



**LUND UNIVERSITY**  
School of Economics and Management

# **Foreign Currency Derivatives and Their Impact on Firm Value – A Study on Swedish Non-Financial Firms**

*Master's Thesis in Finance*

**May 2015**

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## Abstract

This paper empirically examines the relationship between firm value and the usage of currency derivatives for 85 non-financial Swedish firms listed on Stockholm Stock Exchange. The sample includes firms operating in a wide range of industries and with different sizes. The time period for the data is from 2005 to 2010. There is no proof of an existing relationship between currency derivative usage and firm value. The most significant result indicates that a negative correlation between leverage and firm value exists.

**Keywords:** risk management, firm value, Tobin's Q, currency derivatives, foreign exchange derivatives, FX risk

## Acknowledgements

I recognize the contribution of my mentor, Håkan Jankensgård who supported me through this thesis with guidance and comments. Furthermore, I would like to thank family and friends for their moral support and encouragement throughout the whole research process.

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# 1. INTRODUCTION

## 1.1. Background of the study

The increased pace of globalization compels internationally-oriented companies to engage in hedging activities to protect themselves against financial perils, such as foreign exchange, commodity and interest rate risks. Financial derivatives, for example, are a mechanism that firms can utilize to hedge their exposure to such risks and guard their cash flows against financial market uncertainties. Various theories state that enterprises can manage risk by other means. This research, however, refers to hedging as using financial derivatives, unless stated differently.

Derivatives, which are merely agreements between two or more parties, derive their value from underlying asset, such as a currency, commodity or interest rate. Using derivatives as a mode of risk management usually requires an initial investment to mitigate unwanted future price movements. In addition to their applicability as a hedging instrument, companies might also use them for speculative reasons.

Numerous theories found empirical evidence on the hedging premium, which implies a positive correlation between hedging and firm value. Additionally, previous studies indicate that hedging helps to mitigate the underinvestment problem, agency cost and reduce corporate taxes (Mayers and Smith, 1982; Stultz 1984; Froot, Scharfstein and Stein, 1993). Firms can hedge in several ways, for example by using options such as futures, forwards and swaps but also by operational and accounting strategies and by issuing foreign debt in order to hedge foreign currency exposure (Allayanis and Ofek, 1997; Petersen and Thiagarajan, 2000).

There are many studies done on the relationship between hedging and firm value, for example Jin and Jorion (2006) investigated the correlation between firm value and oil hedging for US oil and gas producers between 1998-2001. Allayannis and Weston (2001) examined the FX derivative usage and its direct impact on firm value for US firms from 1990 to 1995. Carter, Rogers and Simkins (2006) explored commodity hedging and firm value in the U.S airline industry. Jankensgård (2015) studied a sample of Swedish firms listed on the Stockholm Stock Exchange in the end of 2009. He examined whether centralized vs. decentralized decision making impacts firm value.

## **1.2. Research objectives**

The purpose of this study is to examine if there exists a difference in firm value between users and non-users of FX derivatives. Firm value is explained by Tobin's Q and is defined as the ratio of the market value of the firm divided by the replacement cost of its assets, evaluated at the end of each fiscal year. This study is based on firms listed on the Stockholm Stock Exchange for the six-year period between 2005-2010. I explore if hedging against FX risk has an impact on firm value, while controlling for factors such as size, profitability, leverage, dividend payouts, diversified product segments and capital expenditures.

As far as my knowledge goes there has not up to this date been a study that investigates the direct relationship between firm value and FX derivative usage made on a sample of Swedish listed firms with a longer time period that experiences a financial crisis. The Swedish market is known to be open, which also means that Swedish firms are more exposed to FX risks than for instance firms from the US. This is because many Swedish firms have operations abroad and are exposed to exchange rate movements through foreign sales and export/import activities. This study provides no clear evidence that hedging is correlated with firm value in either direction. The most significant result is the negative correlation between leverage and firm value.

## **1.3. Outline**

This paper is segmented into six sections. Section 2 summarizes previous research on hedging and firm value. Section 3 includes the discussion and background and develops the hypothesis. Section 4 elaborates the methodology and sample data. Section 5 includes the empirical result and analysis. Section 6 concludes the study.

## 2. Prior research on hedging and firm value

### 2.1. Overview

Hedging should not be relevant to firm value in a perfect capital market (Modigliani and Miller, 1958). Theory, however, recognizes several market imperfections that can make risk management beneficial, thus contradicting the Modigliani and Miller (1958) theorem. These imperfections, which will be further discussed in the context of previous research and include; the underinvestment problem, the cost of financial distress and costly external financing (Carter et al., 2006; Froot et al., 1993; Geczy et al., 1997), managerial risk aversion (Guay and Kothari, 2002; Mian, 1996; Stulz, 1984; Smith; Stulz, 1985) tax incentives (Mayers and Smith, 1982; Smith and Stulz, 1985; Stulz, 1996; Leland, 1998). Most importantly, this section will examine the direct relationship between hedging and firm value.

### 2.2. The underinvestment problem

Several theories suggest that derivative usage can reduce the underinvestment problem (Carter et al., 2006; Geczy et al., 1997; Froot et al., 1993; Gay and Nam, 1998; Hagelin, 2003). The problem of underinvestment occurs when external financing is expensive and internal capital is insufficient to finance growth opportunities. (Ogden, Jen and O'Connor, 2003). Froot et al. (1993) argues that hedging could reduce the underinvestment problem to firms with growth opportunities when external financing is more costly than internal funds. They discovered that cash flows generated within the firm could be disrupted by external factors such as volatile market prices. The hedging firm can increase value even though the market is volatile by ensuring that it has sufficient cash flows available to take on value-enhancing projects. Gay and Nam (1998) directly analyzed the underinvestment problem as a factor of derivative usage. They argue that risk management is beneficial as it decreases the cost of external financing in poor economic climates, hence reducing the underinvestment problem. Carter et al. (2006) examines whether jet fuel hedging is positively related to firm value in the airline industry. They test a sample of 259 U.S. airlines and find that hedgers trade at a premium of about 14%; moreover, they suggest that hedging is important as it allows firms to expand operations during unstable times, thereby alleviating the underinvestment problem. Hagelin (2003)

examined a sample of firms listed on the Stockholm Stock Exchange together with their hedging policies. He finds evidence that firms hedge with the aim of reducing their FX exposure. Consequently, this decreases the expected costs of financial distress by lowering the cost of external financing, which will minimize the underinvestment problem during poor economic times. Likewise, Geczy et al. (1997) examines FX derivative activities and demonstrates that currency derivative usage is related to research and development expenditures, which is also consistent with the theory that hedging reduces the underinvestment problem. Nance, Smith and Smithson (1993) corroborate this theory by proving that hedgers have higher R&D expenditures. Furthermore, they provide evidence that hedgers have less fixed claims, are larger and have more growth opportunities.

