. As the negative value premium is considerable for foreign currency hedgers and the interest rate environment factor should be more effective on interest rate hedgers, it is likely that the result is driven by firms which belong to both hedging groups.

Panel C shows the largest value difference out of the three hedging groups for interest rate hedgers with highly significant mean (median) difference of -0,29 (-0,08) during years from 2010 to 2014. The negative rates period shows also the largest and highly significant negative difference in Q values between hedgers (1,40) and non-hedgers (2,59) in line with differences shown in Panel A and B, which confirms that the negative hedging premium seems to be driven by the most recent years in the sample period and further the interest rate hedgers appear to drive the negative premium shown for the general hedgers which would leave to the confirmation of the third hypothesis.

The results from mean and median tests in Panel D for commodity hedgers are also in line with the findings from foreign currency and interest rate hedgers and throughout highly significant. Due to the small sample size and the fact that most of the commodity hedgers (94 %) have an open position in at least one of the other derivative segments, the Panel D Tobin's Q values are considered biased by other hedger groups. Therefore, commodity price hedgers are not included in Table 6 as their own group where the possible value effects of hedging with only single type of derivatives are tested.

The univariate tests in Table 5 show no support for the first and second hypothesis but instead are indicating that the value premium might be rejected for both general and individual derivative type hedgers and the negative value premium hypothesis confirmed for interest rate hedgers.

To further evaluate the assumption in second hypothesis, table 6 presents Tobin's Q values for firms which used only foreign currency derivatives (Panel A) or interest rate derivatives (Panel B). The results are compared against non-hedgers as in Table 5, to see if hedging only one specific risk exposure can lead to a higher Q value than hedging with multiple derivative types. When foreign currency hedgers are isolated the difference between hedgers and non-hedgers is positive which was not present in Table 5 statistics, and thus in line with Allayannis & Weston (2001) findings. However, results here are insignificant for both time periods excluding the positive median difference during positive rates with only 10 % significance.

Table 6: Mean and median tests for hedging with single derivative type.

Tobin's Q		**Positive rates**			**Negative rates**		
		Mean	Median	Obs	Mean	Median	Obs
Panel A: Foreign currency							
	Hedgers	1,7	1,38	52	1,98	1,47	14
	Non-hedgers	1,59	1,23	102	2,59	1,71	79
	Difference	0,11	0,15		-0,61	-0,24	
	p-value	0,5345	0,0625*		0,3954	0,9700	
	Total obs			**154**			**93**
Panel B: Interest rate							
	Hedgers	1,3	1,19	83	1,33	0,98	39
	Non-hedgers	1,59	1,23	102	2,59	1,71	79
	Difference	-0,29	-0,04		-1,26	-0,73	
	p-value	0,0227**	0,2641		0,0040***	0,0000***	
	Total obs			**185**			**118**

***,** and * imply 1%, 5% and 10% significance levels, respectively.

Panel B on the contrary follows the findings in Table 5 with -0,29 difference during positive rates period, but strong and highly significant negative difference of -1,26 during negative rates. These results are expected and strengthen the assumption that negative hedging premium is driven by interest rate hedgers which is especially valid during negative rates period from 2015 to 2016. The findings in Tables 5 and 6 are disputing Allayannis & Weston (2001) and Belghitar et al. (2008) findings as well as many of the previous literature findings and the main hypotheses in this thesis. Therefore, further analysis with multivariate regression is needed to see which factors other than hedging are driving the negative value premium noted here.

For estimating firm value effect of derivatives with OLS regression there are conditions to be met if we seek to avoid biased coefficient results. The OLS assumptions are introduced further in the multivariate analysis chapter, but to see if chosen independent and control variables are in breach of OLS assumption MLR.3 a correlation matrix is reviewed in Table 7. MLR.3 is one of the five OLS assumptions which need to be met or controlled to confirm unbiased regression results. MLR.3 is the "No Perfect Collinearity" assumption according to which none of the independent variables can be constant and no exact linear relationships can exist among the independent variables. (Wooldridge 2009: 84–94.)

Table 7: Pearson correlation matrix.

Correlation matrix (p-value)	Tobin's Q (ln)	General hedgers	Size (ln)	Growth	Leverage	Liquidity	Profitability	Access to financial	Negative rates	Hedging coverage
Tobin's Q (ln)	1,000 -----									
General hedgers	-0,217*** (0,000)	1,000 -----								
Size (ln)	-0,183*** (0,000)	0,550*** (0,000)	1,000 -----							
Growth	0,199*** (0,000)	-0,077** (0,038)	-0,121*** (0,001)	1,000 -----						
Leverage	-0,228*** (0,000)	0,091** (0,014)	0,177*** (0,000)	-0,083** (0,025)	1,000 -----					
Liquidity	0,231*** (0,000)	-0,150*** (0,000)	-0,186*** (0,000)	0,153*** (0,000)	-0,094** (0,011)	1,000 -----				
Profitability	-0,036 (0,334)	0,170*** (0,000)	0,216*** (0,000)	-0,349*** (0,000)	0,028 (0,451)	0,065* (0,080)	1,000 -----			
Access to financial markets	0,037 (0,319)	0,238*** (0,000)	0,346*** (0,000)	-0,077** (0,037)	-0,087** (0,019)	0,029 (0,430)	0,410*** (0,000)	1,000 -----		
Negative rates	0.178*** (0.000)	-0.140*** (0.000)	-0.052 (0.159)	0.082** (0.026)	0.011 (0.760)	0.066* (0.074)	-0.040 (0.284)	0.002 (0.965)	1.000 -----	
Hedging coverage	-0,167*** (0,000)	0,479*** (0,000)	0,647*** (0,000)	-0,036 (0,326)	0,087** (0,019)	-0,091** (0,014)	0,085** (0,021)	0,159*** (0,000)	-0.073** (0.049)	1,000 -----

