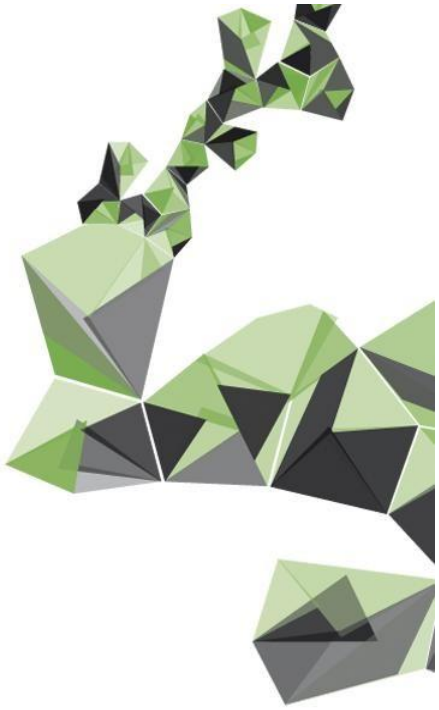
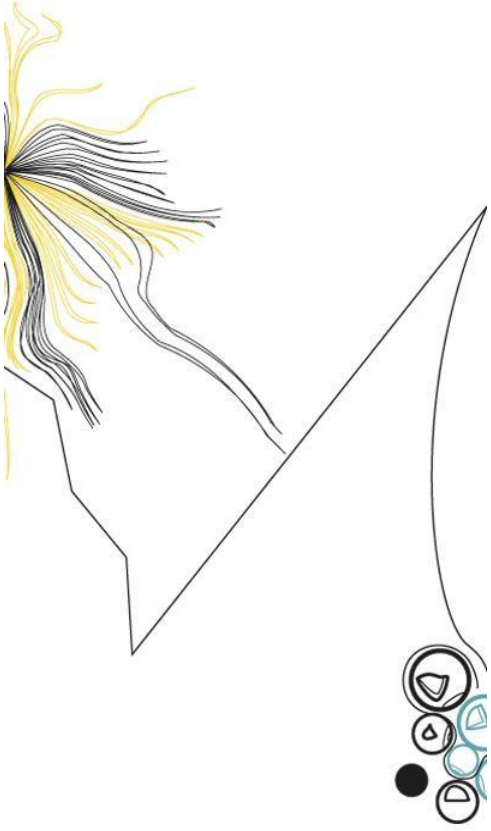


UNIVERSITY OF TWENTE.

Does hedging lead to value increase among non-financial firms in Netherlands?

Master thesis from the faculty of School of Management and Governance



Zhenlei LI (s1286544)

Under supervision of:

Dr. X. Huang

Prof. Dr. R. Kabir

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Abstract

The topic of this thesis concerns the effect of hedging with foreign currency derivatives on firm value of 93 Dutch firms that publicly listed non-financial in 2012. For this purpose, Firm value is measured by Tobin's Q, a hedging dummy variable is as a proxy for foreign currency derivatives and other control variables that can affect firm value are considered as well. Then a linear regression is performed on the data to investigate the impact of hedging with FCD on firm value. The results from my research show that hedging with FCD may decrease the firm value.

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1. Introduction:

1.1Background and motivations

In recent years, hedging corporate risks with the use of derivative contracts are becoming increasingly popular. This evolution is directly associated with the augmented volatility of financial markets in the whole financial world. The constantly changing financial markets and the activation of firms in the contemporary globalized environment, makes the identification and management of the corporate financial risks (e.g. foreign exchange rates, the interest rates, the equity and the commodity price) growingly imperative (Kapitsinas, 2008). And this development is further accompanied by the rapidly increasing volume of derivative securities and the increasing volatility in financial prices of the firm. While in earlier times, the corporate financial risk was of little concern by the managers, because during the period of 1944-1971 both the foreign exchange and interest rate risks were quite stable. However after that period, exactly from December 1971, the fluctuations in exchange rate were especially considered. The exchange rate movements adversely affected the interest rate stability， since the interest rate was explicitly used to deal with the exchange rate fluctuations. The exchange rate fluctuations can change the positions of the firms' foreign assets and liabilities, while, the expected cash flows and further the firms' portfolio structure can be affected by the interest rate movements. Thus, the consistent volatility of exchange and interest rate makes it compulsory and inevitable for firms to hedge these risks, otherwise it can result in the breakdown of the business.

With the rapid growth of globalized economic activities and volatility in exchange and interest rate, risk management has devised some financial instruments like derivatives to hedge these risks. Previously, hedging by the use of financial derivatives such as interest rate and foreign exchange rate protects firm's cash flows and earnings from adverse exchange and interest rate fluctuations. Nowadays, financial institutions provide a range of financial derivatives like future, forward, option and swap to manage firm's financial risks (Bashir, Sultan & Jghef , 2013).

1.2Problem definition

During the last two decades, many studies have been done to analyze the determinants and theoretical motivations behind the hedging policy, as well as its correlation with some other corporate aspects like the capital structure, leverage, investment policy and the growth opportunities. However, the extent of research on the question of whether the hedging with derivatives is a value creation for nonfinancial firms is limited. According to Modigliani and Miller (1958) hypothesis that if there are no taxes, no costs of financial distress, no information asymmetries, no transaction costs

and if investors can perform the same transactions as companies, the risk management is irrelevant. They propose that in perfect capital markets, hedging by the firms is unnecessary since investor would be able to build a diversified portfolio that would eliminate the risks. On the contrary, in practice, imperfections in the capital markets create a rational for lessening the volatility of the earnings through hedging. Some hedging theories have found that derivative usage for hedging risks could affect firm value in case that firms face frictions in real financial markets like financial distress, underinvestment problem, cost of bankruptcy, costly external financing and heavy taxes. Hedging, through the derivative usage, increases the firm value by reducing tax payment, lessening the probability of financial distress, lowering the underinvestment problem, as well as lowering the cost of external financing (Nance, Smith, & Smithson, 1993)[1].

Early empirical studies mostly tested what determines firms' decisions to use the derivatives instrument. Recently, some studies were conducted to examine whether hedging risks can increase firm value. Allaynnis and Weston (2011) are the first ones to examine the relation between the firm value and the use of foreign currency derivatives. Using a sample of 720 large U.S. firms over a period of 1990-1995, they find that the value of firms using foreign currency derivatives averagely is higher with a 5% hedging premium compared with non-hedging firms. In addition, this hedging premium is statistically significant. More recently, Carter, Rogers, and Simkins (2006) test the case of fuel hedging for a sample of U.S. airlines and report an even higher hedging premium of about 14% from hedging fuel costs. And this financial risk is also shown significant for the airlines. Obviously, these studies are sufficiently important to warrant a hedging premium for firms using derivatives.

In contrast to the positive valuation effects, some other studies support negative or no valuation effects of hedging risks. Guay and Kothari (2003), challenge the hypothesis that hedging with derivative usage is associated with value creation. They collect a sample of 234 large non-financial firms using derivatives and state that the possible gains from derivative usage by non-financial firms are minimal compared to movements in equity prices and cash flows, and thus unlikely generate large change in firm value . Consistent with Guay and Kothari, Jin and Jorion (2006) study the hedging activities of 119 U.S. oil and gas producers from 1998 to 2001 and evaluate their effects on firm value. They find no relationship between the use of derivatives and firm value. Additionally, an important role is played by a research conducted by Fauver and Naranjo (2010), who adopt data on over 1,746 firms headquartered in the U.S. from 1991 and 2000, and find that the firms with greater agency and monitoring problems (i.e., firms that are less transparent, face greater agency costs, have weaker corporate governance, larger information asymmetry problems, and overall poorer monitoring) exhibit a negative association between Tobin's Q and derivative usage.

According to the mixed empirical evidence mentioned above, the influence of

[1]This literature will be discussed in greater detail in chapter 2.

hedging risks on firm value is controversial and this issue increasingly arouses enormously attention in researchers in recent years. Thus, it is necessary to conduct further research to warrant the impact of hedging with derivatives on firm valuation. The thesis will focus on the effect of hedging activities on firm value by use of foreign currency derivatives. Generally, most firms hedge their financial risks by different derivative usage such as interest rate derivatives, foreign currency derivatives, commodity derivatives. While recent years, with the globalization of goods and capital markets, international activities enormously increase and further exchange rate fluctuations are becoming an important source of uncertainty for firms. Therefore, growing firms are affected by the movements of exchange rate, regardless of whether firms are domestically or internationally oriented. Currency exchange rates can improve or reduce investment returns when these returns are translated into home currency. To hedge an international investment to home currency is to limit the effect of exchange rates fluctuations. Thus hedging, by using currency derivatives to eliminate currency risks, is becoming more popular.