However, there are contradictory studies that show no evidence of a relationship between hedging and underinvestment. Some studies, such as Mian (1996) even reveal a negative correlation between a firm's derivative usage and its investment opportunities. Likewise, Berkman and Bradbury examine a sample of New Zealand firms and find little evidence to support the underinvestment hypothesis. In New Zealand firms are required to report the fair and notional value of their off- and on balance sheet derivatives. Berkman and Bradbury, thus, have access to accurate data, which gives them a more precise outcome compared to studies where information is gathered using surveys. Several studies show no relation between hedging and firm value, which supports the evidence of hedging not reducing the underinvestment problem.

### **2.3. Managerial risk aversion**

There are several contradicting theories concerning managerial risk aversion. One theory typology suggests that managers hedge because of the incentive to maximize their own utility. Guay and Kothari (2002) argue that a risk averse manager, one keeps most of his wealth within the firm, will most likely attempt to reduce the firms' risk by hedging. This will reduce the required risk premium, which means that stakeholders will receive a smaller return on their investments.

Risk-averse managers engage in hedging for their own benefit if their wealth is concentrated in the firm and if the cost of independently hedging for their own benefit

exceeds the cost of hedging at the firm level (Stulz 1984; Smith and Stulz 1985). Managers are responsible to choose a firm's hedging policy. Even though it is believed that managers will pick a hedging policy that maximizes their own utility, Stulz (1984) argues that shareholders will in the end select managers that will maximize shareholder wealth, hence maximizing firm value. Smith and Stulz (1985) argue that hedging should increase firm value, as long as the cost of hedging is less than the reduction in managers' compensation plus the increased revenues gained through hedging.

Jin and Jorion (2007) studied the effect of hedging activities on gold mining firms and found strong indication that supports the managerial risk aversion theory. They suggest that managers who hold more stock tend to undertake more hedging activities, while managers that hold more options tend to be less involved in hedging. This is also supported by Graham and Rogers (2002), who imply that derivative usage is related to a manager's equity position. Tufano (1996) examined hedging activities in the gold-mining industry and found that the use of commodity derivatives is positively related to the value of stock that is held by managers and directors. This implies that managers' who have their own wealth within the company believe that derivative usage affects firm value positively. They are more engaged in managing risk because their own wealth is directly affected by their actions at the firm level. This is also consistent with theories of managerial risk aversion done by Stulz (1984). Jin & Jorion (2006) found no evidence that hedging leads to higher firm value, but suggest that if hedging has no impact on firm value, then the management uses hedging activities for personal utility maximization purposes.

## 2.4. Tax incentives

Several theories suggest that derivative usage may be motivated by tax incentives. First, firms can reduce the expected cost of tax liability if the tax function is convex (Mayers and Smith, 1982; Smith and Stulz, 1985). A convex tax function implies that the effective tax rate increases together with the pre-tax income. Second, firms can hedge to expand their debt capacity, which will increase interest tax deductions and lead to greater tax advantages (Leland 1998). Nance et al. (1993) implied that hedging will reduce financial distress costs and reduce expected taxes. Smith and Stulz (1985) argue that tax volatility is costly for firms with a convex effective tax rate. Thus firms will undertake hedging activities which minimizes tax related costs by reducing pre-tax income volatility. They imply that the structure of the tax code can make it advantageous for firms to take positions in futures, forward and option markets, if the effective marginal tax rates are an increasing function of the firm's pre-tax income. If hedging reduces the variability of the pre-tax value, then the expected corporate tax liability is reduced and the expected post tax value of the firm is increased, as long as the cost of hedging does not exceed this value.

Graham and Rogers (2002) directly measure the tax function convexity and determine tax savings that can be achieved by reducing the volatility of the taxable income. They do this by studying derivative usage in 1994-1995 on a sample of 442 firms and find no evidence that firms engage in hedging activities in order to reduce the expected tax liability by decreasing the volatility of the taxable income. Their study shows that there is no evidence implying a positive relationship between derivative usage and tax convexity. Graham et al. (2002), Leland (1998) and Stulz (1996) illustrate that hedging increases debt capacity by minimizing the volatility of income and reducing the probability of financial distress.

## 2.5. Direct relationship between firm value and hedging

Clark and Mefteh (2010) examine the direct relationship between FX derivatives usage and firm value for 240 of the largest French non-financial firms in 2004. They find evidence implying that derivative usage significantly adds value to French firms,

but that this effect mainly applies to larger firms. However, the limitation of this study is that seasonal effects might influence their results as they only use cross-sectional data. Similarly, Allayannis and Weston (2001) examined the relationship between firm value and the usage of foreign currency derivatives on 270 large non-financial firms. They use panel data, with a time period of 5 years (1990-1995), which gives a more accurate result as the longer time period accounts for seasonal effects. They find that the firm market value of foreign currency derivative users is about 5% higher compared to non-users, which is almost \$200 million of added value to hedging firms. However, they argue that companies that enjoy high growth opportunities tend to have higher firm value, and therefore have bigger incentives to hedge. They tested for reverse causation and found no evidence that enterprises merely based on their large firm value choose to hedge, and that firms with lower firm value would choose to stay un-hedged. They found evidence that companies that begin to use derivatives experience increased firm value compared to firms that choose to remain un-hedged. Likewise, firms that quit hedging experience decreased firm value compared to firms that remain hedged.