***,** and * imply 1%, 5% and 10% significance levels, respectively.

Table 7 shows the correlations between dependent and independent variables where the p-values are presented in parenthesis below the correlation coefficients to determine the significance levels. The correlations in Table 7 vary from -0,349 to 0,647 and are mostly rather low, thus we can conclude that MRL.3 requirements are met, and perfect collinearity does not exist. If two or more of the regression variables have high but not perfect collinearity, the sample has multicollinearity, which is ruled out by taking a closer look on the correlation coefficients. The natural logarithm of Tobin's Q as dependent variable has expected and highly significant negative correlations with general hedgers, size, leverage and hedging coverage with the highest coefficient of leverage -0,228. In line with previous literature large and highly leveraged firms have lower Q values, but in contrast to Belghitar et al. (2008) the value premium looks to be negative for general hedgers and is supported by negative correlation between Q value and the size of derivative position. Positive correlations for ln Q are growth, liquidity and negative rates which confirms that Q values for the overall sample are higher during negative rates.

For general hedgers all correlations are significant at least at 5 % level, with small negative correlations for growth, liquidity and negative rates. The high positive correlations for size, access to financial markets and hedging coverage are expected as general hedgers are characterized as large firms which tend to pay dividends. High positive coefficients for size against access to financial markets (0.346) and hedging coverage (0.647) confirm the above and further indicate that large firms tend to have relatively larger derivative positions. With these findings it is concluded that there are no multicollinearity problems with the independent variables as there are only few isolated high correlations not greater than 0.647. Overall the correlation coefficients in Table 7 are expected and in line with previous literature for the most part, added with the new findings regarding negative market rates and hedging coverage. Though, the results are in contrast on the account of value premium noted for derivative users. Further analysis on the value premium and dependencies between the variables is conducted in OLS multivariate regressions in the following chapter.

4.2.2. Multivariate analysis

To capture the factors affecting firm value and the possible value effect of hedging, multivariate regression models are estimated on the OMX Helsinki sample. The multivariate analysis part consists of introduction of OLS assumptions, and further regression models for pooled OLS regression and fixed effects OLS regression are determined.

The Ordinary-Least-Squares or OLS regression is widely used through existing literature to estimate the coefficients in multivariate regression models. In OLS regression, the sum of squared residuals is minimized meaning that OLS model reduces distance between the actual sample observations and the chosen linear regression model. The data set used here is characterized as panel data with several cross-sections but employing the OLS pooled regression means that the observations are pooled together resulting in broken panel structure. In order for the OLS estimators to be considered unbiased, a set of pre-defined assumptions have to be met. The Gauss-Markov OLS assumptions are listed from one to five as multiple regression model (MLR) conditions. MRL.1 (Linear in Parameters) defines the general form of multivariate regression and states that the dependent variable is linearly formed by set of chosen independent variables and the error term. MLR.2 (Random Sampling) defines that the sample must consist of random observations and thus the expected error term is equal to zero. According to MLR.3 (No Perfect Collinearity) any chosen independent variable cannot be perfect linear combination of the other independent variables, a condition for which the variable correlations were compared in Table 7. MLR.4 (Zero Conditional Mean) is considered the most important of the assumptions stating that the error term in the model has an expected value of zero given any values of the independent variables. And finally, MLR.5 (Homoskedasticity) states that the variance of error terms has to remain unchanged with any given values of independent variables, otherwise the errors are considered heteroskedastic. (Wooldridge 2009; 84–94.)

Pooled OLS regression allows for the sample to vary between observation years and as a large part of the sample firms are included every year, the statistical significance is increased by getting rid of the panel structure and pooling the cross-sections across time. As the panel structure is ignored, controlling for time effects with negative rates dummy variable provides relevant information of the value effect in different market environments. Table 8 shows the variation in Tobin’s Q values through to sample period from 2010 to 2016. When considering the largest increase in Q values from 2014 to 2015 present in Table 8 which demonstrates the time effect, and the fact that the number of cross-sections (firms) is large and the duration of time period (years) short, fixed effects regressions are applied in addition to pooled

OLS regressions to improve the goodness of fit for this panel data. (Wooldridge 2009: 444–449.)

Table 8: Tobin's Q values by year.

All firms	2010	2011	2012	2013	2014	2015	2016
Mean	1,48	1,24	1,28	1,51	1,50	1,80	1,87
Median	1,26	1,09	1,12	1,22	1,22	1,33	1,45
Observations	98	98	100	104	108	117	123
General hedgers							
Mean	1,49	1,24	1,27	1,43	1,38	1,42	1,52
Median	1,27	1,05	1,12	1,17	1,22	1,20	1,31
Observations	82	82	80	82	80	80	81
Non-users							
Mean	1,44	1,26	1,35	1,82	1,87	2,64	2,55
Median	1,24	1,22	1,10	1,52	1,23	1,57	1,73
Observations	16	16	20	22	28	37	42

The first model is pooled OLS regression with natural logarithm of Tobin's Q as dependent variable, general hedgers as the independent variable of interest and the following control variables: Size, leverage, profitability, growth, liquidity, ability to access financial markets and negative rates.

$$\text{Tobin's } Q\ (ln) = \beta_0 + \beta_1 \text{general hedgers} + \beta_2 \text{size} + \beta_3 \text{leverage} + \beta_4 \text{growth} + \beta_5 \text{profitability} + \beta_6 \text{liquidity} + \beta_7 \text{access to financial markets} + \beta_8 \text{negative rates} \quad (8)$$

Further pooled OLS regressions are estimated for the effect of hedging with interest rate and foreign currency derivatives specifically. The individual effect of commodity price hedgers is left out of the models due to the low number of observations and high overlapping percentage with interest rate and foreign currency hedgers. Models 8 and 9 provide evidence the first two hypotheses concerning value premium expectations of general and foreign currency hedgers and Model 10 is used for testing the use of interest rate derivatives effect on firm value.