1.3Research question

Due to the fact that mostly studies regarding to the impact of hedging on firm value are investigated with U.S. samples, and some European samples as well like in UK, Sweden, Greece and Poland, this issue in Netherlands seems receive little attention. Consequently, a research which examines whether hedging can increase firm value in Netherlands market is necessary. More importantly, doing a research regarding the relation between hedging and firm value can test whether predictions of hedging in Netherlands are consistent with the predictions from corporate hedging theory mostly based on U.S. firms, improving the validity and consistency of hedging theory. Additionally, the Dutch companies are much more open because of small domestic demand, suggesting larger exposure to international financial price volatility for Dutch firms. Thus, a greater emphasis on currency exposure and foreign exchange risk hedging policies by Dutch firms is expected (Bodnar, Jong & Macrae,2003).So in this thesis, the question that "*Does hedging by foreign currency derivatives lead to value increase in Netherlands*?" is expected to be answered.

In order to answer this question, a research with a sample from Dutch listed firms' currency derivative usage will be conducted. Financial data will be collected from ORBIS database. And annual reports will be used to obtain the data of derivative usage for hedging.

The thesis result will contribute to corporate risk management research in two ways. Firstly, given the conflicting results on the association between hedging and firm value, additional evidence concerned with this issue will be provided by studying the hedging phenomenon in Netherlands. Secondly, perhaps more important, this research will be helpful to guide managers, policy makers to determine whether the derivatives usage can add firm value in Netherlands or not.

1.4 Structure

The reminder of this thesis is as follows: chapter 2 of thesis explores the literature review and summarizes the prior findings of incentives to adopt hedging policy and of the relationship between hedging by derivative usage and firm value. Further, chapter 3 provides the method to test the hypotheses and how the data is collected. Then the detailed empirical results are presented in chapter 5. Finally, the conclusion is proposed.

2. Literature Review

This chapter describes the main financial hedging theories and empirical evidence concerning the determinants and motivations behind hedging risks by use of derivatives. And the main findings and evidence related to the impact of hedging risks on firm value are provided as well.

2.1 Hedging theory

Hedging, according to the Investopedia (2013), is defined as "*Making an investment to reduce the risk of adverse price movements in an asset. Normally, a hedge consists of taking an offsetting position in a related security.*" Due to the fact that hedging could not increase firm value in the perfect capital markets, the rational for hedging has been sought in various capital market imperfections (Mayers & Smith, 1982; Smith and Stulz, 1985; Froot, Scharfstein & Stein, 1993). The cost of financial distress, taxes, and underinvestment are some of the reasons widely used to explain the usage of hedging activities. It is also suggested that hedging can stem from the motivations of managers to maximize their personal utility functions (Smith and Stulz, 1985).Theoretical literature concerning hedging, develop two classes of theory to explain the motives for corporate hedging risks: one is based on firm value maximization, and other is manager' utility maximization. In the following, these two theories and empirical evidence related are discussed in detail.

2.1.1 Firm value maximization theory

Firm value maximization theory states that firms can hedge to reduce certain costs or capital market imperfections related to volatility of cash flows. According to Modigliani and Miller (1958), in perfect capital markets with no taxes, transaction costs, information asymmetries and financial distress, investors have equal access to capital markets. There is no need to hedge risks because investors could manage their risks by holding well-diversified portfolios. However, in a real world, imperfections in capital markets usually exist. Financial theory suggests that the corporate risk management can add firm value in the presence of imperfections of capital markets. Recent years, enormous empirical studies provide considerable evidence in support of these theories. To sum up these findings, they can be typically categorized three various explanations: (1) hedging can reduce financial distress costs (Mayers & Smith, 1982; Smith and Stulz, 1985); (2) hedging can reduce the expected taxes (Smith and Stulz, 1985); (3) hedging can mitigate the underinvestment problem (Froot, Scharfstein & Stein, 1993).

A. Financial distress

The first line of explanation suggests that, hedging by use of derivatives can decrease costs of financial distress (Mayers & Smith, 1982; Smith & Stulz, 1985). Cash flow volatility will lead to a situation in which a firm's liquidity is not adequate to timely

satisfy fixed payment obligations like wages and interest payments. Financial risk management can reduce the probability of encountering such states and thus reduce the expected costs related to financial distress (Smith & Stulz, 1985). Additionally, reducing the probability of financial distress can also lower the contracting costs involved relationships with creditors, suppliers, and employees.

B. Taxes

The second view of value-maximization theory proposes that hedging can be motivated by tax incentives. When firms face a convex tax function that firms' effective tax rates rise along with the increase of pre-tax income, reducing the volatility of taxable income may reduce the expected value of tax liabilities (Mayers & Smith, 1982; Smith & Stulz, 1985). For example which illustrated in table 1, suppose the convex tax function is that when earnings are equal or below 100,000 Euros, the tax rate is 20% while when earnings are above 100,000 Euros, the tax rate is 25%. With the same total earnings in two years, Firm A with hedging pays 40,000 taxes while Firm B without hedging pays 45,000 taxes, which indicates that firms can reduce expected tax liabilities by using financial instruments.

Hedging by reducing volatility of income and reducing the probability of financial distress can increase a firms' debt capacity (Leland, 1998). If firms add leverage in response to greater debt capacity, the associated increase in interest deductions reduces tax liabilities and thus increases firm value. Therefore, the ability to increase debt capacity provides a tax incentive to hedge.

Table 1: The effect of risk management on tax liability

	Firm A		Firm B	
	Earnings	Taxes	Earnings	Taxes
1st year	100,000	20,000	0	0
2ed year	100,000	20,000	200,000	45,000
Total	200,000	40,000	20,000	45,000

C. Underinvestment

The third argument is that hedging can help firms to relieve underinvestment problem which in a circumstance that firms might reject the positive net present value (NPV) projects (Myers, 1977; Myers & Majluf, 1984). Bessembinder (1991) argue that in the absence of hedging, the firm may underinvest because too much of the incremental value from investment accrues to debt holders. However, in the presence of hedging, the underinvestment problem is decreased because the value of debt is less sensitive to incremental investment. The hedge results in equity holders capturing a large portion of incremental benefits from new investment, increasing their willingness to provide funds for additional investments. In addition, underinvestment problem arises when raising external capital is more expensive than internally generated funds (Froot, Scharfstein & Stein, 1993). If the internal funds are relatively scarce, the positive NPV projects may be rejected by managers because the marginal costs of external

funds may exceed the marginal benefits to shareholders. Hedging ensures that firms have sufficient cash flow to invest more valuable projects and further increase firm value.

2.1.2 Managerial utility maximization theory

Another strand of theory claims that hedging stems from the incentive of managers to maximize their personal utility functions. Shareholders hire managers because managers have specialized resources that could increase the firm value. And then the managerial compensation must be designed so that when managers increase the firm value, managers' expected utility would be increased as well. The managers' expected utility depends on the distribution of the firms' payoffs. Hedging, by reducing the variance of the firm's payoffs, changes the managers' expected utility. According to Stulz (1984) and Smith and Stulz (1985), shares held by the manager provide an incentive to hedge more, while options held by the manager can provide an incentive to hedge less, because stocks provide linear payoffs as a function of stock price whereas options provide convex payoffs. Smith and Stulz (1985) argue that stock options introduce a convexity between managerial wealth and stock value; this convexity of the option contracts may induce managers to take on greater risks, because greater risk would increase the volatility of earnings and hence increase the value of expected utility of managers' option contracts. Thus, hedging activity is negatively related to manager option holdings.

2.1.3 Empirical evidence on incentives of hedging

Earlier empirical literature focuses on the incentives of hedging, trying to explain why firms engage in hedging activity. In the following are the results derived from empirical researches done recently and these evidences are summarized in Appendix 1.