Jankensgård (2015) studied a sample of 257 Swedish firms that were listed on Stockholm Stock Exchange in the end of 2009. Because of the data scarcity on centralization /decentralization, his research is limited to cross-section data. This can give biased results due to seasonal cycles and macroeconomic effects. Jankensgård showed that derivative usage is value adding to firms with a centralized foreign exchange exposure management, while firms with a decentralized approach showed no evidence of FX derivative premium. He called this the “centralized premium” and argued that firms with a decentralized risk management suffer from coordination problems and cost inefficiencies.

In contrast to Allayannis and Weston (2001) and Clark and Mefteh, (2010), Jin & Jorion (2006), finds no support that hedging leads to higher firm value. They investigate the hedging activities of a sample of 119 U.S oil and gas producers from 1998 to 2001 and conclude that hedging reduces stock price sensitivity to oil and gas prices. However, they found no evidence that there is a variance in firm values between hedgers and non-hedgers. They also argue that the hedging premium is associated with the types of risks a company is exposed to. However, they claim that

if hedging does not impact firm value, then management uses hedging for personal utility maximization.

Likewise, Hentschel and Kothari (1997) argue that numerous firms actively manage their foreign exposure with derivative usage. But, when comparing hedgers to non-hedgers, they barely show any differences in their risk characteristics that can be linked to derivative usage. Tufano (1996) examined hedging activities in the gold-mining industry and state that more than 85% of all gold mining firms engaged in some sort of gold price hedging in 1990-1993. Nevertheless, he finds little empirical support that risk management increases firm value. Jin and Jorion (2007) contributed with an additional study on the relation between hedging activities and gold mining firms. They found no evidence that derivatives would have a positive impact on firm value.

Adam and Fernando (2006) examined gold mining firms in the period 1900-2000 and found that companies that engage in hedging experience an economically significant increase in cash flows. They have a considerable longer time period compared to other studies, which should reduce seasonal and macroeconomic effects and provide unbiased results. They claim that forward prices are usually higher than spot prices, which will allow firms to sell at a forward price that is on average higher than the spot price, earning on typically a premium of 3%. However, there is no evidence that this contributes to higher firm value.

Petersen and Thiagarajan (2000) provide a different and very detailed case study made on two gold mining firms, whereas one of them uses derivatives and the other one does not. They find no premium for the user of derivatives and conclude that the equity exposure to gold prices is almost the same for the two firms. However, they claim that risk management can be done in other ways besides using derivatives. They imply that the firm that does not use derivatives manages its risk through operational and accounting strategies, which can be a reason to why they do not find any differences in firm value. These studies are made on firms operating in specific industries; hence the outcomes of their research can highly be affected by industry-specific factors.

### 3. HYPOTHESIS DEVELOPMENT

#### 3.1. Background

According to the classic Modigliani and Miller paradigm; risk management is irrelevant, assuming that firms operate in a frictionless capital market. They argue that investors are rational and can protect themselves by keeping a well-diversified portfolio, but also that they are able to reduce risk by themselves at the same cost (Modigliani and Miller, 1958). However, we do not live in a perfect world and recent studies show that in the presence of capital market imperfections, such as agency costs, costs of external financing, information asymmetries, direct and indirect bankruptcy costs, as well as taxes, corporate hedging will add value to shareholders (Bartram & Dufey, 2007; Gay and Nam, 1998; Graham and Rogers, 2002; Hagelin, 2003; Judge, 2003; Mian, 2006; Smith and Stulz, 1985).

Several empirical studies provide evidence on reasons to why firms participate in hedging activities. Carter et al. (2006), Gay and Nam (1998) and Hagelin (2003) argue that risk management is relevant to firms because it will alleviate the underinvestment problem in bad economic times as it reduces the cost of external financing. They show that there is a positive relationship between hedging and growth opportunities. Similarly, Nance et al. (1993) and Geczy et al. (1997) examined hedging activities and found that hedging is positively related to growth opportunities.

There are different interpretations on the value maximization theory. Numerous studies found empirical evidence that corporate hedging has no impact on firm value, as investors can by themselves reduce risk at least as efficiently through diversification. Managing risk that investors cannot diversify away by themselves may not increase shareholder value because investors receive a premium return for holding risky securities (Hentschel and Kothari, 1997; Jin and Jorion, 2006; Jin and Jorion 2007; Tufano, 1996). Dufey and Srinivasulu (1983) argue that hedging market risk is a trade-off between risk and reward in the market.

Jin and Jorion (2007) and Tufano (1996) studied the effect of hedging activities on gold mining firms and could not find evidence that hedging positively impacts firm

values. As mentioned previously, Jin & Jorion (2006) tested for a difference in firm value between firms that hedge and those that do not hedge their oil and gas price risk. Their findings indicate that there is generally no difference in firm value between hedging and non-hedging companies. These studies are contrary to the findings reported in Allayannis and Weston (2001) and Carter et al. (2006).

As we know, a frictionless market only exists in order to support and develop theories, and corporate hedging can according to several empirical studies enhance shareholder's value through its impact on agency costs, costly external financing, direct and indirect costs of bankruptcy, as well as taxes (Jankensgard, 2015). According to theory, risk management can create value by reducing various forms of financial distress costs such as costs of bankruptcy or alleviating underinvestment problems by decreasing cash flow volatility (Bartram and Dufey 2007; Smith and Stulz 1985).

### **3.2. Discussion and delimitations**

Several theories have been developed on the derivative premium and the numerous factors that might impact firm value. A limitation to this study is that some of the explanatory variables that are not included in the research possibly impact firm value and the decision to hedge. Some of these variables are not observable, or have been excluded due to the data and time constraints. To allow for a better analysis, some of the omitted variables will be deliberated; a managers' own stake in the company, foreign sales, a manager's quality, the faced risk exposure, industry-specific factors, the aim of hedging and whether the firm has a centralized or decentralized approach to risk management. Foreign sales or other international activities are important factors to why firms chose to hedge against currency fluctuations. Figures on foreign sales were obtained from Datastream, but was excluded due to huge data inconsistency. Jankensgård (2015) finds that firms with a centralized approach to risk management experience a derivative premium while firms with a decentralized approach do not show an increase in firm value associated with derivative usage. Managerial quality is rather an unobservable firm characteristic and is difficult to measure. Additionally, my econometric model is bound to several limitations and provides evidence of robustness.

