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THE DETERMINANTS OF CURRENCY HEDGING

Evidence from the Finnish markets

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TABLE OF CONTENTS **page**

LIST OF TABLES

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ABSTRACT

The purpose of the thesis is to investigate the determinants of currency hedging in the Finnish markets. The sample consists of 106 non-financial firms listed on Nasdaq Helsinki in the year 2018. Logit regressions are estimated as the dependent variable is dichotomous. Different estimations are carried out to find the differences between currency hedgers and non-hedgers and to test robustness of the results.

Five different models are estimated. Results imply that economies of scale, investment opportunity set, and foreign currency exposure are all important factors in hedging decision. Some evidence is provided for the relation between hedging and costs of financial distress, but the evidence is weak. Further, liquidity is an insignificant factor and leverage has some support behind it after excluding other hedgers from the non-hedging group.

Currency hedgers are larger in terms of asset size and have higher foreign sales ratio. Hedgers spend more on research and development and distribute higher dividend yields than non-hedgers. Excluding other hedgers from the non-hedging sample results in stronger estimates. These results are robust through variety of tests with alterations on model specifications.

KEY WORDS: derivatives, hedging, currency risk, currency

1. INTRODUCTION

The fluctuations of foreign exchange rates can have a significant impact on the financial and competitive position of companies. The growth of international business and the uncertainty of foreign exchange rates and challenges of its predictability (Rossi 2013) has had its impact on hedging. Companies are more exposed to the foreign currency risk which highlights the importance of appropriate risk management. Companies expose themselves to currency risk through international business and international competition, thus both domestic and foreign operated firms are exposed to currency risk (Kasanen, Lundström, Puttonen & Veijola 1997: 100). Corporate financial policy has an important role in controlling the risk and understanding the determinants that affect decision to hedge or not, are crucial.

Derivative contracts have become more important in the finance world. They have been present for a long time and one example of their early popularity in the history is the Dutch tulip market in the 17th century (Puttonen & Valtonen 1996: 20-23). These days their presence cannot be ignored as their market is huge and hedging has become more important in the corporate world (Hull 2015: 5). Derivative contracts are praised as a risk management tool, but they have also proven to be harmful when their features are not fully understood combined with the ability to take speculative and risky positions in the markets. Derivatives played a large part in the latest financial crisis and since then they have been subject to criticism (Hull 2015: 185).

In the finance and corporate world, it is crucial to understand how derivatives work, why they are used and how their prices are determined. Effective risk management requires an understanding of when a risky position is better to be hedged than not. Derivatives are mostly used to hedge risk through transferring it from one entity to another (Allayannis & Ofek 2001), but they can also be used for speculative purposes. This study focuses on the hedging side of the corporate and derivative world.

1.1. Purpose and hypotheses of the study

This study examines the determinants of currency hedging in the Finnish markets. Data consist of Finnish non-financial firms listed on Nasdaq Helsinki and the observation period is 2018. As the empirical evidence on the determinants is partially mixed and hedging is done by different reasons, the objective of this study is to give a better understanding of the main factors affecting firms' decisions to hedge. This study aims to find to what extent do listed companies in the Finnish markets use currency derivatives and to find the key variables that affect the decision to their usage.

The paper by Smith and Stulz (1985) can be seen as the first study to show a positive theory for value-maximizing and hedging. They argue that there are three drivers for hedging: taxes, costs of financial distress and managerial risk aversion. Nance, Smith and Smithson (1993) show evidence on these hypotheses as their results indicate that hedging decision is associated with reduced taxes and transaction costs and to control agency costs. Just as they, also many others, such as Mian (1996) and Graham and Rogers (2002) find firm size to be an important factor in the decision to hedge. As this finding is consistent with all studies the first hypothesis is as follows:

H_1: Economies of scale has a significant effect on hedging decision.

Géczy, Minton and Schrand (1997) find foreign sales to be an important factor in hedging decision. They argue that hedging is associated with reduced variation in cash flows and the source which the foreign exposure comes from has an important role in hedging decision. Allayannis and Ofek (2001) find firms to use derivatives for hedging purposes rather than in a speculative way. They find foreign sales to have an important role on the level of hedging. Foreign sales also remain as an important factor across studies, such as Hagelin (2003) and Graham and Rogers (2002), and thus, the second hypothesis is as follows:

H_2: Foreign currency exposure has a significant effect on hedging decision.

Judge (2006) argues that including other hedgers in the non-hedging group might induce bias which could explain why other studies before his fail to find strong evidence between hedging and financial distress. Bae, Kim and Kwon (2018) find similar results regarding financial distress in their study but with different methods. This study also controls for other hedgers and the third hypothesis is as follows:

H_3: After controlling for other hedgers, expected costs of financial distress has a significant effect on hedging decision.

This thesis complements previous research on the topic and will act as a comparison to previous studies as there has not been a similar study with Finnish data. Majority of the previous studies examine U.S. data. As this study focuses on a smaller economy with high imports and exports relative to gross domestic product, foreign exchange exposure and currency derivatives are likely to have a large role for firms operating in the Finnish markets[1]. Further, Brunzell, Hansson and Liljeblom (2011) study overall derivative usage in Nordic firms and find Finland to use significantly more derivatives than Denmark, Iceland or Sweden. They argue derivatives to be more accessible for Finland than others because of the eurozone.

Hedging itself is an expensive process but also by not hedging, firms may experience losses that exceed the costs of hedging multiple times. Corporate financial policy in mind, it is important for the management to know what are the determinants that affect firm's decision to hedge and thus, this study should be in their interest. As investors are likely to expect firms to manage their risk and risk management creates value (e.g. Adam & Fernando 2006; Allayannis & Weston 2001; Aretz, Bartram & Dufey 2007), this should also be of interest to the shareholders.

[1] Goods imported to Finland in 2018 represent 36.5% of the GDP while goods exported represent 35.2% of the GDP. The same figures for United States are 15.0% and 12.1%. (see OECD Economic Surveys: Finland 2018)

1.2. Structure of the thesis

This thesis is organized into three major sections. First, the theoretical section on risk management and financial derivatives is introduced where the essential subjects related to these topics are covered. The second section introduces relevant previous researches that study matters related to this topic. The last part, empirical section, describes the sample, presents the statistical tests and results and discusses and compares the empirical results.

First, the theory section presents derivatives and their different features. Next, the section continues with financial risks where the focus is on the currency risk and its components. Last part of the theory section identifies the measurements of the currency exposure and presents the incentives to hedge. It also includes hedging methods and discusses different matters to consider when implementing these strategies. The literature review part discusses what other studies find on the topic and constructs expectations of what this study expects to find. These findings are also used for the comparison between this study and the others. The empirical section introduces data, describes methodologies and models of the study. It presents the results and the critical discussion of the results. The thesis ends with a conclusion.

2. THEORETICAL BACKGROUND

This chapter focuses on relevant theories regarding this study. The first topic is derivatives which introduces their qualities, how they work and how their prices form. Next, the focus is on financial risks where emphasis is on currency risk and its components. Then, utilizing these theories, next section introduces ways to manage currency risk, methods to measure currency exposure, incentives to hedge and ways to hedge using derivatives.

2.1. Financial derivatives

Derivatives are an effective way to manage risk in the underlying market. Derivative is a financial asset whose value is dependent of the underlying. The value of derivative derives from almost any variable such as weather, box office revenues and milk. The most common underlying assets are commodities, currencies, interest rates, stocks and bonds. A derivative security is a financial agreement between two parties to buy or sell an asset with predefined conditions of the price, delivery, quantity and date. It is rather common that the underlying asset does not change owners as the delivery under the terms of the agreement is often impractical and expensive. Derivatives are traded on derivate exchanges and over-the-counter (OTC) markets that are maintained by financial institutions.

Derivatives have been around for hundreds of years, for example trading with options was popular in the 17th century on the Dutch tulip market. There is also information on organized futures markets in Japan in the 18th century when commodity prices were agreed in advance between two parties. The derivatives markets gained worldwide popularity in 1972 when foreign exchange futures were introduced on the Chicago Mercantile Exchange. (Puttonen & Valtonen 1996: 20-23.)

With the global financial crisis, derivatives and their lack of regulation have been subject to criticism for their role in the crisis (Hull 2015: 195-196). Derivative products were generated from risky mortgages that were packed in a portfolio and the cash generated

from them were securitized and sold to markets (Gorton 2009). As the housing market went down, the products created from the mortgages became worthless and with that everyone who owned them took a great loss (Hull 2015: 185-193). Spillover effect was felt worldwide with the collapse of the subprime market which lead to tighter regulation (Zimmerman 2007).

Derivatives attract a variety of different kind of investors and are used in three different ways with different objectives (Hull 2015: 11). These are hedging, speculation and arbitrage. The goal of hedging with derivatives is to eliminate or reduce the risk that could occur from undesired future price movements of the underlying. Speculation is betting on the direction of future market price of the underlying. Arbitrage is a way of locking in the profit by exploiting the market imbalances and taking offset positions of multiple instruments.

Forwards

A forward contract is an agreement to buy or sell a particular amount of underlying asset at a predetermined price at a specified future date. The predetermined price is called the forward price. The forward price is set to a value such that no advance payment is required for entry of the contract which is made between two parties, a buyer and a seller (Cox, Ingersoll & Ross 1981). The buyer of the contract takes a long position and agrees to buy the underlying asset with a specified price on a certain future date while the seller takes a short position and agrees to sell the asset in the future date for a specified price (Cornell & Reinganum 1981). Forward contracts are traded in OTC markets and are usually traded with a standard maturity of 30, 60, 90, 180 or 360 days. (Hopper 1995.)