A. Hedging can reduce financial distress costs

Based on Smith and Stulz (1985) model which develop a positive theory of hedging behavior of value-maximizing cooperation, probability of hedging is higher for firms with higher expected financial distress costs. Firm with a higher level of leverage and debt to equity which exposure to a greater financial distress. Dolde (1995), Berkman and Bradbury (1996), Gay and Nam (1999) use debt ratio as a proxy for expected costs of financial distress and find that debt ratios lead to higher hedging. Thus, greater expected financial distress costs cause greater hedging. In addition, since direct financial distress costs are less than proportional firm size, Nance et al. (1993) argue that smaller firms are more likely to hedge than large firms because small firms are thought to have greater financial distress costs. Moreover, Graham and Rogers (2002) find a positive relation between hedging and leverage, consistent with the view that greater expected financial distress costs cause greater hedging.

B. Hedging can reduce the expected taxes

According to the tax convexity theory developed by Smith and Stulz (1985) who describe that firms' effective tax rates rise along with the increase of pre-tax income, reducing the volatility of taxable income may reduce the expected value of tax liabilities, Nance, Smith and Smithson (1993), survey 169 firms attempting to test the incentives of real hedging activity. They propose that firms with more convex tax schedules hedge more. Following the prior studies, Leland (1988) finds that hedging can increase a firm's debt capacity, and therefore increases firm value due to the tax deductibility of interest payments. Additionally, Graham and smith (1999) also conduct a research to empirically test tax convexity theory for a large sample of U.S. firms. The results show that firms facing a convex tax schedule can achieve averagely $120,000 tax savings by reducing income volatility by 5%. However, Graham and Rogers (2002) find that tax function convexity does not influence a firm's hedging activities, which is against with view that hedging can reduce the expected tax liability. They argue that there are two tax incentives for firms to hedge: one is to increase debt capacity and interest tax deductions; other one is to reduce expected tax liability if the tax function is convex. They use an explicit measure of tax function convexity, finding no evidence that firms employ hedging in response to tax convexity. However, their analysis does indicate that firm hedges to increase debt capacity, with increased tax benefits averaging 1.1 percent of firm value. Furthermore, they also find that firms hedge because of expected financial costs and firm size, which consistent with theory of transaction cost of scale of economic s of hedging developed by Smith and Stulz (1985).

C. Hedging can mitigate the underinvestment problem

Géczy, Minton and Schrand (1997) argue that firms with greater growth opportunities and tighter financial constraints are more likely to hedge. The results suggest that firms can use hedging to reduce cash flow volatility that may prevent firms from investing in valuable growth opportunities, which in line with the finding of Bessembinder (1991) and Froot et al. (1993). Bartram, Brown and Fehle (2006) conduct a research on the international evidence in the use of financial derivatives. The variable like R&D ratio and capital expenditure are used as proxy for the investment growth opportunity. As a result, the analysis shows that capital expenditure has a positive and significant relationship with hedging. This study is supportive of that hedging firms have greater growth opportunities, which is consistent with the argument that hedging mitigates the potential underinvestment problems.

D. Management incentives

On the whole, however, supportive evidence for value maximization theory is controversial. Tufano (1996) studies the derivatives hedging activities of the gold mining industry in 1990-1993 and finds no empirical support for the value maximization theory. Instead, his evidence is consistent with manager utility

maximization. Managers who hold more stock tend to hedge more, while managers who hold more options tend to hedge less. Graham and Rogers (2002) also find that derivatives usage is associated to managers' equity positions. Knopf, Nam and Thornton (2002) examine the sensitivity of managers' stock option portfolios to stock return volatility, and the sensitivity of managers' stock and stock option portfolios to stock price to test the relationship between managers' risk preferences and hedging activities. The results indicate a positive relation between hedging and managerial share ownership, which is consistent with the managerial risk aversion argument. While, other studies (e.g., Géczy et al., 1997; and Haushalter, 2000) find no evidence that managerial risk aversion or shareholdings affect corporate hedging. Conversely, the results of these studies are consistent with value maximization theory.

2.2 The impact of hedging risks on firm value

Empirical evidence mentioned above primarily discusses whether a firm's hedging policy is consistent with theoretical motives about why firms should hedge. Based on perfect market hypothesis, corporate risk management is irrelevant to the firm value. However, in a real world, the financial market is imperfect. Based on shareholder value maximization theory, risk management can increase firm value by reducing firm's financial distress costs, taxes, and underinvestment problems. While based on managerial utility maximization theory, risk management is initially used for managerial private utility and then may decrease firm value. The general conclusion from empirical literature is that there is mixed support for that hedging can increase firm value. Hence, recently years, enormous researchers start to directly focus on the value effects of hedging. The main difference of direct approach from previously used is that derivative usage is the independent variable and firm value is dependent variable. The approach examines the relation between these two variables with controlling other factors affecting firm value. In the following is the main empirical evidence about the direct relation between hedging and firm value, and more empirical evidences are summarized in Appendix 2.

Allayannis and Weston (2001) are the first to empirically examine whether hedging in fact related to higher firm value and to estimate the magnitude of the increase in firm value associated with hedging which referred as hedging premium. They test the potential impact of foreign currency derivatives (FCDs) usage on firm value with a sample of 720 large U.S. nonfinancial firms in the period of 1990-1995. They use Tobin's Q as a proxy for firm value and use of foreign currency derivatives as a proxy for a firm's hedging policy, and find that there is a positive relation between firm value and use of FCDS. The hedging premium is statistically significant for firms with exposure to exchange rates and is on average 4.87% of firm value. They find that overall the cumulative benefits of hedging is due to the reduction in expected taxes, financial distress costs and underinvestment (e.g. 0.5% due to taxes, 0.2% due to costs of financial distress, and 4.32% due to underinvestment). Therefore their evidence is

consistent with the hypothesis that hedging causes an increase in firm value.

After Allayannis and Weston (2001), an extensively number of studies focuses on the investigation of the relationship between hedging and firm value with controversial results. Some of them exactly implement the initial model developed by Allayannis and Weston (2001), while others adjust it to the occasional economic environment under consideration. For instance, Cater, Rogers and Simkins (2006) implement Allayannis and Weston (2001) model with slight adjustments to investigate jet fuel hedging behavior of U.S. firms in airline industry during the period of 1992–2003, attempting to examine whether hedging is a source of value creation for firms. They find hedging to create a premium of 14.94% -16.08% on firm value, statistically significant at the level of 10% and 1%. In addition, they illustrate that the investment and financing climate in the airline industry conforms well to the theoretical framework, which in line with evidence of Froot, Scharfstein, and Stein (1993) that hedging can increase firm value by reducing underinvestment problems.

While, using an entirely different methodology from Allayannis and Weston (2001), Graham and Rogers (2002) estimate the contribution to the hedging premium because of a reduction in a specific frictional cost, namely, taxes. Study results show that hedging can increase debt capacity of firms by 3.03%. This increased debt capacity produces tax savings of 1% to 2% and an equivalent increase in firm value. Most recently, using a large sample of nonfinancial firms from 47 countries, Brown and Conrad (2011) examine the effect of derivative use on firm risks and value. They find strong evidence that financial derivative usage can reduce both total risks and systematic risks. And results reveal that the effect of derivative use on firm value is significantly positive, which is consistent of findings of Allayannis and Weston (2001).

However, the effect of hedging on firm value of empirical studies is controversial. In contrast to the positive valuation effects discussed above, abundant studies argue either no valuation effects or negative valuation effects associated with hedging. Guay and Kothari (2003) use a sample of 234 large non-financial firms using derivatives to survey the impact of hedging on firm value. As a result, they document that the extent of the corporate financial risk that is hedged is too small to influence firm value. They propose that in the case of a simultaneous extreme change in the interest rates, foreign exchange rates and commodity prices, the expected change in the value of the corporate derivatives portfolio will not exceed 4% of the book value of firms, thus derivatives usage does not have a significant influence on firm value.