Studies illustrate mixed empirical results regarding the hedging premium, but most of these analyses were based on data before the financial crisis in 2007-2008. Therefore they do not examine change in firm value that experienced a severe financial crisis. The hedging premium of hedging firms should – according to some theories – have a lower financial distress cost during poor economic times (Smith and Stulz, 1985). Consequently, the difference in firm value between hedgers and non-hedgers should be even greater during this volatile period. After reading numerous articles, I observed that most studies have a relative short time period; in most cases the time period varies between 1-3 years. Therefore, I use panel data with a time period of 6 years, which should be sufficient to get appropriate results and account for seasonal effects.

Another important factor is whether companies hedge with the aim of protecting themselves from market uncertainties or for speculative reasons. There are several studies indicating that firm's hedge for other reasons than managing risk (Mian, 1996; Nance et al., 1993; Tufano, 1996; Geczy et al., 1997). It is vital to mention that Allayannis and Ofek (1997) examined whether firms hedge to reduce foreign exchange risk or for speculative purposes and discovered that firms use derivatives to reduce their risk exposure, and not to speculate. This indicates that the purpose of derivative usage is to manage risk and is part of a value-increasing strategy. Additionally, they found a positive relationship between foreign sales and the decision of a firm to issue foreign debt. This suggests that companies can by issuing foreign debt manage foreign exchange instability. This can affect my results as we are only examining how derivative usage impact firm value. The fact that firms may hedge for speculative reasons and that can firms are able manage risk in other ways than by using derivatives is disregarded. This is supported by Petersen and Thiagarajan (2000) who claim that firms are able to decrease their risk exposure through operational and accounting choices.

An additional problem is the relationship between the dependent variable and the independent variables. For example, Froot et al. (1993) pointed out that the more valuable the firm's investment opportunities, the more attractive risk management becomes because disruptions to the investment program are more costly, this leads to

the endogeneity problem, that is the independent variable is correlated with the error term. It is possible to test for this possibility by running the Hausman test.

### 3.3. Hypothesis

The purpose of this research is to examine if there exists a relationship between firm value and the usage of FX derivatives. Due to the mixed results on the derivative premium in previous studies, I want to study the relationship between FX derivatives and firm value. A large number of Swedish firms have operations abroad, hence are exposed to foreign exchange risk. This fact makes it suitable to study Swedish companies. The time period is from 2005 to 2010, where the economy witnessed one of the most severe financial crises in history, which could have an effect on the results.

Due to the facts mentioned in the background and discussion and given that we are living in an uncertain financial world, I aim to test if hedging impacts firm value. Hedging does not only serve as a measure against instability but it also sends signals to investors that the firms' future cash flows are secured and that the risk of financial distress is reduced.

The hypothesis is the following:

$H_0 = \text{Using FX derivatives does not impact firm value}$

$H_1 = \text{FX derivative usage does impact firm value}$

## 4. Methodology

### 4.1. Overview

The focus of my research lays on a sample of Swedish firms that are listed on the Stockholm Stock Exchange. The aim is to examine if the usage of foreign currency derivatives impacts firm value. To my research I have used numerous empirical studies based on similar topics, but would point out Jankensgård (2015) and Allayannis and Weston (2001) as the main benchmarks. Both studies provide exceptional analyses and examine the relation between FX derivative usage and firm value. Jankensgård research is important because his sample collection is based on Swedish firms. He studies the impact of centralized vs. decentralized risk management, but has the limitation of only using cross-sectional data.

### 4.2. Descriptive statistics

The choice of sample selection is very critical to the accuracy of the results. The sample selection is narrowed down to Swedish firms with different size that are operating in different industries. Second, firms operating in different industries and with different growth rates can make the comparison biased since firm value can be affected by industry-specific variables not included in our analysis. But, as my focus is country-specific, I chose to study a wide range of industries in order to measure the overall effect of hedging. The choice of currency derivatives is due to the fact that they are one of the most frequently used derivatives and I want to examine how their usage affects firm value.

This study is conducted on 85 Swedish firms that were listed on the large, mid, and small cap lists on the Stockholm stock exchange from 2005 to 2010, totaling (85 firms\*6 years) 520 observations. As we know, 2007-2008 experienced a severe financial crisis. This is a relevant time period to test the hedging premium, because if it exists, hedging firms will reduce the financial distress cost during poor periods and consequently show an even greater difference in firm value than non-hedging firms (Smith and Stulz, 1985). Froot et al. (1993) and Gay and Nam (1998) found that hedging firms could increase firm value in the case of market volatility, because hedging will reduce the underinvestment problem when external financing is costly.

The reason I study firms from Sweden is because the country is largely dependent on export, has an open economy and a well-integrated financial market. Nevertheless, Sweden has not been studied thoroughly in previous researches and is a country that has managed to cope with the financial crisis better than many other economies.

We have included firms that operate in different industries and with different sizes; hence the study includes companies that are listed as small, mid and large cap. All the financial service firms were excluded, because most of them are market makers in foreign currencies derivatives, thus their motivations for using derivatives may differ from the motivations of nonfinancial firms. I also excluded public organizations because they are heavily regulated. After excluding these, I was left with 353 firms that were extracted from Datastream. Many of them lacked data for the whole sample period and had to be omitted. There was also evidence of the financial crisis during 200-2008 as many firms were being unlisted in this period. Due to incomplete data and missing relevant information both in Datastream and the annual reports; left were only 85 companies to include in the research. As many as 66 (78%) of them are currency derivative users while only 19 (22%) do not use FX derivatives. As noted, the proportion of derivative users is much higher, which can be expected in an open economy where firms in one way or another deal with foreign currencies.

#### **4.2.1. Firm value**

Tobin's Q is used as a measure of a firm's market value. Tobin's Q is defined as the ratio of the market value of the firm to replacement cost of assets, evaluated at the end of the fiscal year. We compute Tobin's Q for a total of 85 firm-year observations (Total 85 firms\*6 years). The natural logarithm of Tobin's Q was calculated as it can account for skewed distribution. Tobin's Q has been used as a firm value measure in numerous previous researches which also makes it suitable to include in my research, as it can serve as a benchmark when comparing my results to other studies. Additionally, all the data needed to calculate Tobin's Q is obtainable from Datastream.