A forward contract on currency is a currency trade with the value date moved to the future. Forward contracts allow parties to buy and sell currencies in advance at exchange rate set by the spot rate and spread of the interest rates. A company that has incoming export earnings in the future may hedge its receivables by selling the currency to be received at a forward rate, thus hedging the exchange rate risk. (Puttonen & Valtonen 1996: 228-231.) The price formula for currency forward is as follows:

(1) $F_0 = S_0 e^{(r-rf)T}$,

where

F_0 = forward rate

S_0 = foreign exchange rate

r = domestic risk-free interest rate

rf = foreign risk-free interest rate

T = time to maturity in years

Forwards are popular instruments for hedging against exchange rates. There is no extra charge, called premium, for entering one and the cash flow is known in advance through the forward exchange rate defined in the contract. The downside of the forward contract is that it is not possible to make a profit from any favorable exchange rate fluctuations because the forward contract cannot be settled, and its result is guaranteed. Thus, the outcome of a forward contract is also the resulting gain or loss on the contract. As the buyer is obligated to buy the asset at the predetermined price, the payoff from long position of one unit is the spot price at maturity minus the delivery price. For the seller the payoff from short position is delivery price minus spot price at maturity. (Cornell & Reinganum 1981; Hull 2015: 6-8.)

Futures

A futures contract is similar to a forward contract. Just like a forward contract, a futures contract is an agreement to buy or sell an asset in the future for a predefined price. However, futures contract is settled daily, whereas the forward contract is settled at its maturity. (Cox et al. 1981.) Also, futures contracts usually have a range of delivery dates and are traded on derivative exchanges, like CME Group that includes Chicago Board of Trade and the Chicago Mercantile Exchange, where the terms of the contracts are standardized. The exchange offers a system that ensures that parties honor their parts of the contract (Cornell & Reinganum 1981; Telser & Higinbotham 1977).

When the exchange develops a futures contract, they need to specify precise details of the nature of the contract. A specification needs to be made on the underlying asset, the

contract size, as well as the place and date of the exchange of the asset. (Cornell & Reinganum 1981.) Most contracts also have daily price movement limits, which are designed to prevent major price changes due to speculative excesses. Boundaries can also be a barrier to trading if the underlying price rises or falls sharply. (Hull 2015: 26-28.)

As the futures contract approaches maturity, futures price starts to converge to the spot price of the underlying asset. This is due to the arbitrage opportunity that will rise if this converge would not happen. If the futures price is above the spot price during the delivery period, one could short futures contract, buy the underlying asset and make the delivery. This would lead to an arbitrage opportunity and the fall of the futures price as traders would exploit it. The same can be done if the futures price is above the spot price during the delivery, by taking long position and waiting for delivery. This leads to higher futures price. (Hull 2015: 28-29.) Thus, at the end of the contract the payment amounts to the spot price and the price movements have already been exchanged between the parties with daily settlements (Cox et al. 1981).

Future trading always involves risks. One party may regret the contract they made, or the other party may have financial problems that prevent honoring the contract. Therefore, futures contract is organized to have a margin account for both parties, for which the broker requires both parties to deposit a certain amount of capital at the time of the agreement, known as initial margin. This is because futures income is credited to counterparties at the end of each trading day, known as daily settlement, whereby margin calculations are adjusted for profit or loss. This simply means that the value of the futures contract is reset daily, which guarantees the motivation to honor the contract. A margin is also set in the margin account, known as maintenance margin, to ensure that the account balance remains positive. If the margin account drops below the maintenance margin, the investor receives a margin call and its balance must be raised to its original margin within the next day. These funds deposited are knows as variation margin. If the variance margin is not provided, the broker closes the position. (Hull 2015: 29-30; Telser & Higinbotham 1977.)

Futures contracts do not generally lead to delivery as delivery under the terms of the contact is often impractical and, in some cases, expensive (Fackler 1993). According to Cornell and Reinganum (1981) over 95% of the positions are closed before the delivery in the currency futures market. Closing out a position is done by entering the opposite trade versus the original trade. In principle this means to close out a position, one that is long for a futures contract needs to sell a futures contract of the same underlying (Cornell & Reinganum 1981; Ederington 1979). Also parties that hedge do generally close out the position and rather buy or sell the underlying as usual (Hull 2015: 25-26).

Options

Options are divided into call options and put options. A call option gives its holder the right to buy a fixed amount of the underlying asset at a predetermined price in a given time period or at a specific date. A put option gives the holder the right to sell a fixed amount of the underlying asset at a predetermined price in a given time period or at a specific date. (Stoll 1969.) The holder has three different choices at any time before expiration date, to sell the option back to the market and close out the position, exercise the option or retain and do nothing. (Cox & Rubinstein 1985: 1-21.) Options are divided into European and American options, with the difference that the American option can be exercised at any time during its maturity, whereas the European option can only be exercised on its expiration date (Grabbe 1983).

The option seller has an obligation to sell or purchase predefined amount of underlying asset at a specified price. The seller receives a premium for his obligation, also known as the price of the option that the buyer pays (Stoll 1969). Pricing an American option is, by its nature, far more complex than a European option. Black and Scholes (1973) define the option being European as one of the conditions under their option pricing formula and thus, only to be exercised at its maturity. The pricing formula for the European currency option is as follows:

(2) $$c = S_0 e^{-r_f T} N(d_1) - K e^{-rT} N(d_2)$$

(3) $$p = K e^{-rT} N(d_2) - S_0 e^{-r_f T} N(-d_1),$$

where

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

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

S_0 = foreign exchange rate

r_f = foreign risk-free rate

$N(d)$ = cumulative distribution function for a standard normal distribution

K = strike price

r = domestic risk-free interest rate

σ = volatility

T = time to maturity in years

Cox and Rubinstein (1985) list direct determinants that affect option value. First, call options are considered while ceteris paribus. Increase in strike price lowers the value of the call option while increase in price of the underlying asset increases it. Higher volatility increases the value as holder of the call option benefits from favorable movements while limits downside risk. Time has similar effects to value as the higher the maturity the more can happen before its expiration. Increase in foreign risk-free rate decreases the value while increase in domestic risk-free rate increases the value of the call option. For put option, increase in strike price increases its value while increase in price of the underlying decreases it. Volatility has the same effect for puts as calls. Effect of time depends on the price of the underlying, low price indicates that longer time decreases its value while higher price would increase its value. Interest rates have reverse effects of a call. (Cox & Rubinstein 1985: 33-39.)

Currency options are mainly traded in the OTC market, which has the advantage of allowing companies to trade large volumes, with strike prices and other features tailored to meet their needs (Bollen & Rasiel 2003). Currency options are also traded at lower volume on the Nasdaq OMX, but the markets are relatively small versus the OTC market (Hull 2015: 369-370). Currency options are an alternative to forward contracts when hedging a currency position.

Swaps

A currency swap is an agreement between parties that allow them to change interest rate exposure and principals in one currency to another. A currency swap can simply be the exchange of principal and interest payments in one currency to another. (Cooper & Mello 1991.) The principal is generally exchanged between the parties at the beginning of the agreement and at the end of the swap, in which case the values may differ significantly due to exchange rate changes. Valuation of currency swaps can be done in two ways, as a portfolio of forward contracts and in terms of bond prices, which is illustrated by equation 4. (Hull 2015. 164-173; Klein 2004.)

(4) $V_{swap} = B_D - S_0 B_F$

where

V_{swap} = value of the swap

B_D = bond value defined by the domestic cash flows

S_0 = spot exchange rate

B_F = bond value defined by foreign cash flows

Currency swaps are typically used to convert a foreign currency debt or receivable into another currency. Thus, the company can manage the currency risk of its receivables and liabilities through a swap agreement. (Puttonen & Valtonen 1996: 240.) Companies tend to raise capital in currencies where they have no significant income or cash flow due to cheaper cost of capital. Generally, cash flows denoted in undesired currencies tend to motivate companies to use currency swaps to replace them into desired currency, usually into currency which is used to generate company's operating income or into one that they have future turnover. (Eiteman, Stonehill & Moffett 2012: 234.)

2.2. Financial risks

As the focus of this thesis is on hedging and currency, financial risks of companies are examined with the focus on currency risk. Financial risks are divided into three categories, credit risk, liquidity risk and market risk. In addition, market risk includes interest rate

risk, equity risk, commodity risk and currency risk. Financial risk can arise from various reasons such as from new projects and debt financing. The main sources that cause financial risk are changes in market prices, transactions with others and internal actions and failures of firms. (Horcher 2005: 3.)

Liquidity risk means that a firm does not have financial capacity to meet its obligations. Becker and Mazur (1995) define liquidity risk to be in two forms. The first form is market liquidity risk which arises when the counterparty may be unable to fulfill their obligations on time or in its entirety. Second form is called funding liquidity risk which relates to the problem of not having liquidity to meet payment obligations which exposes the firm to bankruptcy risk. Managing liquidity risk includes having procedures for funding requirements when markets fluctuate, realistic expectations of future cash flows and having a high enough liquidity reserve to survive bad times. (Becker & Mazur 1995.)

Credit risk can occur as a result of investing, lending and credit granting activities. Firms are exposed to credit risk when they have receivables from others and rely on someone to pay them. The risk arises usually when the counterparty has financial problems. However, the risk can also occur when the counterparty simply does not pay their dues in time. Credit risk in the investment market can arise with derivative agreements. This happens when the counterparty is in default and does not fulfill its contractual obligations. Credit risk can be managed through many ways such as using collateral lending, through diversification and using third parties to provide insurance against default risk. (Horcher 2005: 103-117.)