In line with prior studies, Lookman (2004) investigate the impact of hedging on firm value with a sample of oil and gas exploration and production firms. He classifies commodity price volatility as primary and secondary risks depending on how they extensively affect on the financial operation of the firm. And the results show that hedging the primary risk exposure leads to a value discount of 17%, while hedging

the secondary exposure creates a premium of 26.7%. Therefore, he suggests that hedging does not lead to higher firm value, which is against the evidence of Allayannis and Weston (2001)

Moreover, Jin and Jorion (2006) use a sample of 119 U.S. oil and gas producers from the period of 1998-2001 to evaluate effect of hedging activities on firm value. In their investigation, hedging gas prices leads to a 3.7% discount in firm value, while oil hedging adds firm value by 0.7%, in both cases without statistical significance. The results are unable to support the hypothesis of Allayannis and Weston (2001) that hedging firms are valued higher relative to non-hedgers. Furthermore, with respect to the hedging premium that other studies have documented, they attribute it to factors such as the information asymmetry or the operational hedging which influence firm value, but happens to be positively associated with derivatives usage. Also Khediri (2010) use a sample of 250 non-financial firms from the French market over the period of 2000-2002 to examine the relation between hedging and firm value. They find that the decision to use derivatives has a negative effect on firm valuation.

2.3 The reasons of mixed empirical evidence

According to prior studies mentioned above, we can conclude that the relation between hedging risks and firm value is puzzled. Personally, mixed results of impact of hedging risks on firm value are not simply caused by one or two reasons, but caused simultaneously by diverse reasons. The fact that mixed empirical evidence on this relation can be summarized as following reasons:

Industry factor bias: Prior studies are conducted in different industries, generating different results of effect of hedging risks on firm value because different industries may reflect different levels of Q ratios. A positive relation between hedging and firm value is tested by Allayannis and Weston (2001) with a sample of U.S. non-financial firms, while both Lookman (2004) and Jin and Jorion (2006) investigating the impact of hedging on firm value with a sample of oil and gas exploration and production firms exhibit a negative relationship between hedging and firm value. Mackay and Moeller (2007) find that hedging concave revenues with a sample of 34 oil refiners. Thus, industry-specific factor can be a bias of mixed results.

Geographic bias: some prior researches are conducted with U.S. companies like Cater, Rogers and Simkins (2006), Graham and Rogers (2002), while Brown and Conrad (2011) conduct a research within a sample from 47 countries, Khediri (2010) use a sample from the French market, Bartram et al. (2009) consider a large sample from 50 countries and Kapitsinas (2008) conduct a research using the data from Greek non-financial firms. Different countries have different policies for financial markets and different economic situation which can cause divergent results.

Time period bias: this bias can be generated if the time period of research is too long or too short. If the time period is too short, research result only reflect phenomenon specific to that period and cannot reflect the whole trend of effect of hedging on firm value. And the result can be easily affected by other factors like financial crisis, thus the result of studies can be bias. For example, Allayannis and Weston (2001) spans a period of 5 years, from 1990-1995; Jin and Jorion (2006) examine the data from 1998-2001; Carter, Rogers and Simkins (2006) investigate the data of the period of 1992–2003; Nelson, Moffitt and Affleck-Graves (2005) examine the data from period of 1995-1998.

Sample selection bias: Allayannis and Weston (2001) conduct a research with a sample of large U.S. non-financial firms with assets greater $500 million and propose a positive relation between FCD and firm value, while Jin and Jorion (2006) do a research with a sample of firms which assets are greater than $20 million and show a different result with Allayannis and Weston (2001. Thus, it is unclear that whether hedging could contribute value to smaller firms. So the sample selection can be a reason for puzzled results.

2.4 Hedging risks by foreign currency derivative usage

2.4.1 The reason of focusing foreign currency hedging

In this thesis, foreign currency hedging will be focused and the reasons are will be described as follows. Firstly, in Netherlands, its economy is much more open in Europe because of its lower domestic demand, suggesting larger exposure to international financial price fluctuations. Dutch firms mostly operate internationally, thus a greater emphasis on currency exposure and foreign exchange risk hedging policies in Netherlands is expected.

Secondly, limited evidence have been found to empirically test the relationship between hedging exchange rate risks and firm value in Netherlands, most of empirical evidence are from U.S. and UK. In large part, the lack of evidence is attributed to poor data availability of foreign currency hedge exposure in Netherlands. While the new regulation of International Financial Reporting Standard, namely *IFRS 7 Financial Instruments: Disclosures*, become mandatory in 2007 for listed companies in the European Union (EU), Dutch firm are forced to report risks and create more transparency in the annual report. As a consequence, the data of foreign currency risks become available from 2007 for listed companies.

Finally, the impact of foreign currency hedging on firm value is controversial according to prior empirical studies. Shapiro (1975) is the first to formally model the relationship between firm value and exchange rates. His two-country model predicts that depreciation in the value of the home currency leads to an increase in the value of the home country firm and a decrease in the value of its foreign competitors. Bartov

and Bodnar (1994) find an insignificant relationship between exchange rate changes and stock returns. Allayannis, Lel and Miller (2012) examine the use of foreign currency derivatives (FCDs) as a proxy for risk management and its potential impact on firm value in a broad sample of firms from thirty-nine countries between 1990 and 1999. They find that on average, hedging is associated with higher firm value around the world. Allayannis and Miller (2012) examine the impact of currency derivatives on firm value using a broad sample of firms from 39 countries with significant exchange rate exposure. They find strong evidence that the use of currency derivatives for hedging risks is associated with a significant value premium. Additionally, Magee (2009) use a sample of 408 large US firms to investigate the impacts of foreign currency derivatives on Tobin's Q. Study results show a positive relationship between foreign currency derivatives and firm value. But found no relationship between firm value and foreign currency hedging after controlling the dependence of foreign currency hedging on past amount of firm value. This is contrary to the findings that a positive relation between hedging currency risks and firm value in Allayannis and Weston (2001).While, Bashir, Sultan & Jghef (2013) propose that use of FCD is associated with lower firm value.

2.4.2 Hypothesis development

In summary, the evidence is more specifically scarce and relatively little known about the impact of foreign currency hedging activities on firm value. Consequently, a further research related to impact of foreign currency hedging on firm value based on the sample of Dutch firms is necessary. Owing to that hedging risks could increase firm value by reducing the costs of financial distress , expected tax liabilities, and relieving the underinvestment problems based on prior findings, the following general hypothesis in this thesis will be tested: *Foreign currency hedging increase firm value in Netherlands*

3. Methodology and data collection

This chapter will provide the model from prior studies explaining the impact of hedging risks on firm value. In the following, the explanation of independent and dependent variable, and control variables in detail will be given. Finally, the criteria settings of selecting the samples from ORBIS database will be described as well.

3.1 Empirical regression model

The regression model in this study is based on the study of Allayannis and Weston (2001), Pramborg (2004), Lookman (2004), Jin and Jorion (2006), Kapitsinas (2008), Fauver & Naranjo (2010), and Bashir, Sultan & Jghef (2013). The two different regression analysis including the univariate and multivariate analysis would be explained in the following.

3.1.1 Univariate regression analysis

According to the hypothesis of this study, firms using foreign currency derivatives for hedging are valued higher than non-users. Thus, a significant difference between hedgers and non-hedgers in terms of firm value should be shown, a premium that could be attributed to derivatives usage. In order to empirically investigate this hypothesis, a test of equality of the mean and median of the firm value as given by Tobin's Q and control variable is conducted to make a comparison between hedgers and non-hedgers (Allayannis and Weston, 2001; Lookman, 2004; Jin and Jorion, 2006; Kapitsinas , 2008; and Bashir, Sultan & Jghef , 2013).

3.1.2 Multivariate regression analysis

In order to verify the relationship between the hedging and firm value, a test of the relation between firm value and hedging dummy variable with control variables is necessary to be conducted. The multivariate regression model used in this study is as follows (Allayannis and Weston, 2001; Pramborg, 2004; Lookman, 2004; Jin and Jorion, 2006; Kapitsinas, 2008; Fauver & Naranjo, 2010; and Bashir, Sultan & Jghef (2013):

$$Tobin's Q_{it} = \beta_0 + \beta_1(hedgingdummy_{it}) + \beta_2(SIZE_{it}) + \beta_3(PROF_{it}) + \beta_4(DIV_{it}) + \beta_5(LEV_{it}) + \beta_6(IO_{it}) + \beta_7(ID_{it}) + \varepsilon_{it} \; (i, t = 1, 2, \dots, N, where\ N\ is\ the\ number\ of\ firm\ year\ observation) \qquad (2)$$

Where

β_0 is the constant coefficient;

β_1 is the coefficient of hedging;
β_2 is the coefficient of firm size;
β_3 is the coefficient of profitability;
β_4 is the coefficient of dividend dummy;
β_5 is the coefficient of leverage;
β_6 is the coefficient of investment opportunity;
β_7 is the coefficient of industry diversification dummy;
ε_{it} is error term.