#### **4.2.2. Derivative usage**

Information on whether firms use currency derivatives is found in their annual reports, which requires manually going through each individual statement. In some cases, this information was easy to obtain as some companies have transparent risk management programs and are also clear about why they use derivatives. Several enterprises stated that the purpose of hedging is not for speculative activities but rather to minimize the volatility of future cash flows and exposure to currency exchange rates. Others are not as transparent and required careful analysis of their annual reports. In this study, the usage of FX derivatives is a dummy variable that will take on the value of “1” for users and “0” otherwise.

#### **4.2.3. Other determinants of firm value**

Similar to Jankensgårds (2015) research, the control variables included in this study are: dividends, firm size, profitability, leverage, diversification and capital expenditures. As mentioned, the aim was to use foreign sales as a control variable, but due to the severe lack of relevant data, this variable had to be excluded. Table 1 summarizes the sample construction.

Table 1: Summary of variables and data sources

<b>Variables</b>	<b>Definition</b>	<b>Source</b>
<b>Tobin's Q</b>	Log(Total book value of assets less book value of equity plus market value of equity)/Total Assets	Datastream
<b>Hedging</b>	A dummy variable that takes on the value of 1 if the firm hedges and 0 otherwise	Annual reports
<b>Leverage</b>	Total debt/Total assets	Datastream
<b>CAPEX</b>	Additions to Fixed Assets/Total sales	Datastream
<b>Profitability</b>	Net income/Total assets	Datastream
<b>Firm size</b>	Logarithm of total assets	Datastream
<b>Dividend</b>	A dummy variable that takes on the value of 1 if firm pays dividend and 0 otherwise	Datastream
<b>Diversified</b>	A dummy variable that takes value 1 if firms have more than 2 product segments and 0 otherwise	Annual Reports

### 4.3. Statistical distributions for diagnostic tests

In order to run an OLS regression that will provide as accurate results as possible, it is necessary to run various regression diagnostic tests. To obtain an unbiased OLS, there are four desirable properties that should be satisfied:

$$(1) E(u_t) = 0$$

$$(2) \text{Var}(u_t) = \sigma^2 < \infty$$

$$(3) \text{cov}(u_i, u_j) = 0$$

$$(4) \text{cov}(u_t, x_t) = 0$$

The first assumption (1) requires that the average value of the errors is zero. To solve this, when estimating the OLS regression we include a constant term in the equation to avoid violation of this assumption.

For the second assumption (2), it is assumed that the variance of the errors is constant and finite over all values of  $x_t$ . This is known as the assumption of *homoscedasticity*. If the errors do not have a constant variance, they are said to be *heteroscedastic*. The consequence of not having a constant variance is that the OLS estimation will be biased.

Assumption (3) requires that the covariance between the error terms over time is zero, which implies that errors are linearly independent of one another. The Watson Durbin statistics can expose this problem.

Assumption (4) requires that there is no relationship between the error term and the corresponding  $x_t$  values.

#### 4.4. Model development

Panel data is used as multiple companies together with their characteristics over a time period of 6 years are being analyzed; consequently we have both time series and cross-section data. The data has been organized according to panel data in Excel and was then extracted to the software program EViews.

As I aim to examine is hedging is associated with firm value, we use Tobin's Q as the dependent variable. In my initial model, Tobin's Q is on the left side of the equation in and the explanatory variables are on the right side. To test for the hedging premium I used an OLS model that is based on the following equation:

$$\begin{aligned} \text{Log(Tobin's } Q) = & \alpha_1 * + \beta_1 * \text{hedging} + \beta_2 * \text{leverage} \\ & + \beta_3 * \text{CAPEX} + \beta_4 * \text{profitability} + \beta_5 * \text{size} \\ & + \beta_6 * \text{dividend} + \beta_7 * \text{diversified} \end{aligned} \quad (1)$$

Because firm value is affected by several variables, I use a multivariate test where I am able to control for other variables besides hedging. I test whether derivative usage has an impact on firm value and control for size, profitability, leverage, capital expenditures, diversification and dividend payouts.

##### 4.4.1. Hypothesis testing

The first regression was made with the random effects specification. In order to evaluate if there exists a significant difference in the estimates of the two models, I employed the Hausman test. Giving a probability of 0.000, it implies that the fixed effect for both time-series and cross-section is a more appropriate model to use on my data. However, two of the dummy variables take on the same value through the whole sample period for a given firm, that is for example when a given firm hedges throughout the whole 6-year period. This is problematic because it is not possible to run the fixed cross-section effects when including these dummy variables in the regression. The fixed effects model assigns a unique intercept to each individual firm and is useful because it controls for unobservable firm characteristics that may affect a firm value (Hausman and Taylor, 1981). Given the unique intercept, fixed effects can

control for individual firm specific effects. The regression for fixed cross-section effect is done without the dummy variables in order to compare the other variables with the pooled and random regression. Running a regression without these dummies means that hedging is excluded, which is the main aspect of this thesis. However, it should serve as a comparable regression of the other variables.

Excluding the dummy variables “hedge”, “diversified” and “dividend”:

$$\begin{aligned} \text{Log(Tobin's } Q) &= \alpha_1 + \beta_1 * \text{leverage} \\ &+ \beta_2 * \text{CAPEX} + \beta_3 * \text{profitability} + \beta_4 * \text{size} \end{aligned} \quad (2)$$

I added back dividend, as it is the only dummy variable that does not take on the same value throughout the whole sample period for an individual firm:

$$\begin{aligned} \text{Log(Tobin's } Q) &= \alpha_1 + \beta_1 * \text{leverage} + \beta_2 * \text{CAPEX} \\ &+ \beta_3 * \text{profitability} + \beta_4 * \text{size} + \beta_5 * \text{dividend} \end{aligned} \quad (3)$$

Afterwards, I ran the pooled regression with all variables included:

$$\begin{aligned} \text{Log(Tobin's } Q) &= \alpha_1 + \beta_1 * \text{hedging} + \beta_2 * \text{leverage} \\ &+ \beta_3 * \text{CAPEX} + \beta_4 * \text{profitability} + \beta_5 * \text{size} \\ &+ \beta_6 * \text{dividend} + \beta_7 * \text{diversified} \end{aligned} \quad (4)$$

To check for robustness, I additionally complemented with testing several models and ran the pooled regression, fixed time-series effects and the cross-section random effects test equation. Running different models permits me to compare the results of multiple regressions, which results in a more comprehensive analysis. Additionally, I ran two separate regressions with fixed effects, one made only on hedgers and the other one on non-hedgers.