Market risk as mentioned before includes different risks that arise from the fluctuations of the markets. Market risk affects the whole market and can be viewed in two different ways. In currency terms one would consider absolute market risk, and when risk is measured relative to a benchmark, one would consider relative market risk. Market risk can be classified into directional risks that arise from exposures to market price or rate movements and nondirectional risk that include non-linear exposures. (Jorion 2007: 22-23.)

2.2.1. Currency risk

Exposure to foreign exchange risk is inevitable for international firms as they tend to operate in multiple currencies. Firms operating domestically are also exposed to currency risk through international competition (Kasanen et al. 1997: 100). Firms can also be exposed to currency risk when one of the capital goods used by them is dependent on the development of an exchange rate (Niskanen & Niskanen 2012: 430). Thus, the exposure to currency risk is present for all firms as each currency has its value in other currency and the rate between currencies varies.

The definition of currency risk varies within the academic community. Henderson (2006) defines currency risk as a result of an unexpected change in the exchange rate of a country. Therefore, companies should be aware of the importance of exchange rates as they can have a significant impact on cash flows, assets and liabilities, net profit and ultimately the market value of the companies. To control currency risk, companies should understand what kind of currency risks they are exposed to, create a strategy for managing the risk, and define what hedging instruments they allow to be used for a given risk. (Henderson 2006: 138-139.)

Currency risk does not only affect financial activities but also the entire organization: pricing decisions, allocation of purchases and sales, investments and budgeting. The risks directed to currency are multidimensional and they are usually divided into three components making the identification and managing the risks easier (Knüpfer & Puttonen 2012: 210). Currency risk consists of sub-positions that are generally in academic literature, and in practice divided into transaction, translation and economic positions (Kasanen et al. 1997: 125). These will be discussed later in chapter 2.2.2.

Exchange rates

Exchange rate is the relative price of two currencies. The exchange rate of a currency can be floating or fixed. When currency is fixed to a foreign currency, the exchange rate is tied to a certain country’s currency. It can also be tied to a price of a commodity, such as gold. The idea behind fixed exchange rate is to keep the rate within a narrow band and if needed, adjust it as time goes on. These adjustments are called devaluations or

revaluations depending on what the monetary authority is trying to accomplish. If the goal is to devalue the currency, the monetary authority increases the price of a domestic currency which makes the price of foreign money domestically more expensive. Vice versa, revaluing the domestic currency is done by decreasing the value of foreign exchange. (Bekaert & Hodrick 2012: 36-69; Obstfeld & Rogoff 1995.)

Floating the exchange rate of a currency means that the relative values of currencies are defined by market forces, demand and supply. The changes in value of floating exchange rates are called deprecation and appreciation. (Bekaert & Hodrick 2012: 36-69.) Floating currencies are strictly supervised by monetary authorities and according to Calvo and Reinhart (2002) there are no freely floating exchange rate systems as governments tend to influence the value of their currency.

For firms the delivery and payment usually happen in the future while agreeing on the terms are done in the present. Time between the agreement and payment can include fluctuations in exchange rates, causing potential gains and losses for the firms. For instance, a firm operating in Finland that sells goods imported from the United States can have its costs increased if dollar strengthens relative to euro. Risk of losing earnings due to exchange rate fluctuations can be eliminated for example by entering forward market and hedging the open currency position.

Interest rate differential between countries has a large impact on foreign exchange rates. Covered interest rate parity (CIP) is an important equilibrium relationship in currency markets. It is a no-arbitrage condition where interest rate differentials between two countries are offset by forward premiums and discounts (Bekaert & Hodrick 2012: 173). Empirical evidence show that this equilibrium does not always hold, and for example a popular strategy called carry trade has been shown to be profitable in the currency markets.[2] If this equilibrium does not hold, investors can make riskless profit by borrowing from a low-interest-rate country, converting and lending it in a high-interest-

[2] Du, Tepper & Verdelhan (2018) show continuous violations of CIP and find systematic arbitrage opportunities. Baba & Packer (2009) among many others document violations of CIP during the global financial crisis.

rate country, investing the proceeds and simultaneously hedging the exchange risk by entering into a forward contract.

Another factor affecting exchange rates is purchasing power parity (PPP). PPP is a theory where exchange rates adjust to correspond the internal and external purchasing powers of a currency. It is an extension of law of one price (LOOP) theory which states that the price of an identical good denominated in a specific currency is the same regardless of location. Where LOOP examines a single good, PPP looks at a basket of goods. PPP is a way to forecast future exchange rates by comparing the purchasing power of a specific currency in one country to its purchasing power in another country. (Rogoff 1996.)

The base idea behind PPP and LOOP theories is rather simple, the prices of identical goods should be equal as otherwise an arbitrage opportunity would occur. This momentary imbalance between the prices would be quickly exploited by competitive markets and the price difference would be eliminated. There are violations of these theories, for example regulations, transaction costs, differences in tastes between countries and speculation effects the prices of goods. (Bekaert & Hodrick 2012: 246-278; Rogoff 1996.) Thus, the price cannot be identical in all countries.

2.2.2. Currency risk components

Identification of risk exposure is the first step of controlling currency risk. The risk of future events affecting exchange rates cannot be known in advance and thus the identification of the risk exposure is only an estimate. As mentioned before, currency risk is divided into three different components, economic, transaction and translation risk which are explained below.

Economic or financial risk is based on the fact that the development of the exchange rate affects the value of a whole company. In this case, the exchange rate changes affect the cash flows of the individual transactions in the local currency and the competitiveness of the firm in the market. (Niskanen & Niskanen 2012: 431.) The sensitivity of competitiveness is dependent on the company's currency distribution compared to its

competitors. In practice, this means that the cash flows in the local currency should be taken into account when considering the economic position. Economic exchange rate risk can also arise from foreign competition. The risk position of the economic risk is of a strategic nature which makes it difficult to measure and to hedge against. (Knüpfer & Puttonen 2012: 211.)

Transaction risk of a company is related to changes that occur between the time of the contract and the transaction. The transaction position includes cash flows denominated in foreign currencies that can be assured with sufficient certainty (Hagelin 2003). These transactions are typically firm's receivables and payables. (Knüpfer & Puttonen 2012: 210.) Transaction position is defined in relation to the local currency of a firm. Thus, if a firm operates in the euro area, the cash flows denominated in euro are not included in the position. The transaction position is determined in the international group of each subsidiary's underlying currency. This is because the foreign subsidiary's transaction position is not secured as its operating currency and the group's local currency exchange rates changes. (Kasanen et al. 1997: 129-130.)

Translation risk arises for international groups due to reporting of group's earnings and position on group's local currency (Hagelin 2003). The earnings and financial position of foreign subsidiaries are reported in their own currency, from which they are translated into group's total position in the local currency. This conversion affects group's overall position and can have a large impact on the position due to fluctuations of exchange rates. (Kasanen et al. 1997: 126.)

There is no consensus for hedging against translation risk and there are several opinions on it. One aspect of hedging translation risk is that the foreign currency value of a subsidiary and the ability of a firm to pay dividends depend on the respective exchange rate between the countries. The perspective against the hedging is based on efficiency of the foreign exchange market and firm's goal of maximizing the wealth of its owners instead of accounting profit. However, it would be beneficial for firms to hedge against the effects of translation risk in certain situations, for example when markets are

inefficient or when the management of a firm is assessed based on financial statements. (Niskanen & Niskanen 2012: 431.)

2.3. Managing the currency risk

Allayannis and Ofek (2001) examine the purposes firms use currency derivatives for. Their evidence suggests that derivatives are not used for speculation but rather for managing risk. Their findings show that firm's exposure to exchange rate volatility is mitigated through hedging with currency derivatives. Thus, the goal of derivative usage is to reduce the volatility of exchange rate exposure that firms face and to stabilize firms' earnings.

To manage currency risk, firms should identify the currency risks to which they are exposed. After identifying the risks, a strategic risk management policy should be established for dealing with these risks. After establishing the risk management policy, firms should figure out how this policy is implemented in practice. Specification should be done on what financial instruments are used for currency hedging. In addition, firms should define the process by which the currency hedging is implemented and monitored, and procedures for monitoring risk management policies. (Henderson 2006: 144-145.)

Currency risk management can be divided into two parts: position hedging and position identification. Position identification consists of three phases: position determination, sub-position determination and position reporting. The important part for managing currency risk is to understand what kind of risk positions the business is undertaking. Hedging currency position in the financial markets is a straightforward operation when the risk position is known. When the risk position is uncertain or unknown, comprehensive hedging is usually an impossible operation. Therefore, identifying the risk position is of utmost importance for risk management. (Kasanen et al. 1997: 123.)

2.3.1. Currency risk exposure

Currencies are not risky when the changes are anticipated. Weak and strong currencies can be just as risky and if the future valuation of currency is known, there should be no

risk at all. Currency becomes risky because of the unexpected part of the exchange rate movements. The exposure should not be determined by currency risk but on the basis of what is at risk. (Adler & Dumas 1984.) As mentioned previously, the identification of the risk position is the key of managing the exposure.

Measuring exposures can be done in different ways. Dumas (1978), Adler and Dumas (1984) and Hodder (1982) show how economic exposure to exchange-rate movement can be defined as the regression coefficient of the firm value on the exchange rate across states of nature. The following regression model introduced by Jorion (1990) can be used to estimate exchange rate exposure:

(5) $$R_{it} = \beta_{0i} + \beta_{1i,1} R_{S,t} + \varepsilon_{i,t}, t = 1, \dots, T,$$

where
R_{it} = rate of return of a firm's stock
$R_{S,t}$ = rate of change in trade-weighted exchange rate
$\varepsilon_{i,t}$ = error term

This model specification is convenient when stock price and exchange rate changes are not anticipated. Positive loading on $R_{S,t}$ would indicate a depreciation of domestic currency. When there is a constant expectation of R_{it} and $R_{S,t}$, the intercept term β_{0i} reflects these expected values and the effect of unanticipated changes in exchange rates on stock returns is measured by the slope coefficient. (Jorion 1990.)