3.2 Dependent variable: Tobin's Q

According to previous researches with the effect of hedging activities on firm value, firm value is taken as dependent variable which is measured through Tobin's Q. Tobin' Q is generally defined as the ratio of market value of the firm to the replacement cost of assets (Tobin, 1969).The existing literature provides many different procedures to estimate q, with the more accurate one to be developed by Lindenberg and Ross (1981). According to Lindenberg and Ross (1981)procedure, market value of firm is equal to the sum of a firm's preferred stock, plus the price of the firm's common stock multiplied by the number of shares outstanding, plus the value of firm's long-term debt, plus the book value of the firm's current liabilities, minus the value of firm's net short-term assets; and the replacement cost of assets is the sum of book value of total assets, minus the book value of the firm's net capital stock and plus the firm's inflation-adjusted net capital stock. It is a complex calculation in which the data of firm's long term debts and replacement cost of fixed assets is required which is not easily available against all firms. To simplify to calculation of Tobin's Q, Lewellen and Badrinath (1997) and Perfect and Wiles (1994) develop a improved Tobin's Q, which the replacement cost of assets is calculated as the sum of replacement cost of fixed assets plus inventories and the market value is calculated as market value of common stock. Allayannis and Weston (2001) examine the impact of foreign currency hedging on firm value with improved Tobin's Q which was used by Lewellen and Badrinath (1997) and Perfect and Wiles (1994). Further Allayannis and Weston (2001) define a simple Tobin's Q as market value of the firm to book value of total assets, and find a very high correlation of 0.93 between simple and improved Tobin's Q used by Lewellen and Badrinath (1997) and Perfect and Wiles (1994). Additionally, Lins (2003) argue that a simple Tobin's Q requires less and available data can yield very effective results for the measurement of firm value. Then in line with Allayannis and Weston (2001) and Lins (2003), Lookman (2004), Hagelin & Pramborg (2004), Jin and Jorion (2006), Kapitsinas (2008), Júnior & Laham (2008), Magee (2009), Fauver & Naranjo (2010), and Bashir, Sultan & Jghef (2013) all use the same firm value measure for Tobin's Q. In their argument, simple Tobin's Q is used as a proxy for firm value calculated as:

$$\boldsymbol{Tobin's\ Q} = \frac{(\boldsymbol{Book\ value\ of\ Total\ Assets} + \boldsymbol{Market\ value\ of\ Equity}) - \boldsymbol{Book\ value\ of\ Equity}}{\boldsymbol{Book\ value\ of\ Total\ Assets}} \quad (1)$$

In this calculation book value of total assets minus book value of equity ,and plus market value of equity is considered as a proxy for market value; while book value of total assets is taken as a proxy for replacement cost of assets.

3.3 Independent variable: foreign currency hedging

IFRS standards are the International Financial Reporting Standards which are the successor to the IAS. Guidelines for accounting for financial derivatives are given under IFRS 7. These IFRS standards became mandatory in 2005 for listed companies in the EU and IFRS 7 became mandatory for listed companies in the Netherlands in 2007. Thus, listed firms in Dutch are required to disclose the information of the foreign currency hedging in their annual reports under the IFRS 7. Normally this information is presented under the heading of Financial Instruments in notes to the accounts. Therefore, the information of foreign currency derivative holdings for each firm in sample can be obtained from annual reports on their websites. The firms in the sample must have the information on foreign currency hedging from their annual reports. The firms are classified as foreign currency derivative users if the important keywords like “foreign currency risk”, “currency risk”, “currency swaps”, “currency forward contracts”, and “foreign exchange rate” can be searched in their annual reports. The others are classified as non-foreign currency derivatives. Due to the fact that the data about notional amount of foreign currency derivatives is not available for all firms in this study, a hedging dummy is created, which is assigned a value of 1 if firms report foreign currency hedging and a value of 0 otherwise.

3.4 Control variable

To infer that foreign currency hedging activities indeed affect the firm value, the study has to exclude other factors which can have the effect on firm value as well. Below, various controls used in Allayannis and Weston (2001), Allayannis, Lel& Miller(2003), Pramborg (2004), Lookman (2004), Jin and Jorion (2006), Kapitsinas (2008), Júnior & Laham(2008), Magee(2009), Fauver & Naranjo (2010), and Bashir, Sultan & Jghef (2013)will be described and the theoretical reasons for using these control variables will be provided as well.

3.4.1Firm Size (SIZE): the proxy is calculated as firm’s total assets. In order to minimize the problem of symmetry of distribution of total assets, the logarithm of total assets is used. Prior studies have found that firm size is positively related to both the decision to hedge and the extent of hedging. The evidence about the effect of firm size on firm value is ambiguous. Larger firms with more capital and human resources contribute to economies of scale and high profitability, thus the relation between firm size and firm value is positive. However, Allayannis (2001) finds that there is a

negative relationship between firm size and firm value. This study, the log of total assets is used to control this variable.

3.4.2 Profitability (PROF): ROA is used as a proxy for profitability. Based on the prior findings, profitable firms are likely to have higher Tobin's Q ratios than less profitable firms. Firms with higher profitability are expected to have more resources to invest in the positive NPV projects, which lead to higher firm value. So the relation of Tobin's Q and profitability can be assumed as positive. This study use ROA to control for profitability with the ratio of net income to total assets.

3.4.3 Access to financial markets: a dummy variable is employed as a proxy for ability to access to financial markets, and equals 1 if the firms paid the dividends on common equity during the fiscal year and 0 otherwise (Allayannis and Weston, 2001; Pramborg, 2004; Lookman, 2004; Jin and Jorion, 2006; Kapitsinas, 2008). Servaes (1996) argues that firms with limited access to the financial market obtain greater firm value, because these restricted firms would only undertake positive and higher NPV projects which can contribute value increase for firms and bypass the less high NPV projects. While, if a firm is less likely to be financially constrained and may take projects with negative NPV and thus have a lower Q. Since firms which have capital to pay the dividends are less likely to be financially constrained, the payment of dividend can be interpreted as the ability to get access to the financial markets. It is expected a negative relation between dividend and firm value.

3.4.4 Leverage (LEV): the ratio of long-term debt to total assets is used as a proxy for leverage. A firm's capital structure is related to its value. On one hand, some studies support that the relation between leverage and firm value is positive. According to trade-off theory, it predicts that leverage can increase firm value because of the tax benefits of debt. High leveraged firms are more likely to hedge by derivative usage (Dolde, 1995). On the other hand, there are some empirical researches implying a negative relation of leverage and firm value. Titman and Wessels (2012) argue that greater debts can lead to financial distress and further decrease firm value. Thus, it is necessary to control the effect of leverage on firm value. While the relation between leverage and firm value is ambiguously stated.

3.4.5 Investment opportunities (IO): the ratio of capital expenditure to total sales is employed as a proxy for investment opportunities (Allayannis & Weston, 2001; Allayannis, Lel & Miller, 2003; Lookman, 2004; Jin & Jorion, 2006; Magee, 2009; and Fauver & Naranjo, 2010). Myers (1997) suggests that firm value is affected by the firm's future investment opportunities. If a firm has lots of investments opportunities, it seems that this firm has the capacity to generate more cash flows to the firm. Therefore, the value of a firm with more investment opportunities will be higher than a firm with less investment opportunities. It is believed that investment opportunities have a positive impact on firm value.

Table2: List of variables

This table presents the definitions of variables used in this study:

Variables	Definition
Dependent variable	
Tobin's Q	Book value of total assets minus book value of total equity plus market value of common equity all divided by the book value of total assets
Independent variable	
FCD dummy	Equals to 1 if firms report foreign currency hedging and a value of 0 otherwise
Control variables	
Firm size (SIZE)	Log of total assets is as a proxy for firm size
Profitability (PROF)	ROA is used as a proxy for profitability
Leverage (LEV)	The ratio of long-term debt to total assets
Access to financial market	Dummy variable is employed as a proxy for ability to access to financial markets, and equals 1 if the firms paid the dividends on common equity during the fiscal year and 0 otherwise
Investment opportunities (IO)	The ratio of capital expenditure to total sales is employed as a proxy for investment opportunities
Industrial diversification	Equals to 1 if the firm operates in more than one business segment and 0 otherwise

3.4.6 Industrial diversification (ID): to control for the effect of industrial diversification on firm value, a dummy variable that equals to 1 if the firm operates in more than one business segment and 0 otherwise is used. Empirical evidence proposes that industrial diversification is negatively related to firm value (Lang and Stulz, 1994; Servaes, 1996). It is expected a negative coefficient on this variable.