## 5. Analysis

### 5.1. Firm value

The regression output shows no evidence that hedging would impact firm value in any of the tested models. Interpreting  $R^2$  in the pooled and the fixed period effects regression; around 13% vs. 22% of firm value is explain by the independent variables. This indicates that the rest is explained by external factors not included in this research. This is also supported by the Durbin Watson statistics for both regressions, which suggest that there exists a positive serial correlation in the residuals. Omitting variables in the model can be the main cause of autocorrelation, because an explanatory variable is excluded, its effect on the regressand instead becomes a part of the residuals. Consequently, if the excluded regressor is positively related to the dependent variable, it can lead to positively correlated residuals. One example of an omitted variable could be managers quality, which logically suggest that the better the manager, the higher the firm value. In previous sections, additional explanatory variables are described that most likely will impact firm value but are not included in this research. It is evident that we are not able to draw a robust conclusion due to variations in the regression results.

When running the fixed effects model and excluding all the dummy variables, the  $R^2$  suggested that roughly 80% of firm value is explain by the independent variables. This implies that dividend, diversification and hedging should not have any noteworthy effects on firm value.

As noted, the empirical evidence indicates that there is no significant difference in firm value between hedgers and non-hedgers, in contrast to what Allayannis and Weston (2001) found. However, Guay and Kothari (2003) question their findings and suggest that derivative usage will not increase firm value under extreme market instability. This supports my research as data have been collected from a time period that experienced a financial crisis. This is also backed by Jin & Jorion (2006) who studied oil hedging and its impact on firm value. They do not find any significant differences between hedgers and non-hedgers. Similarly, Jin and Jorion (2007) could not find any positive relationship between firm value and derivative usage in their

study based on North American gold mining firms. Copeland and Joshi (1996) and Hagelin and Prambourg (2004) also imply that hedging might be ineffective when it comes to reducing risk. However, their findings may be affected by industry-specific factors.

## **5.2. Leverage**

Comparing the different regression results in table 2, the independent variable LEVERAGE appears to have the most significant influence on firm value, implying a negative relationship between leverage and firm value. This is contradictory to evidence found by Clark and Mefteh (2010) who argues that leverage is not a significant explanatory variable of firm value. Table 3 shows that hedgers tend to employ higher levels of leverage. Moreover, it also demonstrates that hedgers on average have lower firm values than non-hedgers. This can support the regression results of negative correlation between leverage and firm value, as it shows that hedgers who employ more leverage have a lower firm value. This is consistent with the research done by Aggarwal and Zhao (2007) who also reports a constant negative relationship between leverage and firm value. This is also in line with theories indicating that firm's hedge with the purpose of increasing their debt capacity. Higher leverage leads to greater tax advantages as it increases the interest tax deductions (Leland 1998).

## **5.3. Profitability**

There are significant outcomes for PROFITABILITY but with mixed results regarding its impact on firm value. Model 2 shows a negative relationship between profitability and firm value while the pooled and fixed period effects imply a positive correlation, which one would expect. According to several theories, profitable firms should have higher market value, because profitable firms tend to trade at a premium (Allayannis and Weston, 2001). This is inconsistent with the mean values calculated in table 3; indicating that hedgers are less profitable than non-hedgers. This outcome can also be caused by reverse causation meaning that risk management is more valuable to less profitable firms.

#### **5.4. Size**

Similarly, the explanatory variable SIZE gives mixed results. While the pooled and fixed for period regression imply that there is a positive relationship between size and firm value, the cross-section random effect specification indicates that size negatively influences firm value. This is supported by evidence from Land and Stultz (1994) who found a negative correlation between size and firm value. Size might impact firm value negatively because the bigger the firm, the harder it becomes to manage and control. As can be seen in table 3, hedgers have on average a lower firm size and are less profitable. But as already mentioned, this can be a sign of reverse causation.

#### **5.5. Diversified**

According to the pooled and fixed period models, diversity impacts firm value negatively, meaning that firms with more than 2 product segments have lower firm values than specialized firms that focuses on 2 or less products. Firms that operate in different fields might have a decentralized decision making for each product segment, which will make them harder to manage. This is also supported by the mean values implying that diversified firms have a lower Q (1.555), compared to non-diversified firms (1.8).

Table 2: OLS model of firm value

Table 2 shows the results from the OLS regressions, where the dependent variable is Tobin's  $Q$  and defines firm value. The first model gives no significant results, where the dummy variable hedging, dividend and diversified has been excluded. The model is re-estimated adding back dividend; where profitability becomes significant, affecting firm value negatively. The model is re-estimated in a pooled OLS regression, where profitability, size, diversification and leverage are significant, but obtains a very low  $R^2$ . meaning that the independent variables only explain 12.6% of the dependent variable. The model is once again re-estimated where the period is fixed and includes all the independent variables. Once again the profitability, size, diversified and leverage variables are significant, with similar effects as the pooled regression. The random effects regression is once again estimated, where size, leverage and dividend are significant. I then chose to separate hedgers and non-hedgers and ran a separate regression for each of them.