(9) $Tobin's\ Q\ (ln) = \beta_0 + \beta_1 foreign\ currency\ hedgers + \beta_2 size + \beta_3 leverage + \beta_4 growth + \beta_5 profitability + \beta_6 liquidity + \beta_7 access\ to\ financial\ markets + \beta_8 negative\ rates$

(10) $Tobin's\ Q\ (ln) = \beta_0 + \beta_1 interest\ rate\ hedgers + \beta_2 size + \beta_3 leverage + \beta_4 growth + \beta_5 profitability + \beta_6 liquidity + \beta_7 access\ to\ financial\ markets + \beta_8 negative\ rates$

Models 8,9 and 10 are estimated for the whole sample of 748 firm year observations and are constructed mainly of variables that are proven in many of the previous studies to affect firm value, including Allayannis & Weston (2001), Belghitar et al. (2008), Bartram et al. (2011) and Khediri & Folus (2010). The control variables for negative rates brings additional information as the data is more recent and the market environment rather unusual but controlling for time effects itself is a relevant factor also in previous literature. The data for hedging coverage control variable is manually collected from the firm annual reports. Hedging coverage measures the relative size of open derivative position by dividing the nominal value of the position by firm's total assets and thus comparable among different firm sizes. Due to missing information for derivative positions, 11 firms are deleted from the sample leaving 737 observations for the final sample. Hedging coverage is added as control variable to test the fourth hypothesis as Models 11, 12 and 13 are formed.

(11) $Tobin's\ Q\ (ln) = \beta_0 + \beta_1 general\ hedgers + \beta_2 size + \beta_3 leverage + \beta_4 growth + \beta_5 profitability + \beta_6 liquidity + \beta_7 access\ to\ financial\ markets + \beta_8 negative\ rates + \beta_9 hedging\ coverage$

(12) $Tobin's\ Q\ (ln) = \beta_0 + \beta_1 foreign\ currency\ hedgers + \beta_2 size + \beta_3 leverage + \beta_4 growth + \beta_5 profitability + \beta_6 liquidity + \beta_7 access\ to\ financial\ markets + \beta_8 negative\ rates + \beta_9 hedging\ coverage$

(13) $Tobin's\ Q\ (ln) = \beta_0 + \beta_1 interest\ rate\ hedgers + \beta_2 size + \beta_3 leverage + \beta_4 growth + \beta_5 profitability + \beta_6 liquidity + \beta_7 access\ to\ financial\ markets + \beta_8 negative\ rates\ \beta_9 hedging\ coverage$

Before the results for the OLS regression models above can be reviewed, the OLS assumptions introduced earlier are tested to see if the chosen regression model is a good estimator for the regression parameters. If the assumptions from MLR.1 to MLR.5 are met, variables chosen are the best linear unbiased estimators (BLUE). (Wooldridge 2009: 103.) After plotting the dependent variable Tobin's Q against the independent variables, it is confirmed that Tobin's Q is linear combination of the independent variables and therefore MLR.1 holds for the equation. MLR.2 holds true if the expected error term (residuals) is equal to zero. This is confirmed by plotting the residuals of Tobin's Q versus the fitted values and since the residuals are evenly distributed around zero, the expected value is zero, thus MLR.2 holds. The evidence for third assumption MLR.3 is presented in Table 7 correlation matrix showing that perfect collinearity does not exist among independent variables confirming the MLR.3 assumption. Heteroskedasticity problem is quite frequent in economic OLS models and also present here as the Durbin-Watson stat for the equation is low, thus achieving MLR.5 assumption for homoscedastic standard errors requires controlling for heteroscedasticity. To control for heteroscedasticity, White's cross-section method is used in all OLS regressions which provides heteroscedasticity robust standard errors without significantly changing the estimation output and better reliability on the significance of the results as measured by t-statistics and p-values. (Wooldridge 2009: 271–276.)

Finally, MLR.4 requires that the mean of the error term does not depend on the values of the independent variables, if such dependence is found the errors are called autocorrelated. Autocorrelation is a problem that often exists in economic pooled OLS regression models, since there are several macroeconomic factors which can and usually do change over the years and thus affecting the dependent variable, such as GDP growth here. When estimating the effect of hedging to firm market value it is important to acknowledge the possibility of autocorrelation since the growth of GDP over the years for instance surely affects firm values and therefore Tobin's Q values in the sample and causes the pooled OLS regression to be biased. To be able to control for the autocorrelation in panel data pooled OLS regression, the number of time periods would have to be large and the number of cross-sections small. Our panel data for OMX Helsinki firms has the opposite characteristics as the number of cross-sections (firms) considered here is large and the sample period relatively short. Running fixed effects regression has better statistical abilities for this kind of panel data characteristics and it is able to correct for autocorrelation, and additionally for heteroskedasticity and multicollinearity. The fixed effects model should not change the regression coefficients remarkably, but most likely the goodness of fit as measured by R-square is expected to improve. The limitations and advantages of fixed effects model are that any time-constant variables, if such exist in the model, cannot be included among the independent variables. This causes no changes to models introduced earlier as sector dummies or other similar constant variables were not added to the Models to begin with. Therefore, fixed effects regressions are estimated for all the Models from 8 to 13 and results are presented along with OLS pooled regressions in tables 9 and 10 in the next chapter. (Wooldridge 2009: 481–489.)