However, with the consideration of the samples selected in this study, I exclude other control variables exhibited in the study of Allayannis and Weston (2001)Allayannis, Lel& Miller(2003), Pramborg, (2004), Lookman (2004), Jin and Jorion (2006), Kapitsinas (2008), Júnior & Laham(2008), Magee(2009),Fauver & Naranjo (2010). I exclude the variable of credit rating because most of the firms in this study do not have credit rating.

3.5 Data collection

In accordance with the existing literature, the sample of the current research consists of the listed firms with the following criteria: (1) they are non-financial firms-financial firms (e.g. SIC=6000-6999) are excluded because they are often both end users and intermediaries in derivative transactions, and they usually act as market makers in derivative markets, and thus their motivations and behaviors are not representative of hedging behavior; (2) owing to that the study area of this thesis is limited in Netherlands, the samples' base and headquarters must be in Netherlands; (3)

their annual reports must be published and available according International Financial Reporting Standards (IFRS) for the fiscal year of 2012; (4) information of foreign exchange derivatives (FCD) are exposured. The data is searched from ORBIS database based on the criteria mentioned above; the search settings and results are exhibited in table 3.

Table 3: search criteria and search results of data collection:

Search criteria	Search results
(1) World region/ Country/ Region in country: Netherlands;	30771
(2) Accounting practice: IFRS	246
(3) Years with available accounts:2012;	208
(4) Listed/ Unlisted companies: Publicly listed companies;	124
(5) Type of companies: Non-financial companies (remove firms with SIC of 6000-6999);	111
(6) Removing firms which have miss data (like capital expenditure, dividends, market value of equity, etc.)	93

Thus, the number of companies that meets these criteria is 93 and then the final sample consists of 93 observations. Appendix 3 lists the samples and presents the main information of samples in this study. Main data (e.g. market value and book value of total assets, long-term debts, and total sales etc.) of this study is collected from ORBIS database. In the full sample firms which use the foreign currency derivatives (FCD) for hedging are considered as hedgers, and in this case the dummy variable of hedging will take the value of 1. On the other hand, firms which do not use foreign currency derivatives (FCD) are non-hedgers, and for those companies the hedging dummy variable is the value of 0.

4. Empirical Results

In this chapter, the main hypothesis that firms with foreign currency derivatives usage to hedge are more likely to have higher firm value than those that without foreign currency derivatives usage will be tested. First of all, the summary statistics of samples will be described in details. Then the univariate and multivariate regression analysis are done to test whether the relation between FCD hedging and firm value is positive.

4.1 Sample description

Table 4 presents the descriptive statistics of the study in three panels named A, B and C for the full samples, FCD users and Non-FCD users respectively. Panel A depicts the statistics for whole sample of 93 firms. On average, 64.5% of the samples use foreign currency derivatives to hedge currency risks, which is higher than 37% of all samples using derivatives in the study of Allayannis and Weston (2001) and 45% in results of Jin and Jorion (2006).

According to Pearson (1895), the skewness coefficient is defined by (mean -median)/standard deviation, and when mean is larger than median, it is sign of right side skewness; when median is greater than mean, it is skewed to left side. The mean (median) value of Tobin's Q is 1.89 (1.17), showing that the average of firms is profitable and indicating that the distribution of Tobin's Q is skewed to the right side. To control for the apparent skewness, the natural log of Tobin's Q will be used in univariate and multivariate tests so that its distribution becomes more symmetric[2].

The mean value of total assets in the whole sample approaches €4272 millions and the mean value sales approaches €3760 millions, while the median value of both two variables are €602 million and €710 million respectively, which differs substantially from mean. Thus the distribution of total assets and sales is skewed to right side. I use the natural log of total assets to proxy the firm size in order to control the distribution asymmetry.

In the last section of Panel A, the statistics of the control variables used in the multivariate analysis are presented. The mean (median) of return on assets is 9.23 (2.91), showing that average of sample firms properly utilized their capitals in 2012. The mean value of dividend dummy is 0.62, suggesting that 62% of the whole sample firms paid the dividends in the year of 2012. In addition, the mean (median) of the ratio of long-term debt to total assets is 0.15 (0.12). The average value of growth opportunity for firm samples is 0.11, while the mean value of growth opportunity in the study of Allayannis and Weston (2001) which based on U.S. firms is 0.7, which

[2] Also observed in Lang and Stulz (1994), Allayannis and Weston (2001) and in most other research.

means that firms in U.S. have more investment opportunities than in Netherlands. The table finally presents that only 37% of all firms are industry diversified on average, while in U.S firms based study, the industry diversification amounts to 63% in the study of Allayannis and Weston (2001) and 70.2% in Magee (2009), suggesting the low level of industry diversification of Dutch firms. From Panel B and C, we can see there are some distinct difference between firms that use derivatives for hedging and firms that do not use derivatives for hedging. The average of total assets for hedgers is €6287 millions, which is largely greater than non-hedgers' €607 millions. The average size of hedging firms is greater than the mean value of non-hedgers. The result is accordance with prior studies by Geczy et al. (1997), Nance et al. (1993) that larger firms are more likely to use derivatives to hedge than smaller firms. Large firm hedge more because of two reasons: one is that the initial costs that are required to establish the derivatives markets are easy for large firms to pay due to economies of scale; second is that it is necessary for large firms to hedge against heavy fixed costs. The ROA on average for firms without FCD is larger than firms with FCD, it means that the hedging firms invested a high amount of capital into its production while receive little income. From Panel B and C, we can see that the minimum and maximum of ROA for firms with hedging is -188 and 107 respectively, and for firms without hedging, the value of minimum and maximum of ROA is -31 and 814, respectively. The value of ROA with -188 in Funcom N.V. is due to the net income and book value of total assets of this firm are -€47 million and €25 million respectively, indicating that Funcom N.V. is less efficiently use its assets to generate earnings. While owing to that the net income and book value of total assets in Spyker N.V. are €114 million and €14 million respectively, the value of ROA of this firm is 814, suggesting that Skyker N.V. utilize less assets to yield greater earnings. The payment of dividend is treated as an access to financial market. The 73.8% of hedging firms pay dividend, while on average 40.6% of non- hedgers pay dividend. The mean value of ratio of long-term debt to total assets of hedgers is lower than the mean value of non-hedgers. It shows that the non-hedgers are more leveraged than hedger. The mean value of ratio of capital expenditure to total sales of hedgers is far smaller than the average value of non-hedgers. This result indicates that the FCD affects negatively to firms' growth, which is inconsistent with Froot et al. (1993) that hedging activities can relieve the problem of underinvestment. Hedgers are more industry diversified than non hedgers. It is in line with the argument that diversified firms in different business segments are more likely to hedge against foreign exchange risks.

Table 4: Summary Statistics

This table presents summary statistics for the sample of all nonfinancial Dutch public firms in 2012. The definition of variables is listed in Table 2.