(6) $$VaR_t^h(\alpha) = -F_h^{-1}(\alpha|\Omega_t)$$

Value at Risk (VaR) is one of the most common ways of measuring risk. It is used to calculate the maximum loss over a given time horizon with a certain level of confidence. In the equation 6, $VaR_t^h(\alpha)$ is the value-at-risk at probability (α) at h-period. F_h^{-1} refers to the quantile function of the h-period profit and loss distribution which varies with respect to the change of the composition (Ω_t). The negative sign indicates normalization and expresses VaR as losses. (Campbell 2007.) If $VaR_t^h(0.05)$ is a thousand euros, one

could say that 5% of the time there is a risk of losing more than a thousand euros over the h-period.

One way of estimating risk is by using multiple forecasts, called simulation method. By using forecasts of various outcomes, one can get an estimate of the possible cash flows that can occur in the future under different assumptions. Compared to the regression model introduced before, this forward-looking simulation method can be a better way of estimating risk as it does not rely on the past information as the regression model does. The disadvantage of the simulation method is that the estimates may not be precise as the forecasts can be biased. (Hillier, Grinblatt & Sheridan 2012: 716.)

2.3.2. Hedge incentives

Finance theory suggests that the main benefits for corporate hedging is to increase firm value by reducing expected costs of financial distress, mitigate the underinvestment problem and minimize corporate tax liability (Hillier et al. 2012: 688). Empirical studies find multiple reasons why hedging is done by firms. The relation of hedging and firm market value is widely studied and there is no clear consensus if the use of derivatives increases firm value or not, but the evidence leans more in favor of value creation by derivatives.

Allayannis and Weston (2001) find positive, statistically and economically significant relation between hedging with currency derivatives and firm value. Their results show that there is an average of 4.87% hedge premium incorporated in firms' market values that hedge with currency derivatives. Against this, Copeland and Joshi (1996) show that hedging does not on average reduce volatility of cash flows and only a small percentage of firms benefit from hedging.

Costs of financial distress are costs that arise from bad times (Almeida & Philippon 2007). These costs can happen when a firm faces challenges to meet their obligations to pay for their stakeholders, on the verge of bankruptcy, firm has sensitive revenues or reorganization costs. Firm that is in distress might need to liquidate its assets in order to

meet their obligations and thus, reduce their future profits and opportunities that would have been possible if there had not been financial distress. (Hillier et al. 2012: 689-691.) According to Andrade and Kaplan (1998) estimates the cost of financial distress is between 10-20% of firm value. Furthermore, Glover (2016) find the expected cost of default to be 45% of firm value. Hedging can significantly reduce the expected costs of financial distress or completely avoid it by reducing cash flow volatility and thus decreasing the illiquidity risk (Smith & Stulz 1985).

Underinvestment problem arises in firms that underinvest due to fear of available cash flow, when the correlation is negative between cash flows and opportunities (Jin & Jorion 2006). Firms with risky debt are likely to miss favorable opportunities (Myers 1977). As firms usually base their investment decisions in advance, the cash flow variation can have a large impact on the investment decision and can become costly for the firm. Firms that rely on financing their investments with internal cash flows are dependent on steady cash flows (Hillier et al. 2012: 692). Hedging currency risk eliminates the variation of cash flows and thus makes it easier for firms to make correct investment decisions and to fund their investment opportunities.

Firms may find hedging to be beneficial due to the tax code structure because of their convexity function. Graham and Smith (1999) find in their study hedging to reduce tax liability. This is due to an asymmetry between the tax treatments of gains and losses. Reducing pre-tax value by hedging is a way of lowering the overall taxes of a firm. If hedging reduces the variability of pre-tax value of firms, it also reduces expected corporate tax liability while expected post-tax value is increased. This is possible if the cost associated with the hedge does not exceed the benefits. (Hillier et al. 2012: 689; Smith & Stulz 1985.)

Adam and Fernando (2006) find realized cash flows from derivatives to be economically significant for gold mining firms. They argue hedging to increase shareholder value. Their findings highlight that derivatives do have positive net present value and thus they find motives for firms to use them. Aretz et al. (2007) argue that hedging can increase value for shareholders as it impacts firms financing and agency costs and it decreases

bankruptcy costs while improving taxes. They also find hedging to ease underinvestment problems as it reduces cash flow volatility. Thus, hedging can lead to increased firm value through decreased risk which further decreases financial distress costs, increases opportunities as financing becomes more available and thus, firms have more opportunities to use leverage.

Campello, Lin, Ma and Zou (2011) find hedgers to have lower interest rate spreads and to have better loan terms overall. In line with Aretz et al. (2007) results, they find hedging to reduce expected costs of financial distress which should increase the availability of external financing. They also find hedging to be positively associated with firms' ability to invest. Just as Hillier et al. (2012), they argue creditors to value hedging which eventually leads to gains for those who are associated with the firm.

Study conducted by Bartram, Brown and Conrad (2011) find that hedging decreases firms' systematic and total risk. Their results show that hedging leads to value creation and derivative users have higher returns than non-users, even during bad times. Luo and Wang (2018) study the effect of currency hedging in the Chinese markets and find derivative usage to be positively related to market value. They argue that this relationship between the two gets weaker during bad times and the value creation differs between industries. In addition, they find smaller firms and firms with higher opportunities and profitability to get more value from hedging.

2.3.3. Hedging with derivatives

Hedging has differing opinions against and for it. The obvious benefit of hedging is that there is no need to have the ability to predict future price movements in variables. Hedging removes the uncertainty associated with future prices and enables hedgers to know the values of future cash flows at present. Considering that shareholders can hedge their positions, one argument is that there is no need for companies to do it. This argument ignores the differences between information, transaction costs and contract sizes that in most cases makes it unrealistic for small investor to carry out the hedging. (Hull 2015: 49-52.) Morey and Simpson (2001) study different currency hedging strategies and find

unhedged strategy to beat hedged strategy in every scenario. On the contrary, Simpson and Dania (2006) find conditional hedging strategies to beat other strategies in the Euro area.

Hedging can lead to a worse result compared to not hedging as documented by Morey and Simpson (2001). If the industry norm is not to hedge, then hedging might not be relevant as hedging in this situation can lead to more fluctuations than not hedging. It is important to understand that hedging is done to reduce risk exposure and not to make profits which can be unclear when hedging results in a worse situation than not hedging. (Hull 2015: 52-54.)

Futures/forwards

Lioui (1998) argues that the effectiveness between futures and forward contracts does not differ in a volatility minimization sense but considering risk-return tradeoff, the choice is defined by the correlation between the term structure dynamics. When a company has or is going to have foreign currency and wants to manage the risk of their position, they can take a short hedge to offset the unfavorable price movements. The gain from futures contracts offsets the losses from weakening of foreign currency. If the foreign currency increases in value, the loss on futures position offsets this gain. (Hull 2015: 49.51.) Thus, the future cash flow is known at present.

Hedging rarely is such a straightforward process as there are many things to consider before implementing a hedging strategy. Implementing a perfect hedge where the risk is completely eliminated is rare due to several reasons. Basis is the difference between futures and spot prices and the risk arises when basis differs from zero (Ederington 1979). Thus, it is related to mismatched hedging positions. For example, if the delivery month does not match, one should choose a delivery that is closest to the hedge but later than it (Hull 2015: 57). The optimal hedge ratio (ratio of position in futures contracts to the size of the exposure) is usually set to a value of 0.9 or higher for currencies (Ederington 1979; Kerkvliet & Moffett 1991).

Options

As mentioned before, foreign currency options are an alternative to forward and futures contracts. A company that receives foreign currency at a future date can hedge its currency risk by purchasing a put option that expires at the same time as the future cash flow happens. This strategy ensures that the exchange rate is at least at the predetermined price level and the maximum loss is equal to the premium paid. At the same time, the company benefits from any favorable exchange rate movements. Similarly, if a company pays in a foreign currency in the future, the company can hedge its currency risk by purchasing a call option and benefit from the favorable exchange rate movements. (Hull 2015: 369-370.)

As Hull (2015) mentions, there are more sophisticated option strategies than the plain vanilla strategy described above. These can involve positions in the option and the underlying asset, like a protective put strategy, positions in two or more option of the same type, known as a spread strategy or a combination where a position includes mixture of calls and puts. One hedging strategy is a simple stop-loss strategy where the losses are limited if the prices move in the unfavorable direction. Another strategy involves Greek letters which are used with an option position to measure different parts of the risk with the goal of managing them in acceptable levels.

Currency swaps

Goswami, Nam and Shrikhande (2004) argue the choice to use currency swaps to be linked to long-term exposure to exchange rate changes. As swaps have longer maturities than other foreign exchange derivatives, a global firm might use swaps to exchange their fixed interest rate exposure from foreign currency to domestic currency. Thus, a principle is specified for both currencies which are generally exchanged at the beginning and end of the swap. At the beginning of the swap the firm receives principle in the foreign currency and pays in domestic currency. Each year the firm receives a fixed rate amount of domestic currency and pays a fixed rate amount of foreign currency. At the end of the swap the firm pays the specified amount of foreign currency and receives the specified amount of domestic currency. (Hull 2015: 168-170.)