4.3. Results

Use of derivatives and firm value effect is widely studied in prior academic literature with variety of samples and research angles. Allayannis & Weston (2001) findings for positive value premium of 4,87 % among foreign currency hedgers set the ground for many others to approach the subject. This chapter presents the results from multivariate regressions on the OMX Helsinki sample to see if the Allayannis & Weston (2001) findings and the hypotheses in this thesis can be confirmed or if the preliminary results from the univariate tests showing signs of negative value premium among Finnish derivative hedgers are repeated in pooled OLS and fixed effects regressions.

4.3.1. Univariate results

The sample characteristics show 46,04 % higher Tobin's Q value for non-users than general hedgers, a significant difference which cannot be explained solely by the hedging activities as the hedgers are quite strongly characterized as large firms whereas non-users are mainly small firms. Tobin's Q as a measure is comparable between different sized firms, but as firm size has been confirmed in previous literature to affect the firm value more robust estimations are needed. Furthermore, Tobin’s Q differences are tested in mean and median tests by dividing the sample into two time periods following the changes in interest rate market environment.

Positive rates period from 2010 to 2014 shows -16,91 % negative premium for general hedgers whereas the difference is considerably stronger during the negative rates period with highly significant -76,19 % negative hedging premium. The result is repeated when interest rate hedgers and foreign currency hedgers are compared against non-hedgers with both sub categories showing sizeable negative difference during 2015–2016 compared to the more moderate difference during the first five years of in the sample period. Repeating the test with firms that hedge only with interest rate or foreign exchange derivatives shows significant negative premium in Tobin’s Q for interest rate hedgers, in line with findings in Table 6 with the entire sample. The correlation matrix in Table 7 further indicates a highly significant negative relation between general derivative hedgers and Tobin’s Q value. These findings indicate rejection of the first and second hypothesis but provide evidence for the third hypothesis instead.

The prior literature has revealed positive value premium for hedgers in numerous studies along with Allayannis & Weston (2001). Pramborg (2004) finds positive value premium for general hedgers using the Swedish sample, Carter et al. (2006) find the same with U.S airlines and commodity hedgers while Belghitar et al. (2008) find a significant value premium for interest rate and foreign currency hedgers among U.K. firms. Documented findings for negative value premium are harder to find, but Khediri & Folus (2010) with French sample and Nguyen & Faff (2007) with Australian sample find evidence of negative value effect for hedgers, Nguyen & Faff (2007) especially for interest rate hedgers. Even though the univariate results are rather surprising considering the large and significant difference to many of the prior literature findings, the fact that negative value effects have been indicated also with French and Australian firms suggests that support for the third hypothesis is possible from the OMX Helsinki sample as well. The following chapter presents the results from pooled OLS regressions and fixed effects regressions.

4.3.2. Multivariate results

Table 9 presents the results for model 8 (general hedgers), 9 (foreign currency hedgers) and 10 (interest rate hedgers) and Table 10 for models 11 – 13 which included hedging coverage as control variable. Next to pooled OLS regression coefficients, fixed effects results are shown for each model independently with p-values in parenthesis below the coefficients to determine the significance level. The dependent variable is the natural logarithm of Tobin's for all the regression models. Control variables used in the models from 8 to 13 are introduced in Table 3 along with the expected signs for each variable.

The sample used in Table 9 regressions includes all the 748 firm year observations as firms with missing data for hedging coverage are included in these results. All the models are ran using robust standard errors by White method to control for heteroscedasticity. R-squared denotes the goodness-of-fit for the regression models, which shows how much of the variation in Tobin's Q can be explained by each model. (Wooldridge 2009: 40.) As discussed earlier, pooled OLS regression models ran on panel data suffer from heteroscedasticity and autocorrelation which is reflected in the weak R-squared figures of 16,3 % for model 8 of general hedgers, and 15,4 % (17,2 %) for foreign currency model (interest rate model) respectively. The goodness-of-fit is considerably higher with the fixed effects models with explanatory level over 80 % for each of the models in Table 9 proving the fixed effects regression provides more robust results on panel data with short time period and high number of cross-sections.

Table 9 results from pooled OLS regression model 8 for general hedgers continue the findings in univariate tests and indicate negative value premium for general hedgers of -13,07 % with high significance at 1 %. The fixed effects regression for general hedgers confirms the negative effect with -6,56 % premium, which is also highly significant. These findings are strongly in contrast with the base study of Allayannis & Weston (2001) and lead us to reject the first hypothesis, but more in line with Khediri & Folus (2010) and Nguyen & Faff (2007). Firm size as natural logarithm is in line with the predicted negative sign showing highly significant negative relation for both pooled and fixed effects regressions, also in line with the

Table 9: Pooled OLS & fixed effects results for general, foreign currency and interest rate hedgers.