Variables	No.	Mean	Median	Ste.Dev	Min	Max
Panel A: All firms						

Independent variable						
FCD dummy	93	0.65	1.00	0.48	0.00	1.00
Dependent variable						
Tobin's Q	93	1.89	1.17	4.80	0.64	46.78
Log of Tobin's Q	93	0.12	0.07	0.24	-0.19	1.67
Controls						
Total Assets (€million)	93	4271.51	602.08	11808.41	9.08	92102.00
Total Sales (€million)	93	3759.62	710.80	9212.88	0.71	56480.00
SIZE(log of Total Assets)	93	2.77	2.78	0.94	0.96	4.96
Profitability(ROA)	93	9.23	2.91	87.85	-188.00	814.00
Access to financial markets	93	0.62	1.00	0.51	-0.33	1.00
Leverage	93	0.15	0.12	0.15	0.00	0.82
Investment Opportunity	93	0.11	0.04	0.37	0.00	3.47
Industry Diversification	93	0.37	0.00	0.48	0.00	1.00
Panel B: firms with FCD						
Dependent variables						
Tobin's Q	60	1.29	1.16	0.51	0.64	3.09
Log of Tobin's Q	60	0.08	0.07	0.15	-0.19	0.49
Controls						
Total Assets (€million)	60	6287.20	1468.29	14302.44	20.55	92102.00
Total Sales (€million)	60	5432.52	1304.95	11042.10	18.00	56480.00
SIZE(log of Total Assets)	60	3.12	3.17	0.84	1.31	4.96
Profitability(ROA)	60	-0.66	2.59	29.53	-188.00	107.00
Access to financial markets	60	0.74	1.00	0.46	-0.32	1.00
Leverage	60	0.15	0.13	0.12	0.00	0.55
Investment Opportunity	60	0.07	0.04	0.10	0.00	0.58
Industry Diversification	60	0.45	0.00	0.50	0.00	1.00
Panel C: firms without FCD						
Dependent variables						
Tobin's Q	33	2.98	1.26	7.99	0.67	46.78
Log of Tobin's Q	33	0.18	0.10	0.35	-0.17	1.67
Controls						
Total Assets (€million)	33	606.63	110.86	1503.23	9.08	7262.68
Total Sales (€million)	33	718.00	104.12	2104.62	0.71	11971.54

SIZE(log of Total Assets)	33	2.13	2.05	0.74	0.96	3.86
Profitability(ROA)	33	27.21	3.00	141.65	-30.75	814.00
Access to financial markets	33	0.41	0.00	0.52	-0.33	1.00
Leverage	33	0.15	0.10	0.19	0.00	0.82
Investment Opportunity	33	0.19	0.05	0.60	0.00	3.47
Industry Diversification	33	0.21	0.00	0.42	0.00	1.00

4.2 Univariate Test

According to the main hypothesis of the study, firms using FCD for hedging are valued higher than non-users. In order to empirically investigate, a test of equality of mean value of firm value is conducted to make a comparison of FCD users and Non-FCD users. According to mentioned above, the distribution of Tobin's Q is skewed to right side, therefore I will test the hypothesis using the Log of Tobin's Q to make the distribution symmetrical. Two-sample t using by test is used for empirically testing whether there is a difference between the mean value of Tobin's Q of hedging firms and non-hedging firms (Allayannis & Weston, 2001; Pramborg, 2004; Jin & Jorion, 2006; Fauver & Naranjo, 2010; and Bashir, Sultan & Jghef, 2013).

Table 5 provides the results of two-sample mean comparison t test. The first two columns from the left side of the Table 3 present the mean values of FCD users and non-FCD users, and the column 3 presents the difference between mean values. The last two columns present whether the difference is statistically significant or not.

According to Table 5, the mean value of log of Tobin's Q for hedging firms and non-hedging firms is 0.08 and 0.18, respectively. The difference between mean values of Tobin's Q is negative (-0.09) and statistically significant at the level of 10% ($p=0.07<0.1$). Thus, it cannot be concluded that the firms with hedging are valued higher than firms without hedging, which is contrast to the earlier literature like Allayannis and Weston (2001) and Bashir, Sultan and Jghef (2013) that the difference mean value of Tobin's Q between hedging firms and non-hedging firms is positive and significant.

The size, on average, of hedging firms (3.12) is higher than that of non-hedging firms (2.13) and this difference (1.00) is significant at the level of 1% ($p=0.00<0.01$). It supports the study of Nance et al. (1993) that larger firms are more likely to hedge than small firms.

Results of ROA show negative difference but this difference is not significant. In addition, more 33% of hedging firms paid dividends than non-hedging firms and this result is statistically significant at the level of 1% ($p=0.00<0.01$).

The negative mean value difference (-0.01) of leverage result shows that non-hedging firms are higher leveraged but this result fails to meet the significant level, which against the study of Graham and Smith (1999) and Leland (1998) that hedging can increase debt capacity to take tax shield advantages.

Moreover, the investment opportunity for firms with FCD is 0.07 on average, which is smaller than mean value 0.19 of firms without FCD. While the difference (-0.12) is not significant (p=0.14), which shows that hedging activities are not able to solve the problem of underinvestment.

Finally, the percentage of firms with FCD in terms of industrial diversification is 45%, which is 23.8% greater than firms without FCD. The mean difference show that hedging firms are more industrial diversified than non hedgers and this result is statistically significant at the level of 5% (p=0.02<0.05).

To be concluded, the mean difference between firms with FCD and firms without FCD is negatively significantly for Tobin's Q, and is positively significant for control variables like size, access to financial market and industrial diversification, and is not significant for profitability, leverage and investment opportunity.

This test of equality of means that firms with FCD are valued lower than firms without FCD but this argument cannot be concluded because a multivariate analysis is required in order to investigate the other factors that may affect firm value.

Table 5: comparison of Hedgers and Non-Hedgers

Notes: Table 5 depicts the outcomes of comparison of mean value of firms with FCD and firms without FCD in terms of Log of Tobin's Q and control variables. And the definition of variables is listed in Table 2.

Variables	Hedgers	Non-hedgers	Difference	t-statistics	p-value
Log of Tobin's Q	0.08	0.18	-0.09	-1.81	0.07
Size	3.12	2.13	1.00	5.68	0.00
Profitability	-0.66	27.21	-27.87	-1.47	0.14
DIV Dummy	0.74	0.41	0.33	3.16	0.00
Leverage	0.15	0.15	-0.01	-0.22	0.83
IO	0.07	0.19	-0.12	-1.51	0.14
ID	0.45	0.21	0.24	2.32	0.02

4.3 Multivariate test

Univariate test is weak since it does not control many other factors that simultaneously affect the dependent variable. Thus, a multivariate regression test, which examines the effects of independent variable on dependent variable with

controlling other factors that affect the dependent variable, is necessary. Multiple regression models can accommodate many explanatory variables that maybe correlated, thus we can infer causality in cases that simple regression analysis would be misleading.

The multicollinearity problem is done in multivariate analysis setting. Multicollinearity is a statistical problem that two or more independent variables in a multiple regression model are highly correlated. Multicollinearity increases the standard errors of the coefficients. Increased standard errors in turn indicate that coefficients for some independent variables may be found not to be significantly different from 0, whereas without multicollinearity and with lower standard errors, these same coefficients might have been found to be significant. Thus, the multicollinearity problem has to be checked. Usually, VIF measurement is to check whether the multiple independent variables are correlated with each other (Bashir, Sultan & Jghef, 2013). The results of VIF test are shown as Table 6: all VIF values for each of independent variables are less than 5, thus there is no multicollinearity problem within the independent variables.

Table 6 presents the results of multivariable linear regression analysis. The data reveals that the coefficient on hedging variable is negatively significant, with the value of -0.26. This result is consistent with Fauver & Naranjo (2010) that there is a significantly negative relation between hedging activity and firm value. Then the hypothesis of this study is rejected because firms with hedging are not valued higher than firm without hedging.

Moreover, the log of total assets which is a proxy for firm size, have negative sign with log of Tobin's Q, while it is not significant. It is against prior study of Allayannis and Weston (2001) that size has a significantly negative effect on firm value. ROA, which as a proxy for profitability, has a positive sign with firm value. While this sign is insignificant, means it is not consistent with prior studies that profitable firms are more likely to have a higher Tobin's Q. In addition, the coefficient of dividend paid as a proxy for access to financial market is significantly positive with a value of 0.398, which means there is a positive relationship between dividends paid and firm value. Furthermore, the coefficient of leverage is positive which in line with Graham and Smith (1999) who find a positive relation between leverage and form value. But this coefficient is not statistically significant (p=0.116). I cannot conclude that higher leveraged firms have higher value. The negative investment opportunity coefficient demonstrates that firm's future investment opportunity is associated with lower firm value but again this relationship has no significance. This negative relationship is against the findings of Smith and Watts (1992) that firms having investment opportunities in future have higher market value. Like Allayannis (2009), the coefficient of industry diversification is negative with Tobin's Q. But this coefficient is not statistically significant; I cannot conclude that more diversified firms have higher value.