Currency swaps can also be used to exchange floating interest rates in one currency to another. In addition, they can be utilized for exchanging floating interest rates to fixed or other way around. (Hull 2015: 175.) There are more complex and less known swaps like a zero-coupon swap where the payment happens at the end of the life of the swap and diff swaps where a rate in one currency is applied to principal of another currency (Hull 2015: 178; Litzenberger 1992).

3. PREVIOUS RESEARCH

As many previous studies mention, Modigliani and Miller (1958) paper is the foundation of corporate financial policy. They argue corporate financing policy to be irrelevant with a fixed investment policy with no transaction costs or taxes. Thus, hedging should not affect firm value in given conditions. Their paper has raised a lot of discussion and as their theorem assumes perfect markets, many have shown violations of their assumptions as in reality the markets are not perfect.

3.1. Determinants of hedging

Smith and Stulz (1985) construct a positive theory of value-maximizing corporate hedging and show that there are three drivers for it: taxes, costs of financial distress and managerial risk aversion. Nance et al. (1993) provide evidence on the Smith and Stulz (1985) theory that hedging has a positive relationship with firm value. They use survey data with firm characteristics to construct evidence on hedge determinants. Their findings suggest that firm's hedging decision is made just like any other financial decision, to reduce taxes and transaction costs and to control agency costs. Their results imply that firms that hedge have more growth opportunities, are larger, use fewer hedging substitutes, face more convex tax functions and have less fixed claims.

Mian (1996) argues that the relationship between hedging and financial distress is more associated with economies of scale rather than financial distress and the costs associated with external financing. He finds firm regulation to be negatively associated with hedging while growth opportunities fail to provide support for capital market imperfections and the contracting cost. His results also provide evidence for hedgers to be larger in size.

One of the first non-survey conducted papers that used cross-sectional study to examine the determinants of corporate hedging was done by Géczy et al. (1997). Their study finds that the use of currency derivatives is positively linked to growth opportunities, firm size and tighter financial constraints. Their results imply that firms hedge to reduce variation in cash flows and the source of foreign exchange rate exposure has an important role in the hedging decision.

Allayannis and Ofek (2001) study whether firms use currency derivatives for hedging or speculating purposes. Their findings suggest firms to use currency derivatives to hedge their risk exposure rather than for speculative purposes and the decision to hedge is associated with exposure factors and theories of optimal hedging. They find that while the decision to hedge is related to variables such as size and foreign sales, the level of hedging depends only on the foreign sales exposure.

Graham and Rogers (2002) study tax incentives and hedging. They find no evidence for a relationship between tax convexity and hedging and argue that firms' incentive to hedge is to increase their tax benefits by increasing the debt capacity. Thus, hedging is associated with higher debt capacity and increase in firm value. Also, they find size of the firm and expected costs of financial distress to have an important role in the hedging decision.

Hagelin (2003) contributes to the research by differentiating the use of currency derivatives to translation and transaction exposure. He finds no evidence for translation exposure hedges to be used to increase firm value. His findings show that transaction exposure hedge is consistent with the hypothesis that currency derivatives are used to increase firm value. Consistent with other studies, he finds firm size and foreign sales to be important factors.

Judge (2006) incorporates foreign currency debt as one of the hedge strategies and controls for non-foreign currency hedging firms. By controlling the non-foreign currency hedging firms, he is able to find strong evidence between foreign currency hedging and financial distress that were not detected by previous research. He argues that there is potential bias in the sample if other hedgers are included. He also finds currency exposure and firm size to be positively related to hedging decision.

In a more recent study on currency hedging and derivatives, Bae et al. (2018) study firm value, currency derivatives and determinants of currency hedging. Their findings suggest that firm value, risk and hedging is connected as high exposure and currency derivative usage are associated with lower risk and lower firm value. According to them foreign

sales exposure, source of foreign debt and overall exposure to foreign currency are related with higher use of currency derivatives.

3.2. Summary and discussion of previous studies

Table 1 summarizes the results of previous studies. As mentioned before, the costs of financial distress are shown to impact hedging (Smith & Stulz 1985). Nance et al. (1993) assume that higher leverage is associated with higher probability of financial distress and thus, should also be associated with higher probability of hedging. This assumption is not supported by the older studies as they imply that there is negative and insignificant relation between the two. The more recent ones (see Bae et al. 2018; Judge 2006) are able to capture a statistically significant and positive relation between financial distress and the use of currency derivatives, thus supporting the assumption of Nance et al. (1993). Judge (2006) controls for non-foreign currency hedging and is able to show that leverage and other proxies for financial distress have an important role in determining foreign currency hedging.

Table 1. Summary of empirical papers

Authors	Leverage	Liquidity	Size	Market to book	Foreign sales	Dividend yield
Allayannis and Ofek	-		+*	-	+*	-
Bae et al.	+*		+*	-	+*	
Géczy et al.	-	-*	+*	-	+*	-
Graham and Rogers	-		+*	+	+*	-
Hagelin	-	-	+*	-	+*	-
Judge	+*	+*	+*		+*	
Mian			+*	-		
Nance et al.	-	-	+*	-		+*

Notes: The sign '-' indicates that the coefficient is negative while '+' indicates that the coefficient is positive. Statistical significance is noted with '*' and empty space indicates that the variable was not investigated in the study.

Liquidity is proposed to reduce expected financial distress by maintaining short-term liquidity (Nance et al. 1993). As for the proxy, Géczy et al. (1997) use quick ratio, that is cash and short-term investments divided by current liabilities, and Hagelin (2003) and Judge (2006) use current ratio, that is current assets divided by current liabilities. Results differ as Géczy et al. (1997) find statistically significant and negative relationship between liquidity and hedging. On the contrary, Judge (2006) finds liquidity to be a significant factor in determining currency hedging. He suggests that the presence of non-foreign currency hedgers in the model could be the critical factor which might explain the failure of detecting the relationship by the previous studies.

The size of the firm is used as a proxy for economies of scale in the costs of hedging. Firm size is significantly related to the decision to hedge as all the previous studies find larger firms to be more likely to hedge than small firms. Thus, these results support the hypothesis that hedging is influenced by economies of scale. As many mentions, such as Hagelin (2003) and Graham and Rogers (2002), this can be due to the fixed costs associated with hedging that can limit the viability of hedging for small firms.

One measure for firms' investment opportunity set is market to book ratio. Previous studies hypothesize that firms with higher growth opportunities are more likely to hedge as they are more exposed to underinvestment problem (see Myers 1977). Results show quite the contrary as there is no statistical evidence for firms with more growth opportunities proxied by market to book ratio to be more likely to hedge as only one of the studies find positive but statistically insignificant relationship between the two.

Divided yield is another proxy for investment opportunity set and only Nance et al. (1993) find a significant relationship between hedging and higher dividend yields. Others find the relationship to be insignificant and negative. Literature on dividends suggest that dividend policies can vary substantially between countries for example, because of agency problems and country specific factors (Porta, Lopez-De-Silanes, Shleifer & Vishny 2000; Belousova, Gurianov, Melnichuk, Vinichenko & Duplij 2016). Thus, differences in results might be explained by country specific data.

Foreign exchange rate risk exposure is measured as the ratio of foreign sales to total sales. Results are consistent across all studies as the coefficient is significant and positive. Thus, the amount of foreign sales has an important role in firms' decision to hedge. This result can be expected as increase in foreign sales should increase the risk exposure to exchange rate movements as long as the foreign sales take place in foreign currency. As Hagelin (2003) mentions the foreign sales is easily obtainable from financial statements and it has shown to be successful in explaining derivative usage but one needs to keep in mind that it may under- or overestimate the exposure as foreign sales might occur in domestic currency.

4. DATA AND METHODOLOGY

This study analyses currency derivatives and their use as hedging tool in the Finnish markets. Most of the earlier studies have focused on larger economies and evidence is limited for the smaller economies. Brunzell et al. (2011) study derivative usage in four Nordic countries, Finland included but to author's knowledge there is no evidence solely from the Finnish markets. Furthermore, their paper focuses overall derivative usage whereas this thesis focuses solely on currency. This section describes the properties of the data and the exclusions of data. The first part presents data collection, its limitations and the reasons and motives behind the variables. The following section discusses the properties of data and introduces descriptive statistics. The last part presents the correlation coefficients, research methodologies and regression models.

4.1. Data

Data consist of Finnish listed companies in the year 2018. As the financial activities of listed companies are publicly available, the sample is constructed from the companies listed in Nasdaq Helsinki. The financial data is obtained from the DataStream database. The hedging activity of companies is manually gathered from the annual reports and financial statements as it cannot be obtained from the database. As annual reports and statements discusses financial instruments under the IFRS 7 and among other things, the Finnish Corporate Governance Code guides companies to discuss their risks and risk management, this information is available from the annual reports. The sample of companies is restricted by the following three criteria:

(1) The company was listed on the Nasdaq Helsinki stock exchange in 2018
(2) The headquarters of the company was in Finland
(3) The company was a non-financial company.

The period time is limited to 2018 as it is the latest annual report that is available from the firms. The differences in accounting standards could rise if the country would not be controlled. Thus, foreign firms are eliminated through restrictions of the sample.

Following other studies, financial firms are excluded as they tend to have different motives behind derivative usage due to the nature of the industry. Financial firms differ from others as they tend to take speculative positions on both buy and sell sides with financial derivatives. Thus, excluding financial firms from the sample eliminates the possible bias that could arise by including them.