	1. Fixed/Fixed	2. Fixed/Fixed	3. Pooled	4. Fixed period	5. Random effects	6. Hedgers FF	7. Non- hedgers FF
<b>Constant</b>	-0.188607 (0.609)	-0.407 (0.326)	0.5184 (0.386)	-0.058 (0.518)	1.951 (0.000)*	-0.359 (0.374)	0.361 (0.666)
<b>Hedging</b>			-0.040 (0.30)	0.029 (0.348)	N/A		
<b>Capex</b>	0.033 (0.1165)	0.029 (0.144)	0.0435 (0.219)	0.051 (0.13)	0.035 (0.184)	0.029 (0.145)	0.339 (0.32)
<b>Profitability</b>	-0.287 (0.244)	-1.71 (0.000)*	0.63 (0.041)*	0.626 (0.034)*	-0.047 (0.878)	-1.694945 (0.000)*	0.262 (0.46)
<b>Size</b>	0.050 (0.369)	0.08 (0.197)	0.03 (0.0498)*	0.042 (0.001)*	-0.262 (0.000)*	0.075 (0.220)	-0.029 (0.817)
<b>Dividend</b>		0.013 (0.6)	-0.015 (0.643)	-0.055 (0.91)	-0.053 (0.059)**		
<b>Diversified</b>			-0.049 (0.098)**	-0.055 (0.033)*	N/A		
<b>Leverage</b>	-0.0575 (0.550)	0.001 (0.996)	-0.595 (0.00)*	-0.54 (0.00)*	-0.337 (0.004)*	0.000272 (0.998)	-0.193 (0.355)
<b>R<sup>2</sup></b>	0.84	0.866	0.126	0.22	0.746	0.866	0.8174
<b>(F-stat)</b>	0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>Durbin-Watson</b>	1.745	1.82	0.713	0.597	1.824	1.824	1.61

P-values are reported in (parenthesis)

Results significant at the 5% level are donated with a star\*

Results significant at the 10% level are donated with two stars\*\*

## 5.6. Mean values of Tobin's Q and its explanatory variables

Table 3 shows that the average value for Tobin's Q is higher for non-hedgers compared to hedgers. This means that we are checking for differences in firm value between hedgers and non-hedgers without considering the impact of other control variables. Both hedgers and non-hedgers have a Tobin's Q larger than 1, which implies that they are trading at a premium. Considering that the sample period included the financial crisis of 2007-2008 is actually consistent with the fact that the Swedish economy managed to better survive and recover from the financial crisis compared to other economies. Excluding the control variables, we can based on this simple interpretation conclude that; non-hedgers have higher firm value than hedgers, which is inconsistent with theories stating that hedging impacts firm value positively (Clark and Mefteh, 2010; Allayannis and Weston, 2001).

Similarly, the mean value of leverage for hedgers is almost the double compared to non-hedgers. The differences in size is not noteworthy, but we can see that non-hedgers tend be larger than hedgers. However, when looking at profitability, non-hedgers are significantly more profitable than hedgers. One interpretation of this is that less profitable firms chose to hedge their risks to protect their cash flows, while more profitable firms do not hedge as they have enough cash flows to cover potential losses incurred by foreign exchange volatility.

Table 3: Mean values for hedger vs. non-hedgers

	<b>Tobin's Q</b>	<b>Leverage</b>	<b>Size</b>	<b>Profit</b>
<b>Hedgers</b>	1.663	0.212	6.559	0.006
<b>Non-hedgers</b>	1.797	0.107	6.636	0.014

Table 4 shows the differences in dividend policies between hedgers and non-hedgers. It reveals that Tobin's Q is the highest for hedgers who do not pay dividend, and lowest for hedgers who pays dividend. There are mixed empirical findings on how dividends impact firm value and are not further studied in this research. Additionally, as can be seen from table 5; diversified firms have on average a lower Tobin's Q compared to firms are focused on two or less product segments.

Table 4: Tobin's Q mean values of dividend policies between hedgers vs. non-hedgers

Tobin's Q	No dividend	Dividend
<b>Hedge</b>	2,105	1,647
<b>No Hedge</b>	1,744	1,862

Table 5: Tobin's Q mean value compared to diversified vs. non-diversified firms

	Tobin's Q
<b>Diversified</b>	1.56
<b>Not diversified</b>	1.80

## 6. Conclusion

This research studies the usage of currency derivatives and their impact on firm value in a sample of 85 firms listed on the Stockholm Stock Exchange from 2005 to 2010. No clear evidence is found that hedging impacts firm value. The results are extremely mixed, which can be justified by several factors. First, we study firm value during a period that experienced a financial crisis. This was done purposely, as theories state that hedging reduces financial distress cost. If this theory holds, hedgers should have coped with the financial crisis better than non-hedgers. However, there are valid reasons to why hedging does not impact firm value, or why it even decreases it (Jin & Jorion, 2006; Hentschel and Kothari, 1997; Tufano, 1996). Second, this research makes the assumption that hedging has been used for the purpose of managing risk. As mentioned in previous sections, derivative usage can be among others, used for speculative reasons. This can increase exposure and lead to losses for a firm. The average value of profitability shows that hedgers are less profitable, which goes in line with this theory. Furthermore, we find that leverage has a negative influence on firm value. This research contributes with studying the hedging premium during crisis and on a national level. It shows that there is no relationship between FX derivative usage and firm value, even in time of crisis. It is evident that we are not able to draw a robust conclusion due to variations in the regression outputs. Clearly, this topic is subject to additional and deeper research. Future study should include more comprehensive data and take into account additional explanatory variables. Besides, it will be beneficial to test this relation using the most recent available figures. This will provide evidence of current market condition, because the impact of hedging might change through times.

## 7. References

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## 8. Appendix

### 1. Fixed for cross-section and time-series

Dependent Variable: TOBQ\_LOG  
 Method: Panel Least Squares  
 Date: 05/22/15 Time: 11:24  
 Sample: 2005 2010  
 Periods included: 6  
 Cross-sections included: 85  
 Total panel (balanced) observations: 510

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.188607	0.368220	-0.512212	0.6088
LEVERAGE	-0.057498	0.096041	-0.598676	0.5497
CAPEX	0.033026	0.020997	1.572861	0.1165
PROFIT	-0.286623	0.245785	-1.166151	0.2442
SIZE	0.050239	0.055878	0.899084	0.3691

#### Effects Specification

Cross-section fixed (dummy variables)

Period fixed (dummy variables)

R-squared	0.839637	Mean dependent var	0.130871
Adjusted R-squared	0.803786	S.D. dependent var	0.298448
S.E. of regression	0.132200	Akaike info criterion	-1.044093
Sum squared resid	7.270417	Schwarz criterion	-0.263632
Log likelihood	360.2436	Hannan-Quinn criter.	-0.738101
F-statistic	23.42053	Durbin-Watson stat	1.745131
Prob(F-statistic)	0.000000		