Tobin's Q (ln)	Model 8		Model 9		Model 10	
	Pooled	Fixed	Pooled	Fixed	Pooled	Fixed
Observations	748					
R-squared	0,163	0,800	0,154	0,803	0,172	0,800
Constant	0,4524 ***	3,3521 ***	0,4800 ***	3,2780 ***	0,3975 ***	3,3412 ***
(p-value)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)
GEN hedgers	-0,1307 ***	-0,0656 ***				
	(0,005)	(0,002)				
FCD hedgers			-0,0301	-0,1485 ***		
			(0,139)	(0,000)		
IRD hedgers					-0,1524 ***	-0,0508 **
					(0,000)	(0,042)
Size (ln)	-0,0161 ***	-0,2486 ***	-0,0253 ***	-0,2399 ***	-0,0127 ***	-0,2491 ***
	(0,001)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)
Leverage	-0,1181 ***	0,0216	-0,1198 ***	0,0244	-0,1121 ***	0,0211
	(0,005)	(0,312)	(0,005)	(0,244)	(0,006)	(0,335)
Growth	0,0917 ***	-0,0617 **	0,0899 ***	-0,0601 ***	0,0949 ***	-0,0616 **
	(0,000)	(0,011)	(0,000)	(0,008)	(0,000)	(0,011)
Profitability	0,0004	-0,0009	0,0002	-0,0009	0,0002	-0,0009
	(0,692)	(0,118)	(0,807)	(0,112)	(0,800)	(0,112)
Liquidity	0,0614 ***	0,0107	0,0654 ***	0,0121	0,0593 ***	0,0112
	(0,001)	(0,618)	(0,001)	(0,573)	(0,001)	(0,596)
Access to	0,0708 **	0,0771 **	0,0661 *	0,0756 *	0,0775 *	0,0730 **
financial markets	(0,078)	(0,036)	(0,095)	(0,063)	(0,058)	(0,033)
Negative rates	0,1309 ***	0,1185 ***	0,1414 ***	0,1127 ***	0,1353 ***	0,1210 ***
	(0,001)	(0,001)	(0,001)	(0,001)	(0,000)	(0,000)

***,** and * imply 1%, 5% and 10% significance levels, respectively.

previous literature. Growth variable is highly significant and positive as in pooled regression as expected but turns significant and negative in the fixed effects estimation. What is distinct in Models throughout Table 9 is that profitability factor is almost non-existent and insignificant in all the models showing no value premium for profitable firms. Liquidity shows significant positive relation in pooled OLS regression, but the significance is not repeated in fixed effects. Access to financial markets measured by dividend dummy is in line with prior literature and expectations and shows positive value premium ranging from 6,61 % to 7,75 % and significant in at least 10 % in all the models thus confirming that dividend payments have been rewarded with value by investors through the sample period. Finally, the negative rates dummy showing positive and highly significant coefficient through

Table 9 confirms the indications from Tables 5 and 8 that the increase in Tobin's Q values are driven by the observations from years 2015 and 2016.

Although the negative rates dummy was chosen in the basis of unusual market rates environment, it is acknowledged that GDP growth and other macroeconomic factors rising from the economic recovery in Finland during 2015 and 2016 is affecting the Tobin's Q values, and those factors are not independently included in these estimations. The highly significant and positive coefficients estimated for the constant in each of the regressions suggest that there are exogenous factors leading to increase in firm valuations. (Tilastokeskus 2018.)

The second hypothesis stating that use of foreign currency or commodity price derivatives specifically is rewarded with positive value premium can be examined in Models 9, excluding the commodity price hedging effect. Model 9 in Table 9 estimates the value effect of foreign currency hedgers for which the pooled model finds no significant relation, but instead the highly significant negative premium of -14,85 % is estimated in fixed effects regression confirming the Model 8 results and indicating that foreign currency hedgers are rewarded with negative premium in contrast to second hypothesis based on Allayannis & Weston (2001) findings. For foreign currency hedgers the control variables are line with general hedgers coefficients with only minor changes in significance levels for growth and access to capital markets variables. For interest rate hedgers pooled regression estimates with Model 10 show strong negative value premium of -15,24 % significant at 1 % which is in line with earlier findings from Tables 5 & 6 and following Nguyen & Faff (2007) findings and providing evidence of accepting the third hypothesis. The result is further confirmed with lower but still negative and significant -5,08 % premium in the fixed effects regression. When considering the control variables, the coefficients are widely in line with the previous models with firm size having negative and significant relation throughout confirming the earlier findings and prior literature results that small firms tend to have value premium over large firms. Further the negative relation for growth firms is noted in all three fixed regression estimates indicating that firms with growth opportunities are not currently rewarded with value premium.

As discussed earlier foreign currency hedger and interest rate hedger groups are partially overlapping as majority of hedgers in OMX Helsinki are using both derivative types. Therefore, distinct difference in the value premium between currency and interest rate hedging is difficult to prove with the current data, but the individual models provide additional information on the findings for general hedgers and further contribute to the existing academic literature of derivative and firm value studies. To study the differences in hedging premiums between different derivative type categories, a much larger and preferably international sample is needed as for instance commodity price hedgers cannot be tested as individual group with the current data from OMX Helsinki due to the small number of observations and strong correlation with foreign currency and interest rate hedger groups.

Table 10 presents the regression results from Models 11 – 13 including coefficients for both pooled OLS regression and fixed effects regression. Hedging coverage is added as control variable to find support for the fourth hypothesis, if the relative position size is a factor contributing to Tobin's Q value. Adding hedging coverage among control variables has slightly increased the goodness-of-fit for the models in both pooled and fixed effect estimates, the increase being 20 – 30 basis points in fixed effects models and 20 – 90 basis points in pooled OLS regressions. The number of observations decreased from Table 9 following the removal of firms with missing data for the hedging coverage control variable, but the sample is still far greater by size compared to Naito & Laux (2011) who faced problems with insignificant coefficients caused by the small sample size.

Table 10: Pooled OLS & fixed effects results including control for hedging coverage.