After the restrictions, the sample contains 106 firms as 19 firms under the sector "financials" were excluded, and a few that had their headquarters located somewhere else than Finland were excluded. From the sample of 106, the currency hedgers and non-hedgers are almost equally divided into half as 55 hedge currency and 51 do not. Many of the firms that hedge currency do also hedge interest rate and the discussion of other hedgers will take place later in the thesis.

4.1.1. Regression variables

The dependent variable, **hedging activity** is the most time-consuming variable to obtain as it requires one to manually search the information from the annual reports and financial statements. As mentioned before, firms have to discuss and report this and thus, it is obtainable. The key words used for the search included words related to derivatives and currency, such as "foreign currency", "currency risk", "forwards" and "currency derivatives". If the search terms did not return clear results, the author checked the reports more thoroughly until there was clear evidence of whether the firm hedged currency with derivatives or not. The variable is assigned a value of one if the firm hedged currency with derivatives and a zero if they did not hedge.

Investment opportunity set is argued to have a relationship with firm value (Myers 1977). According to Froot, Scharfstein and Stein (1993) hedging ensures that firms have funds to exploit the investment opportunities that they come across. Gay and Nam (1998) show empirical evidence between the growth opportunities and derivative use. Their results support the view that hedging is motivated at least in some extent to avoid underinvestment problems. To proxy investment opportunity set, three variables motivated by earlier studies are observed. Market to book ratio such as Bae et al. (2018),

Hagelin (2003) and Judge (2006), dividend yield such as Allayannis and Ofek (2001), Géczy et al. (1997) and Hagelin (2003) and as a third variable R&D to assets is used such as Bae et al. (2018) and Graham and Rogers (2002).

Economies of scale is proxied by firm size, measured by logarithmic of total assets as many others before, such as Graham and Rogers (2002), Hagelin (2003) and Judge (2006). As firm size is shown to be positively related to derivative usage due to costs related to hedging, this study controls for it. Alternative variables such as net sales and market capitalization could be used but total assets seem to be the most used one in the previous studies. Further, the correlation between the three varies between 0.88 and 0.96, with total assets having the highest among the three.

Table 2. Variable list and their formulas

Variable	Definition of variable
Market to book ratio	Share Price / Book Value
Dividend yield	Dividends Per Share / Market Price-Year End * 100
R&D to assets	Research & Development expense / by Total Assets
Firm size	Logarithm of Total Assets
Current ratio	Current Assets / Current Liabilities
Debt to equity	Long Term Debt / Common Equity * 100
Interest coverage	EBIT / Interest Expense on Debt
Foreign sales to total sales	International Sales / Net Sales or Revenues * 100

Notes: list of variables used in the study and their composition.

Financial distress cost and its probability is argued to decrease with hedging by Smith and Stulz (1985). They show that hedging increases firm value by decreasing the probability of financial distress and thus costs related to it. Three proxies of financial distress are investigated. To proxy liquidity, current ratio is used just as Bae et al. (2018), Nance et al (1993) and Hagelin (2003). Two different proxies for leverage is used, debt to equity such as Géczy et al. (1997), Graham and Rogers (2002) and Hagelin (2003) and interest coverage such as Allayannis and Ofek (2001), Géczy et al. (1997) and Judge

(2006). As Judge (2006) points out, the leverage ratio between debt and equity is widely used but as high level of debt is not always a sign of financial distress, another proxy is used in addition.

Foreign currency exposure is measured by foreign sales to total sales ratio such as Allayannis and Ofek (2001), Géczy et al. (1997) and many others. It directly measures firms' international activities but can still be inaccurate as the activity can be inside the euro area. Still there is motive for including this variable in the model as it has shown to have great importance in the previous studies. Also, Allayannis and Ofek (2001) find the relation to be positive and strong between exchange-rate exposure and foreign sales.

4.1.2. Descriptive statistics

Table 3 presents the descriptive statistics for the regression variables. The table is divided into three different categories. First, the total sample and its properties are presented, then the total sample is divided into two subsamples, currency hedgers and non-hedgers. Thus, the differences between the two are easy to compare and the total sample can be used as a baseline. Firms that hedge currency have on average smaller current ratio than those who do not, but the values tend to be closer to the mean for those who hedge. Dividend yield is clearly higher for the firms that hedge, meaning that hedgers distribute higher dividends relative to the stock price.

Foreign sales seem to have the greatest difference between the two. This is expected as currency hedgers are more likely to have foreign operations than non-hedgers. The average is over three times higher for hedgers, and the median confirms the difference between the two as it is zero for non-hedgers. Interest coverage is higher for hedgers, which could imply that hedgers are less likely to default as their earnings are higher, their financing terms are better, or they have lower amount of debt.

Non-hedgers have higher debt to equity ratio which can explain some of the differences between interest coverage ratios. Market to book ratio is higher for non-hedgers while research and development expenses relative to total assets are higher for hedgers. It can

Table 3. Descriptive statistics

Independent variable	Mean	Median	Max.	Min.	S.D.
Total sample N=106					
Current ratio	1.59	1.32	7.63	0.27	1.13
Dividend yield	3.05	3.30	11.43	0.00	2.50
Foreign sales%	43.36	41.57	100.00	0.00	37.46
Int coverage	16.57	9.01	100.00	-80.00	29.09
Debt to equity	48.63	29.77	856.86	0.00	89.40
Market to book	2.77	1.73	46.67	-1.73	4.85
R&D to assets	0.02	0.00	0.19	0.00	0.04
log(assets)	12.56	12.56	17.36	8.76	1.96
Currency Hedgers N=55					
Current ratio	1.45	1.35	3.78	0.29	0.67
Dividend yield	3.82	4.29	8.44	0.00	2.27
Foreign sales%	63.87	68.06	100.00	0.00	31.07
Int coverage	18.08	9.26	100.00	-80.00	29.42
Debt to equity	40.79	30.98	171.96	0.00	36.89
Market to book	2.17	1.82	8.01	-1.73	1.69
R&D to assets	0.03	0.01	0.19	0.00	0.04
log(assets)	13.81	13.83	17.36	10.24	1.60
Non-hedgers N=51					
Current ratio	1.75	1.30	7.63	0.27	1.46
Dividend yield	2.23	2.23	11.43	0.00	2.50
Foreign sales%	21.25	0.00	98.71	0.00	30.70
Int coverage	14.94	6.83	100.00	-43.26	28.93
Debt to equity	57.08	25.43	856.86	0.00	123.19
Market to book	3.42	1.66	46.67	-0.31	6.75
R&D to assets	0.01	0.00	0.14	0.00	0.03
log(assets)	11.22	10.82	14.79	8.76	1.32

Notes: descriptive statistics for the regression variables. Total sample and two subsamples of hedgers and non-hedgers are presented. N = observation number and S.D. stands for standard deviation.

be concluded from table 3 that hedgers are larger relative to the total asset size, have more foreign sales, have better interest coverage and debt to equity ratios and use more resources on research and development.

4.2. Empirical methodology

This study uses both univariate and multivariate tests to explain differences between currency hedgers and non-hedgers and to find statistical evidence on the determinants of hedging. Univariate test is used to find the differences between medians of the regression variables by using Wilcoxon rank sum test, where the null hypothesis test is carried out as follows:

(7) $H_0: \mathrm{med}(x) = m$
$H_1: \mathrm{med}(x) \neq m.$

As univariate tests tend to be weak, also multivariate tests are applied. As this study investigates hedging and currency derivative usage, the dependent variable can only obtain a value of one or zero. As mentioned before one indicates that the firm uses currency derivatives to hedge and zero if not. Logit regressions are performed to obtain the hedging likelihood. Next, a brief overview of the logit regression is introduced. The following linear probability model is used for example (Woolridge 2012, 584-587):

(8) $FCD = \beta_1 X_1 + \beta_2 X_2 + \ldots \beta_n X_n + \varepsilon_i$

For the model we have $FCD = G(\beta_1 X_1 + \beta_2 X_2 + \ldots \beta_n X_n + \varepsilon_i)$ where G is a function for all real numbers and gets a value between zero and one, $0 < G(z) < 1$. Thus, G must be a non-linear function and the typical ordinary least squares method cannot be applied as for it $G(Z) = z$. Logit model is based on the logistic function of:

(9) $G(z) = \exp(z) / [1 + \exp(z)]$

As for the interpretation of the logistic regression coefficients and their economic significance, one needs to keep in mind that from a binary model, the estimated coefficients cannot be interpreted as the marginal effect on the dependent variable. For obtaining the marginal effect of the continuous variables on the response probability, the following is estimated:

$$(10) \qquad \frac{\partial p(FCD = 1|X)}{\partial X_j} = G(\beta_1 X_1 + \beta_2 X_2 + \ldots \beta_n X_n)\beta_j$$

Model specification for the logit regression estimations in this study is illustrated in equation 11, where FCD obtain a value of 1 if the firm hedge currency with derivatives and 0 otherwise.

$$(11) \qquad P(FCD) = G\begin{pmatrix} \beta_0 + \beta_1 MtoB + \beta_2 Dividend\ yield + \beta_3 RD\ to\ asset + \\ \beta_4 \log(assets) + \beta_5 Current_r + \beta_6 Debt\_to\_equity + \\ \beta_7 interest_c + \beta_8 Foreign\ sales\ to\ total\ sales \end{pmatrix}$$

Table 4 below presents the correlation coefficients between the variables. Correlation coefficient of one would propose a perfect correlation between the variables which would imply multicollinearity problem. As correlation can be negative or positive, variables can obtain values between -1 to 1. Debt to equity and market to book ratio have the highest correlation between the variables, 0.76. Thus, in some model specifications market to book ratio is omitted to deal with this high correlation problem. As interest coverage is significantly correlated with many variables and is used as one of the two variables to proxy leverage, this variable is also omitted in some of the model specifications to see if changing the proxy for leverage affects the results.