## 2. Pooled regression including all variables

Dependent Variable: TOBQ\_LOG

Method: Least Squares

Date: 05/22/15 Time: 11:34

Sample: 1 432

Included observations: 432

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.104003	0.119952	0.867033	0.3864
HEDGE	-0.040631	0.039184	-1.036914	0.3004
LEVERAGE	-0.595278	0.092439	-6.439655	0.0000
CAPEX	0.043527	0.035361	1.230936	0.2190
PROFIT	0.629760	0.307797	2.046027	0.0414
SIZE	0.032083	0.016307	1.967436	0.0498
DIVIDEND	-0.014765	0.031800	-0.464293	0.6427
DIVER	-0.049030	0.029595	-1.656686	0.0983
R-squared	0.126370	Mean dependent var		0.157973
Adjusted R-squared	0.111947	S.D. dependent var		0.300460
S.E. of regression	0.283143	Akaike info criterion		0.332618
Sum squared resid	33.99214	Schwarz criterion		0.407959
Log likelihood	-63.84547	Hannan-Quinn criter.		0.362362
F-statistic	8.761606	Durbin-Watson stat		0.712871
Prob(F-statistic)	0.000000			

### 3. Fixed for time-series including all variables

Dependent Variable: TOBQ\_LOG  
 Method: Panel Least Squares  
 Date: 05/22/15 Time: 12:20  
 Sample: 2005 2010  
 Periods included: 6  
 Cross-sections included: 85  
 Total panel (balanced) observations: 510

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.058275	0.090162	-0.646339	0.5184
HEDGE	0.029058	0.030926	0.939606	0.3479
LEVERAGE	-0.541585	0.080453	-6.731669	0.0000
CAPEX	0.050967	0.033654	1.514452	0.1305
PROFIT	0.626304	0.294934	2.123538	0.0342
SIZE	0.041996	0.012863	3.264921	0.0012
DIVIDEND	0.003315	0.028483	0.116397	0.9074
DIVER	-0.054978	0.025674	-2.141419	0.0327

#### Effects Specification

Period fixed (dummy variables)

R-squared	0.220301	Mean dependent var	0.130871
Adjusted R-squared	0.201475	S.D. dependent var	0.298448
S.E. of regression	0.266693	Akaike info criterion	0.219726
Sum squared resid	35.34933	Schwarz criterion	0.327662
Log likelihood	-43.03020	Hannan-Quinn criter.	0.262044
F-statistic	11.70213	Durbin-Watson stat	0.596849
Prob(F-statistic)	0.000000		

#### 4. Only included hedgers – Fixed for cross-section and time-series

Dependent Variable: TOBQ\_LOG  
 Method: Panel Least Squares  
 Date: 05/22/15 Time: 17:13  
 Sample: 2005 2010  
 Periods included: 6  
 Cross-sections included: 66  
 Total panel (balanced) observations: 396

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.358635	0.403058	-0.889785	0.3742
LEVERAGE	0.000272	0.107551	0.002525	0.9980
CAPEX	0.028793	0.019714	1.460533	0.1451
PROFIT	-1.694945	0.411828	-4.115659	0.0000
SIZE	0.074597	0.061165	1.219609	0.2235

#### Effects Specification

Cross-section fixed (dummy variables)  
 Period fixed (dummy variables)

R-squared	0.865528	Mean dependent var	0.122550
Adjusted R-squared	0.834528	S.D. dependent var	0.302364
S.E. of regression	0.122996	Akaike info criterion	-1.184508
Sum squared resid	4.856130	Schwarz criterion	-0.430452
Log likelihood	309.5325	Hannan-Quinn criter.	-0.885774
F-statistic	27.92041	Durbin-Watson stat	1.824009
Prob(F-statistic)	0.000000		

## 5. Includes only non-hedgers. Fixed for cross-section and time-series

Dependent Variable: TOBQ\_LOG

Method: Panel Least Squares

Date: 05/22/15 Time: 12:09

Sample: 2005 2010

Periods included: 6

Cross-sections included: 19

Total panel (balanced) observations: 114

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.361151	0.834153	0.432955	0.6661
LEVERAGE	-0.192669	0.207130	-0.930187	0.3549
CAPEX	0.339015	0.338585	1.001270	0.3195
PROFIT	0.262288	0.353522	0.741929	0.4602
SIZE	-0.029194	0.126057	-0.231594	0.8174

### Effects Specification

Cross-section fixed (dummy variables)

Period fixed (dummy variables)

R-squared	0.782962	Mean dependent var	0.159776
Adjusted R-squared	0.714822	S.D. dependent var	0.283811
S.E. of regression	0.151561	Akaike info criterion	-0.726285
Sum squared resid	1.975473	Schwarz criterion	-0.054237
Log likelihood	69.39826	Hannan-Quinn criter.	-0.453538
F-statistic	11.49053	Durbin-Watson stat	1.611079
Prob(F-statistic)	0.000000		

## 6. Cross-section random effects test equation

Cross-section random effects test equation:

Dependent Variable: TOBQ\_LOG

Method: Panel Least Squares

Date: 05/22/15 Time: 16:14

Sample: 2005 2010

Periods included: 6

Cross-sections included: 85

Total panel (balanced) observations: 510

WARNING: estimated coefficient covariance matrix is of reduced rank

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.951119	0.386389	5.049617	0.0000
HEDGE	NA	NA	NA	NA
DIVIDEND	-0.052817	0.027932	-1.890869	0.0593
DIVER	NA	NA	NA	NA
LEVERAGE	-0.336977	0.116686	-2.887895	0.0041
CAPEX	0.034943	0.026230	1.332174	0.1835
PROFIT	-0.046639	0.304752	-0.153040	0.8784
SIZE	-0.261930	0.058469	-4.479830	0.0000

### Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.746019	Mean dependent var	0.130871
Adjusted R-squared	0.692199	S.D. dependent var	0.298448
S.E. of regression	0.165578	Akaike info criterion	-0.599960
Sum squared resid	11.51480	Schwarz criterion	0.147289
Log likelihood	242.9897	Hannan-Quinn criter.	-0.306989
F-statistic	13.86140	Durbin-Watson stat	1.740849
Prob(F-statistic)	0.000000		