Tobin's Q (ln)	Model 11		Model 12		Model 13	
	Pooled	Fixed	Pooled	Fixed	Pooled	Fixed
Observations	737					
R-squared	0,172	0,803	0,161	0,805	0,177	0,803
Constant	0,3107 ***	3,5900 ***	0,3278 ***	3,5067 ***	0,3061 ***	3,5603 ***
(p-value)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)
GEN hedgers	-0,1377 ***	-0,0303				
	(0,003)	(0,429)				
FCD hedgers			-0,0194	-0,1098 ***		
			(0,357)	(0,004)		
IRD hedgers					-0,1486 ***	-0,0527 *
					(0,000)	(0,071)
Size (ln)	-0,0026	-0,2680 ***	-0,0108 ***	-0,2586 ***	-0,0045	-0,2650 ***
	(0,142)	(0,000)	(0,000)	(0,000)	(0,184)	(0,000)
Leverage	-0,1255 ***	0,0241	-0,1273 ***	0,0256	-0,1181 ***	0,0234
	(0,008)	(0,282)	(0,008)	(0,248)	(0,010)	(0,295)
Growth	0,0951 ***	-0,0632 **	0,0934 ***	-0,0610 ***	0,0972 ***	-0,0625 **
	(0,000)	(0,012)	(0,000)	(0,010)	(0,000)	(0,014)
Profitability	0,0004	-0,0009	0,0003	-0,0008	0,0003	-0,0009
	(0,638)	(0,139)	(0,756)	(0,151)	(0,760)	(0,139)
Liquidity	0,0618 ***	0,0094	0,0657 ***	0,0104	0,0594 ***	0,0097
	(0,000)	(0,661)	(0,000)	(0,631)	(0,001)	(0,651)
Access to	0,0696 *	0,0798 **	0,0608	0,0789 **	0,0764 **	0,0769 **
financial markets	(0,076)	(0,030)	(0,131)	(0,047)	(0,049)	(0,027)
Negative rates	0,1324 ***	0,1151 ***	0,1438 ***	0,1107 ***	0,1374 ***	0,1148 ***
	(0,001)	(0,001)	(0,000)	(0,001)	(0,000)	(0,001)
Hedging	-0,1307 ***	-0,0976	-0,1780 ***	-0,0718	-0,0833	-0,0792
coverage	(0,003)	(0,159)	(0,000)	(0,268)	(0,115)	(0,243)

***,** and * imply 1%, 5% and 10% significance levels, respectively.

Model 11 shows highly significant and negative value premium of -13,77 % for general hedgers which is relative unchanged from -13,07 % premium found by Model 9 in pooled OLS regression and still supports rejection of the first hypothesis. However, the fixed effect coefficient for Model 11 is negative but insignificant due to high reported p-value. Whether this change is caused by the hedging coverage variable leading Model 11 to provide better estimate for Tobin's Q, or the high correlation between hedging coverage and general hedgers is causing the result to be biased, is debatable in lack of further research on the matter. Furthermore, the control variables for general hedgers in Table 10 are in line with Table 9 findings and expectations for the most part with only few counts of higher p-value. Hedging coverage itself is estimated to have -13,07 % negative and highly significant premium in the pooled OLS model indicating that larger derivative positions do not lead to higher firm value, though coefficient in the fixed regression is slightly insignificant with p-value of 0.159. This result conflicts with the fourth hypothesis but is expected considering indications of negative value premium for hedgers are found throughout univariate and multivariate testing, and if hedging leads to lower value of Tobin's Q, a larger hedging position is expected to further increase the negative effect since the open risk related to the position is higher. Moreover, as the first, second and fourth hypotheses were based on the strongest findings in prior literature, the hedging coverage sign is opposite to the expected sign in Table 3.

Further evidence for rejecting the second hypothesis on account of foreign currency hedgers is found from Model 12 as foreign currency hedgers dummy in both pooled OLS and fixed effects regression is negative with fixed effects showing highly significant and negative premium of -10,98 %. Even greater negative premium of -14,85 % for foreign currency hedgers found with Model 9 has decreased due to adding of hedging coverage while the coefficients for other control variables are still in line with Table 9 findings. Since the hedging coverage coefficient is strong and negative in the pooled OLS regression of Model 12 and shows additional support for rejecting the fourth hypothesis, it is possible that the negative hedging premium found for foreign currency hedgers in Models 9 and 12 is related or the result of large derivative positions established for hedging foreign currency risk exposure in firms.

On the contrary, more evidence for accepting the third hypothesis is found with Model 13 as the interest rate hedgers have negative and highly significant premium of -14,86 % in pooled OLS model and -5,27 % premium in fixed effects estimation still significant at 10 % level. The negative premium for interest rate hedgers has been present from the univariate tests to multivariate regression estimates, and in theory is expected because of the current negative interest rate market environment.

5. CONCLUSIONS

The purpose of this study is to examine the use of derivatives in Finnish non-financial firms and to test if a value premium in line with Allayannis & Weston (2001) can be found for derivative users. Firms are categorized for univariate tests based on the type of derivatives they employ: foreign currency derivatives, interest rate derivatives or commodity price derivatives. Furthermore, firms are classified as general hedgers if they use any of the above mentioned derivative types, and non-hedgers if no sign of derivative usage is found from their financial statements. The total sample used in univariate and multivariate regressions includes 748 firm year observations from Nasdaq OMX Helsinki collected during 2010–2016. In addition, effect of the relative size of firm's nominal derivative position on firm market value is tested by adding hedging coverage as a control variable for the final regressions for which eleven firms are deleted from the sample due to missing data leaving 737 observations for the final regressions.