Table 4. Pearson **c**orrelation coefficients

	Dividend yield	Current ratio	Int coverage	log(assets)	Debt to equity	Market to book	R&D to assets	Foreign sales%
Dividend yield	1.00							
Current ratio	0.16*	1.00						
Int coverage	0.17*	0.16*	1.00					
log(assets)	0.40***	-0.16	0.02	1.00				
Debt to equity	-0.17*	-0.11	-0.19**	-0.06	1.00			
Market to book	-0.12	0.09	0.18*	-0.14	0.76***	1.00		
R&D to assets	-0.21**	-0.05	0.12	-0.06	0.18*	0.32***	1.00	
Foreign sales%	0.10	0.02	0.17*	0.50***	-0.03	0.12	0.14	1.00

Notes: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

5. EMPIRICAL ANALYSIS

In this section the focus is on empirical results based on univariate test and multivariate tests. First part presents and discusses the univariate test results from Wilcoxon rank sum test. Then the analysis moves to multivariate tests where discussion on different model specifications and results are presented. First table of multivariate tests, table 6, introduces the whole sample results and small modifications of the model specification. Next, table 7 presents results which excludes from the non-currency hedging group either those firms that do not have foreign sales or those who do have foreign sales. Table 8 results excludes from the non-currency hedging group those firms that hedge other exposures. Table 9 includes firms that hedge only currency and nothing else and firms that do not hedge anything at all. Lastly, table 10 results include industry dummies into the whole sample specification. A summary of multivariate results is presented at the end of the thesis in the appendix section.

5.1. Univariate test

Table 5 below presents the univariate test results from Wilcoxon rank sum test where the differences in medians of hedgers and non-hedgers are tested. Statistical significance indicates that hedgers and non-hedgers are not equal in terms of median. Results show that dividend yield is statistically highly significant and positive, meaning that dividend yields of hedgers are higher and the null hypothesis that the dividend yields of the two groups are the same is rejected.

Results show that the variable R&D to assets is also highly significant meaning that hedgers use more resources to research and development relative to assets than non-hedgers. Also, as hypothesized, the size of assets is positive and highly significant, meaning that hedgers are bigger in terms of assets. As the R&D to assets and assets are both higher, the magnitude of research and development is even bigger with asset size in mind. Foreign sales variable is as hypothesized, positive and highly significant, meaning hedgers to have more foreign sales than non-hedgers.

Table 5. A comparison of characteristics of hedgers and non-hedgers

	Currency Derivative Users (N = 55)		Non-Users (N = 51)		
Variables	Mean	Median	Mean	Median	z-value (p-value)
Market to book	2.17	1.82	3.42	1.66	0.25 (0.80)
Dividend yield	3.82	4.29	2.23	2.23	3.67*** (0.00)
R&D to assets	0.03	0.01	0.01	0.00	3.70*** (0.00)
log(assets)	13.81	13.83	11.22	10.82	6.83*** (0.00)
Current ratio	1.45	1.35	1.75	1.30	0.10 (0.92)
Debt to equity	40.79	30.98	57.08	25.43	0.61 (0.54)
Int coverage	18.08	9.26	14.94	6.83	1.29 (0.20)
Foreign sales%	63.87	68.06	21.25	0.00	6.01*** (0.00)

Notes: summary statistics for the variables and their significance tests between firms that use currency derivatives as a hedging tool and those who do not. Means, medians, observation number (N), z-values and p-values are reported. The statistical significance values are from a Wilcoxon rank sum test for the differences between the variable medians of the two groups. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

5.2. Multivariate tests

This section presents the multivariate test results from logit regressions which are presented in tables 6 through 10. Results from the first logit regression are presented in table 6. In this estimation the whole sample is considered, 106 firms of which 55 are currency hedgers and 51 are non-hedgers. Model 2 omits interest coverage from the

model specification and model 3 omits market to book ratio as discussed previously in the correlation coefficients.

Results from table 6 provide evidence that investment opportunity set is an important factor in hedging decision. Proxies stay statistically significant throughout the models except for market to book ratio, which is in line with previous studies. R&D to assets is highly significant throughout the models. Dividend yield is positive and significant at 5% level except for model 3. These findings support the previously hypothesized positive relationship between hedging and higher growth opportunities argued by Myers (1977) and results of Gay and Nam (1998).

Table 6. Logit results between currency hedgers and non-hedgers

	Model 1		Model 2		Model 3	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
Intercept	-16.892	0.000***	-16.754	0.000***	-16.692	0.000***
Market to book	-0.494	0.120	-0.535	0.072*		
Dividend yield	0.384	0.031**	0.382	0.033**	0.305	0.054*
R&D to assets	38.311	0.006***	38.198	0.007***	34.350	0.003***
log(assets)	1.179	0.002***	1.172	0.002***	1.170	0.000***
Current ratio	-0.289	0.402	-0.305	0.377	-0.247	0.451
Debt to equity	0.006	0.578	0.006	0.534	-0.004	0.244
Int coverage	-0.005	0.721			-0.017	0.182
Foreign sales%	0.043	0.001***	0.043	0.001***	0.036	0.001***
McFadden R^2	0.629		0.628		0.599	
Log likelihood	-27.231		-27.295		-29.447	
N	106		106		106	
Obs. Dep=0	51		51		51	
Obs. Dep=1	55		55		55	

Notes: Logit regression estimates between proxies and the use of derivatives for currency hedging. In these models the whole sample is considered. All independent variables are as defined in the data section. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

The relationship between hedging and growth opportunities is not generally documented as strongly by previous studies. Only Nance et al. (1993) find significant and positive results regarding dividend yield and hedging while others find negative and insignificant results. This can be at least partly explained by the previously mentioned differences between dividend policies across countries. R&D to assets is positive and in line with previous studies such as Graham and Rogers (2002) and Géczy et al. (1997). One possible reason for hedgers having higher R&D could be explained by Lewent and Kearney (1990). They argue that firms may need to use external sources from abroad to finance their R&D expenses if domestic financing is more expensive.

Economies of scale is as hypothesized, an important factor in firms' hedging decision. Logarithmic of assets is used as a proxy for the firm size and the coefficient estimate is highly significant and positive as expected. This is consistent with the previously mentioned argument that hedging includes fixed costs that can limit smaller firms from being able to hedge.

Results for costs of financial distress proxies are all insignificant and thus, not related to the likelihood of hedging. Nance et al. (1993) assumptions of the relationships between leverage, liquidity and hedging are not supported. These results are somewhat in line with the previous studies as there is no clear evidence for the relationship between the two. Previous studies find liquidity to have both, negative and positive relationship between hedging. Many previous studies find leverage to be insignificant but the more recent ones, such as Judge (2006), find a significant and positive relationship between hedging and leverage. Later in this study methods used by Judge (2006) are applied to test if the relation exists.

Results show supporting evidence for the hypothesis that foreign exchange rate risk exposure has significant effect on hedging decision. Foreign sales to total sales ratio variable stay highly significant and positive across models as expected from previous studies. There needs to be caution with this variable as the proxy does not directly measure the foreign currency exposure but rather the sales outside of the domestic country. Still, this variable can be assumed to be a good proxy as Allayannis and Ofek

(2001) argue with their findings that the relation between foreign sales ratio and exchange-rate exposure to be positive and strong.

5.2.1. Further tests

Next, table 7 presents estimations where from the non-currency hedging group is either excluded those firms that do not have foreign sales (model 1) or firms that have foreign sales (model 2). This test is motivated to find differences between hedging decision when a firm is exposed to foreign exchange risk and has decided not to hedge and with firms that do not face foreign currency risk. The results between models 1 and 2 remain rather same regardless of whether the firm has foreign sales or not.

Table 7. Further tests, foreign sales

	Model 1		Model 2	
	Coeff.	p-value	Coeff.	p-value
Intercept	-15.137	0.002***	-19.391	0.000***
Market to book	-0.547	0.139	-0.313	0.377
Dividend yield	0.314	0.131	0.215	0.220
R&D to assets	34.332	0.040**	42.321	0.012***
log(assets)	1.251	0.004***	1.473	0.000***
Current ratio	-0.592	0.126	0.730	0.056*
Debt to equity	0.001	0.903	-0.001	0.959
Int coverage	0.002	0.890	-0.002	0.904
Foreign sales%	0.018	0.244		
McFadden R^2	0.562		0.539	
Log likelihood	-21.259		-23.946	
N	79		82	
Obs. Dep=0	24		27	
Obs. Dep=1	55		55	

Notes: Logit regression estimates between proxies and the use of derivatives for currency hedging. Model 1 excludes from the non-currency hedging group those firms that do not have foreign sales. Model 2 excludes from the non-currency hedging group those firms which have foreign sales. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

These results remain fairly similar to results from table 6, but dividend yield loses its significance, current ratio becomes slightly significant in model 2 and as expected, foreign sales loses its significance. Foreign sales estimate is expected to be insignificant in the model 1 as the non-hedging group contains only firms that have foreign sales. In the model 2 the foreign sales variable must be omitted from the model specification as otherwise it would have too much explanatory power over others. This is due to the non-hedging group containing only firms that do not have foreign sales.

Excluding other hedgers from the non-currency hedging group

Following Judge (2006) and to test the third hypothesis, other hedgers are excluded from the non-currency hedging group which results in 37 firms that do not hedge anything at all. As Judge (2006) argues, including other hedgers can result in bias as some factors can be more important for example to interest rate hedgers than for currency hedgers. Thus, the relationship between currency hedging and these factors can be difficult to obtain if there are other hedgers included. Results are presented in table 8 in a similar manner to table 6.