This thesis contributes to the existing literature by providing results on derivatives firm market value effect with recent data including years after the financial crisis, which are not included in most of the prior studies. Moreover, the effect of negative market interest rates environment can be examined as years 2015 and 2016 are included in the sample period. The hypotheses are tested in univariate and multivariate regressions using Tobin's Q as a proxy for firm market value, following Allayannis & Weston (2001) and Belghitar et al. (2008). Mean and median differences in Tobin's Q are tested in univariate analysis between derivative user sub categories during positive and negative interest rate periods. Selected control variables are added in multivariate analysis to capture the factors which are known to affect firm market value, including rather untested hedging coverage.

In contrast to Allayannis & Weston (2001) and many of the previous studies, univariate regressions indicate negative value premium for general hedgers. The negative effect is stronger during negative interest rate period and seems to be driven by interest rate hedgers especially. When tested for firms which use only one type of derivative, a highly significant negative premium is still found for interest rate hedgers, the negative premium being larger during negative rates period in

2015–2016. These results are in support for the third hypothesis and in line with Nguyen & Faff (2007) and Khediri & Folus (2010). Commodity price hedgers are not included in the individual tests since over 90 % of commodity price hedgers are using also foreign currency or interest rate derivatives. Thus, commodity price hedgers are not included as their own group in multivariate analysis, where regressions are run for general hedgers, foreign currency hedgers and interest rate hedgers separately.

For multivariate analysis where pooled OLS and fixed effects regressions are estimated, control variables are added for size, leverage, growth, profitability, liquidity, access to financial markets, negative rates and hedging coverage. With pooled OLS regression, a highly significant negative premium of -13,77 % is found for general hedgers, and even larger negative premium of -14,86 % for interest rate hedgers. These results are strongly in contrast to Allayannis & Weston (2001) findings and indicate a rejection for the first and second hypothesis. The negative value premium is further confirmed in fixed effects regressions which show negative but insignificant effect for general hedgers, highly significant and negative premium of -10,98 % for foreign currency hedgers and -5,27 % negative value premium still significant at 10 % for interest rate hedgers respectively. These results indicate that instead of positive value effect, hedging has been value destroying for Finnish firms after the financial crisis. Therefore, we reject both first and second hypothesis as positive value premium supporting Allayannis & Weston (2001) results is not found in any of the results in this thesis. Support for accepting the third hypothesis is found from the univariate analysis as negative value premium for interest rate hedgers is found to be larger during negative market rate environment, a result further confirmed with multivariate analysis. Finally, the fourth hypothesis cannot be accepted as hedging coverage has negative effect to firm market value in pooled OLS regressions and negative but insignificant effect in fixed effects regressions. Thus, indicating that as hedging with derivatives seems to cause negative value effect, a larger derivative position further enhances that negative effect.

Overall the results show no support for Allayannis & Weston (2001) findings but are more in line with Nguyen & Faff (2007), Khediri & Folus (2010) and Naito & Laux

(2011), which found no effect or found negative effect between use of derivatives and firm market value. However, there are aspects that affect firm market value which require further analysis, and which are not controlled by the regression models used here. First, as the sample descriptive statistics show, non-users in the Finnish sample are identified as mostly small firms and therefore the effect of firm size on Tobin's Q is difficult to rule out as most of the large firms are hedgers. Also, firms are classified as hedgers and non-hedgers without considering the level of hedging and therefore the hedgers group can include also firms which have only one derivative contract, for instance. Furthermore, factors like brand value and public image which are hard to value but still affect firm market value, are not included in the models. Additionally, the global economic growth after the financial crisis is definitely a factor in increased firm market value during the sample period, even though years 2015 and 2016 are here treated from the negative market rates perspective.

For further research, testing the hedging coverage control variable with larger European sample could provide stronger results on the significance of derivative position size, and to be able to differ the value effect of derivatives from the other variables affecting firm market value, a more advanced regressions models are needed. By replicating a comprehensive study like Allayannis & Weston (2001) using large U.S or European sample and data after the financial crisis, more reliable evidence could be found on the current value effect of hedging with derivatives.

REFERENCES

Alkebäck Per, Niclas Hagelin & Bengt Pramborg. (2006). Derivative Usage by Non-Financial Firms in Sweden 1996 and 2003: What Has Changed? *Managerial Finance* 32: 2, 101–114.

Allayannis, George & James Weston. (2001). The Use of Foreign Currency Derivatives and Firm Market Value. *Review of Financial Studies* 14:1, 243–276.

Allayannis, George, Ugur Lel & Darius P. Miller. (2012). The Use of Foreign Currency Derivatives, Corporate Governance, and Firm Value Around the World. *Journal of International Economics* 87, 65–79.

Bank for International Settlements. (2018). *Semiannual derivatives statistic: Global OTC derivatives market* [online]. Basel. Switzerland. Available in World Wide Web: http://stats.bis.org/statx/srs/tseries/OTC_DERIV/H.N.A.A.A.A.A.5A.5J?t=d5.1&c=&p=20132&i=1.4

Bank for International Settlements. (2018). *Semiannual derivatives statistic: Global OTC derivatives market* [online]. Basel. Switzerland. Available in World Wide Web: http://stats.bis.org/statx/srs/tseries/OTC_DERIV/H.N.D.A.A.A.A.5A.5J?t=d5.1&c=&p=20151&i=1.8

Bartram, Söhnke M., Gregory W. Brown, & Jennifer S. Conrad. (2011). The Effects of Derivatives on Firm Risk and Value. *Journal of Financial and Quantitative Analysis* 46:4, 967–999.

Bartram, Söhnke M., Gregory W. Brown & Frank R. Fehle. (2009). International Evidence on Financial Derivatives Usage. *Financial Management* 38:1, 185–206.

Bartram, Söhnke M. (2000). Corporate Risk Management as a Lever for Shareholder Value Creation. *Financial Markets, Institutions & Instruments* 9:5, 279–324.

Belghitar, Yacine, Ephraim Clark & Amrit Judge. (2008). The Value Effects of Foreign Currency and Interest Rate Hedging: The UK Evidence. *International Journal of Business* 13:1, 46–60.

Bingham, Nicholas H. & Rüdiger Kiesel. (1998). *Risk-Neutral Valuation: Pricing and Hedging of Financial Derivatives*. London etc.: Springer. ISBN: 1-85233-001-5.

Block, Stanley B & Timothy J. Gallagher. (1986). The Use of Interest Rate Futures and Options by Corporate Financial Managers. *Financial Management* 38:1, 185–206.

Bodnar, Gordon. Greg Hayt, Richard Marston & C. Smithson. (1995). Wharton Survey of Derivatives Usage by US Non-Financial Firms. *Financial Management* 24:2, 104–114.

Bodnar, Gordon. Greg Hayt & Richard Marston. (1998). Wharton Survey of Financial Risk Management by US Non-Financial Firms. *Financial Management* 27:4, 70–91.

Brunzell, Tor, Mats Hansson & Eva Liljeblom. (2011). The Use of Derivatives in Nordic Firms. *The European Journal of Finance* 17:5–6, 355–376.

Carter, David A., Daniel A. Rogers & Betty J. Simkins. (2006). Does Hedging Affect Firm Value? Evidence from the US Airline Industry. *Financial Management* 35:1, 53–86.

Clark Ephraim & Amrit Judge. (2009). Foreign Currency Derivatives versus Foreign Currency Debt and the Hedging Premium. *European Financial Management* 15:3, 606–642.

Dahlberg, Jasmin. (2012). The Use of Derivatives and Firm Market Value: Finnish Evidence. *Master's Thesis.*

Finanssivalvonta. (2018.) Available in World Wide Web: http://www.finanssivalvonta.fi/fi/Saantely/Saantelyhankkeet/EMIR/Pages/Default.aspx

Hakkarainen, Antti, Eero Kasanen & Vesa Puttonen. (1997). Interest Rate Risk Management in Major Finnish Firms. *European Financial Management* 3:3, 255–268.

Haushalter, David G. (2000). Financing Policy, Basis Risk, and Corporate Hedging: Evidence from Oil and Gas Producers. *The Journal of Finance* 55:1, 107–152.

Hillier, David, Mark Grinblatt & Sheridan Titman (2012). *Financial Markets and Corporate Strategy*. 2. European ed. Berkshire: McGraw-Hill Education. 854 p. ISBN: 0-07-712942-3.

Hull, John C. (2012). *Options, Futures, and Other Derivatives.* 9. Ed. Boston: Pearson Education. ISBN: 0-13-345631-5.

Jin, Yanbo & Philippe Jorion. (2006). Firm Value and Hedging: Evidence from U.S. Oil and Gas Producers. *The Journal of Finance.* 61:2, 893–919.

Jin, Yanbo & Philippe Jorion. (2007). Does Hedging Increase Firm Value? Evidence from the Gold Mining Industry. (Unpublished).

Khediri, Karim B. & Didier Folus. (2010). Does Hedging Increase Firm Value? Evidence from French Firms. *Applied economics letters* 17:10, 995–998.

Lewellen Wilbur G., S. G. Badrinath. (1997). On the measurement of Tobin's q. *Journal of Financial Economics* 44, 77–122

Modigliani, F. & M. H. Miller. (1958). The Cost of Capital, Corporation Finance, and the Theory of Investments. *American Economic Review* 48, 261–297.

Naito, John, Judy Laux. (2011). Derivatives Usage: Value-Adding Or Destroying?. *Journal of Business & Economics Research* 9:11. 41–50.

Nance, Deana R., Clifford W. Smith & Charles W. Smithson. (1993). On the Determinants of Corporate Hedging. *Journal of Finance* 48:1, 267–284.

Nguyen, H. & R. Faff. (2007). Are Financial Derivatives Really Value Enhancing? Australian Evidence. *Economics and Finance Working Paper*, School of Accounting, Deakin University.

Pramborg, Bengt. (2004). Derivatives Hedging, Geographical Diversification, and Firm Market Value. *Journal of Multinational Financial Management* 14, 117–133.

Tilastokeskus. (2018.) Available in World Wide Web: https://www.tilastokeskus.fi/tup/suoluk/suoluk_kansantalous.html

Tufano, Peter. (1996). Who Manages Risk? An Empirical Examination of Risk Management Practices in the Gold Mining Industry. *The Journal of Finance* 51:4, 1097–1137.

Wall, Larry D. & John Pringle. (1989). Alternative Explanations of Interest Rate Swaps: An Empirical Analysis. *Financial Management* 18, 58–73.

Wooldridge, Jeffrey M. (2009). *Introductory Econometrics: A Modern Approach* 4. ed. Mason, Ohio, USA: South-Western Cengage Learning. 849 p.

Yahoo Finance. (2018). Available in World Wide Web: http://finance.yahoo.com/echarts?s=DB+Interactive#{"customRangeStart":1420063200,"customRangeEnd":1458338400,"range":"custom","allowChartStacking":true}