Results show that excluding other hedgers increase the coefficient estimates and their explanatory power. Where Judge (2006) finds evidence for the relation between costs of financial distress and hedging, this study fails to some extent in finding it. Liquidity remains an insignificant factor in hedging decision and only debt to equity is significant from costs of financial distress proxies. In an unreported analysis, a logit regression is estimated to test whether interest coverage has explanatory power when the other leverage variable debt to equity is omitted. This estimation does not change the results and it seems that interest coverage is not an important factor in hedging decision as it remains insignificant throughout all estimations. Thus, there is some evidence for the hypothesis for the relationship between hedging and financial distress, but the relationship is not as strong as documented by Judge (2006).

Table 8. Other hedgers excluded from the non-hedging group

	Model 1		Model 2		Model 3	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
Intercept	-17.485	0.001***	-16.830	0.001***	-15.930	0.000***
Market to book	-0.682	0.010**	-0.725	0.006***		
Dividend yield	0.842	0.008***	0.837	0.008***	0.424	0.036**
R&D to assets	51.470	0.011**	51.280	0.011**	31.733	0.005***
log(assets)	0.964	0.008***	0.917	0.009***	1.080	0.001***
Current ratio	0.274	0.644	0.194	0.738	0.004	0.994
Debt to equity	0.028	0.022**	0.029	0.014**	-0.003	0.283
Int coverage	-0.008	0.611			-0.023	0.115
Foreign sales%	0.065	0.001***	0.066	0.001***	0.037	0.003***
McFadden R^2	0.687		0.685		0.598	
Log likelihood	-19.408		-19.540		-24.936	
N	92		92		92	
Obs. Dep=0	37		37		37	
Obs. Dep=1	55		55		55	

Notes: Logit regression estimates between proxies and the use of derivatives for currency hedging. In these models other hedgers from the non-currency hedging group are excluded. All independent variables are as defined in the data section. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

5.2.2. Robustness tests

To further test robustness of the results, two additional tests are concluded. Table 9 presents results where currency-only hedgers from the currency hedging group are considered and from the non-hedging group only those who do not hedge anything are considered. This results in 15 firms that only hedge currency and 37 firms that do not hedge anything. Results stay consistent with previously obtained results with the exception of variable assets. In an unreported analysis foreign sales variable is omitted which results firm size to become a significant factor. Comparing to table 6, R&D to assets and foreign sales variables change from highly significant to significant.

Table 9. Currency-only hedgers and non-hedgers

	Model 1		Model 2		Model 3	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
Intercept	-11.980	0.027**	-10.618	0.026**	-10.019	0.016**
Market to book	-0.677	0.065*	-0.595	0.071*		
Dividend yield	0.781	0.043**	0.697	0.037**	0.439	0.089*
R&D to assets	48.677	0.021**	45.070	0.018**	25.395	0.046**
log(assets)	0.482	0.243	0.438	0.245	0.546	0.109
Current ratio	0.512	0.432	0.412	0.480	0.050	0.916
Debt to equity	0.028	0.110	0.024	0.132	-0.004	0.363
Int coverage	-0.012	0.543			-0.002	0.519
Foreign sales%	0.057	0.012**	0.045	0.028**	0.030	0.062**
McFadden R^2	0.532		0.459		0.387	
Log likelihood	-14.629		-16.911		-19.153	
N	52		52		52	
Obs. Dep=0	37		37		37	
Obs. Dep=1	15		15		15	

Notes: Logit regression estimates between proxies and the use of derivatives for currency hedging. Models in this table include from the currency hedging group only those firms that hedge currency and nothing else and from the non-currency hedging group only those firms are included that do not hedge anything. All independent variables are as defined in the data section. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Industry dummies

For the second robustness test industry dummies are included in the whole sample specification. Industries are basic materials, consumers goods, consumer services, health care, industrials, technology, telecommunications, utilities and oil. Three dummies from the industries, telecommunications, utilities and oil are omitted as these include only one or two firms each. Without taking these three industries into account the most frequent currency hedging industries are basic materials, consumer goods and consumer services. A more specific information on industries is presented in the appendix.

Table 10. Industry dummies included

	Model 1		Model 2		Model 3	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
Intercept	-28.253	0.000***	-26.776	0.000***	-29.729	0.000***
Market to book	-0.218	0.593	-0.349	0.344		
Dividend yield	0.224	0.243	0.229	0.240	0.192	0.290
R&D to assets	53.105	0.008***	50.968	0.010***	55.422	0.004***
log(assets)	1.776	0.001***	1.696	0.001***	1.841	0.000***
Current ratio	-0.240	0.535	-0.308	0.440	-0.200	0.586
Debt to equity	-0.002	0.859	0.000	0.989	-0.006	0.368
Int coverage	-0.015	0.349			-0.019	0.195
Foreign sales%	0.042	0.006***	0.040	0.007***	0.039	0.006***
Basic materials	1.103	0.721	1.093	0.725	1.662	0.562
Cons. goods	5.027	0.063*	4.683	0.067*	5.631	0.028**
Cons. services	5.326	0.050**	4.912	0.056*	5.917	0.023**
Health care	2.505	0.384	2.243	0.412	2.863	0.314
Industrials	4.525	0.083*	4.135	0.094*	5.128	0.039**
Technology	2.285	0.447	2.117	0.462	2.569	0.390
McFadden R^2	0.693		0.687		0.690	
Log likelihood	-22.539		-23.007		-22.759	
N	106		106		106	
Obs. Dep=0	51		51		51	
Obs. Dep=1	55		55		55	

Notes: Logit regression estimates between proxies and the use of derivatives for currency hedging. Industry dummies are included in the model. All independent variables are as defined in the data section. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 10 show that only dividend yield loses its significance when industry dummies are included. Otherwise the results stay similar to the results of table 6. From industries consumer services, consumer goods and industrials are significant. Interestingly basic materials dummy is not even close to significant while it has the highest percentage out of the firms that hedge currency. There is no highly significant (<0.01) estimates within

industry dummies which is somewhat expected. Graham and Rogers (2002) find industry dummies to be insignificant and find that excluding them from the models do not affect their findings. Also, Géczy et al. (1997) find no significant results regarding industry dummies in their study.

6. CONCLUSIONS

This thesis investigates the determinants of currency hedging for a sample of Finnish non-financial firms. Out of the sample of 106 firms, 55 firms are classified as currency hedgers. The determinants are investigated through univariate test and multiple logit regressions. The empirical results provide strong and robust evidence for the first and second hypotheses while the third hypothesis lacks strong evidence. Five different multivariate models are used to investigate the relation between currency hedgers and variables.

Results are robust through multiple model specifications. Tests are carried out where from the non-hedging group firms with or without foreign sales are excluded with the results implying that there is no difference. One specification excludes other hedgers from the non-hedging group which results in stronger estimations. In addition, a test is carried out where only those who hedge currency or those who hedge nothing are included. For the last test industry dummies are included into the original model and the main results stay consistent.

Economies of scale proxied by total asset size is positively related to hedging decision. This thesis finds evidence for the hypothesis that larger firms are more likely to hedge than smaller firms. Thus, results support that hedging for smaller firms is discouraged because of the fixed costs associated with hedging. This thesis confirms the hypothesized positive relation between hedging and foreign currency exposure as results show foreign currency exposure to be a significant factor in hedging decision. These two findings are in line with the findings of previous studies.

The empirical analysis takes other hedgers into account to investigate the arguments of Judge (2006). Results imply that excluding other hedgers appears to result in stronger estimates and one of the two leverage proxies become significant. Unlike Judge (2006), this study fails to document a significant relation between hedging and liquidity. Thus, there is some evidence for the relation between hedging and costs of financial distress, but the evidence is not close to what Judge (2006) documents.

Investment opportunity set is also an important factor in hedging decision. R&D to assets is positive and significant throughout the tests while dividend yield is significant in more than half of the tests and remains positive. Market to book ratio is negative throughout the tests and is the weakest explanatory variable of the three proxies. Results are in line with previous studies except for dividend yield which is much stronger in this study compared to others. This can be explained at least partly by the differences in dividend policies between countries.

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Table	Model	Market to book	Dividend yield	R&D to assets	log(assets)	Current ratio	Debt to equity	Int coverage	Foreign sales%
Table 6	1	-	+**	+***	+***	-	+	-	+***
	2	-*	+**	+***	+***	-	+		+***
	3		+*	+***	+***	-	-	-	+***
Table 7	1	-	+	+**	+***	-	+	+	+
	2	-	+	+***	+***	+*	-	-	
Table 8	1	-**	+***	+**	+***	+	+**	-	+***
	2	-***	+***	+**	+***	+	+**		+***
	3		+**	+***	+***	+		-	+***
Table 9	1	-*	+**	+**	+	+	+	-	+**
	2	-*	+**	+**	+	+	+		+**
	3		+*	+**	+	+	-	-	+**
Table 10	1	-	+	+***	+***	-	-	-	+***
	2	-	+	+***	+***	-	+		+***
	3		+	+***	+***	-	-	-	+***

Notes: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. The sign - indicates that the coefficient is negative while + indicates that the coefficient is positive. Empty space indicates that the variable was not included.

APPENDIX 2. Industry distribution

Industry	Total firms	Hedgers	Non-Hedgers
Basic Materials	7	6	1
Consumer Goods	16	10	6
Consumer Services	12	7	5
Industrials	42	22	20
Technology	18	6	12
Health Care	7	2	5
Telecommunications	2	0	2
Utilities	1	1	0
Oil	1	1	0
Total	106	55	51