Thus, it can be concluded that there is a negatively significant relation between hedging with foreign currency derivatives and firm value. And among the control variables, only dividends paid have a statistically significant positive relation with firm value. And other controls like firm size, profitability, leverage, investment opportunity and industry diversification are not significantly related to firm value in this study.

Table 6: Linear regression results

Formally, variance inflation factors (VIF) measure how much the variance of the estimated coefficients is increased over the case of no correlation among the X variables. If there are two or more variables that will have a VIF around or greater than 5, one of these variables must be removed from the regression model. The definition of other variables is listed in Table 2. *** denotes the significance at the level of 1%, ** denotes the significance at the level of 5%, and * denotes the significance at the level of 10% based on a two-tail test.

Log of Tobin's Q	**（1）**	**VIF**
Constant	1.332	
Hedging Dummy	-0.26	1.48
	（-2.18）**	
Size	-0.08	2.13
	（-0.58）	
ROA	0.07	1.08
	（0.67）	
DIV Dummy	0.40	1.41
	（3.45）***	
IEV	0.22	2.02
	（1.59）	
IO	-0.09	1.65
	（-0.70）	
ID	-0.04	1.25
	（-0.36）	

4.4 Sensitive analysis

In order to verify the initial results with respect to the effect of hedging with FCD on firm value, a sensitivity analysis is conducted that comprises two different tests.

4.4.1 Removing different controls

The first sensitive analysis is based on testing the effects of hedging with FCD on Tobin's Q by controlling differences in firm characteristics. Owing to that controls like firm size, profitability, access to financial market, leverage, investment opportunity and industry diversification may affect the value of Tobin's Q together, it is necessary to test whether the negative relation between hedging and firm value is still exists by removing different controls. By removing different controls and then re-performing the regression model, the results are revealed as Table 7: the coefficient on hedging variables is still negatively significant after removing the different control variables, which strengthens the results tested above. Thus, the existence of significant relation between hedging with FCD and firm value tested in prior multivariate analysis is verified.

Table 7: Linear regression results after controlling different variables

Notes: Column (1) removes the control variable of Size; Column (2) removes the control variable of Size and Profitability; Column (3) removes the control variable of Size, profitability and access to financial market; Column (4) removes the control variable of Size, profitability, access to financial market, and leverage; Column (5) removes the control variable of Size, profitability, access to financial market, leverage, and investment opportunity; Column (6) removes the control variable of Size, profitability, access to financial market, leverage, and investment opportunity and industry diversification. *** denotes the significance at the level of 1%, ** denotes the significance at the level of 5%, and * denotes the significance at the level of 10% based on a two-tail test.

Log of Tobin's Q	**（1）**	**（2）**	**（3）**	**（4）**	**（5）**	**（6）**
Constant	(1.14)	(1.43)	(2.49) **	(3.806)***	(4.01)***	(4.25)***
Hedging Dummy	-0.29	-0.30	-0.22	-0.19	-0.20	-0.18
	（-2.72）***	（-2.90）***	（-2.02）**	（-1.80） *	（-1.81） *	（-1.81） *
Size						
ROA	0.07					
	（0.70）					
DIV Dummy	0.37	0.37				
	（3.48） ***	（3.44） **				
IEV	0.18	0.19	0.25			
	（1.50）	（1.54）	（1.94） *			
IO	-0.07	-0.08	-0.15	-0.01		
	（-0.61）	（-0.66）	（-1.16）	（-0.08）		
ID	-0.05	-0.04	0.06	0.03	0.03	
	（-0.47）	（-0.34）	（0.52）	（0.27）	（0.28）	

4.4.2 Elimination outliers

Outlier is an observation point that is distant from other observations. It can occur by chance in any distribution, but it always indicative if measurement error. Thus, it is necessary to remove these outliers to make statistics robust. The main propose of this method is to reduce the "noise" in the data and then to improve the fit of the regression, and further to better explain the relationship between hedging with FCD and firm value. In my study, after remove the large distant from mean value of Tobin's Q from the whole sample (Kapitsinas, 2008), the observations in the full sample are reduced to 87. Then I re-executed the regression model and the results are displayed as Table 8. According to table 8, it can be seen that the coefficient on hedging variable is negatively significant, which supports the existence of a negative and significant relation between hedging with FCD and firm value. While there are no striking changes in the coefficients on the control variable, with the exception of the coefficient of size and investment opportunity is positive but both not significant, contrary to initial results.

Table 8: Linear regression results after removing outliers

The definition of variables is listed on Table 2. *** denotes the significance at the level of 1%, ** denotes the significance at the level of 5%, and * denotes the significance at the level of 10% based on a two-tail test.

Log of Tobin's Q		**VIF**
Constant	(0.45)	
Hedging Dummy	-.214	1.45
	(-1.71)*	
Size	.063	2.16
	(0.42)	
ROA	0.11	1.09
	(1.06)	
DIV Dummy	0.31	1.44
	(2.53)**	
LEV	0.14	2.14
	(0.94)	
IO	0.02	1.71
	(0.16)	
ID	-0.01	1.28
	(-0.06)	

4.4.3 Use of alternative control variable

The third sensitive analysis is based on replacement of log of total assets as a proxy

for firm size. Log of sales is used to replace the log f assets. Then the regression is re-executed and the results are presented as Table 9. In comparison with the results of initial regression as presented in Table 9, this test produces some changes. The hedging dummy coefficient in full sample decreases from -0.26 to -0.28 and preserves its significant with the level of 5%, which strengths that the hedging with FCD is negatively related to firm value. The coefficients of control variables are found to be more or less identical with a different value to original analysis. And from Table 9, it can be observed that there is no multicollinearity problem within the independent variables because all VIF values for each of independent variables are less than 5.

Table 9: Regression results with sales as a proxy for size

The definition of variables is listed on Table 2. *** denotes the significance at the level of 1%, ** denotes the significance at the level of 5%, and * denotes the significance at the level of 10% based on a two-tail test.

Log of Tobin's Q		**VIF**
Constant	(1.03)	1.031
Hedging Dummy	-0.28	1.392
	(-2.43)**	
Size	-0.03	2.182
	(-0.21)	
ROA	0.07	1.153
	(0.62)	
DIV Dummy	0.38	1.463
	(3.25)***	
LEV	0.19	1.799
	（1.46）	
IO	-0.08	1.756
	（-0.64）	
ID	-0.05	1.289
	（-0.41）	

4.5 Interpretation of the results

Having completed the empirical analysis, a brief critical conclusion is presented: for firms in the full samples the hedging dummy coefficient is on average -0.258 and significant at the level of 5% (p=0.032). Thus, it is obvious that the impact of hedging with foreign currency derivatives on firm value is negative in our study. This result is against with some prior studies like Allayannis and Weston (2001), Graham and Rogers (2002), Rogers and Simkins (2006), Mackay and Moeller (2007), Magee (2009) who document a hedging premium based on U.S. samples. This discrepancy

suggests that there are major differences between Dutch and U.S. corporations. Firstly, Dutch firms are open than US economy with greater exposure to foreign exchange risks: in our samples, almost 65% samples use foreign currency derivatives to hedge, while according to US studies like Allayannis and Weston (2001) and Jin and Jorion (2006), only 37% and 45% respectively using foreign currency derivatives. Secondly, the model of corporate governance is different between in US and Netherlands. US corporate with one-tier board of directors emphasizes on interests of shareholders, while Dutch corporate with two-tier board of directors is more towards a stakeholder orientation. This difference in shareholder-stakeholder orientation could lead to some differences in the area of risk management. It means Dutch firms might be expected to focus on the impact of hedging on a longer time span reported performance, while US firms are worried more about near term. Our study only focus on Tobin's Q of whole samples in the year of 2012 not on a long run, which is one reason lead to a statistically negative relation between hedging with FCD and firm value.

In addition, hedging can be only effective when the overall gains from derivative usage are greater than the costs for executing hedging activities like human resources, physical and financial needs. Thus, the second reason that hedging with FCD fail to add firm value in our study is greater costs for performing hedging activities. Moreover, endogeneity is a big concern. The unobserved factors like credit rating at the firm level have an impact on firm value. This is another reason why we get a value discount with hedging. Furthermore, according to study of Fauver & Naranjo (2010) suggest that firms with greater agency and monitoring problems exhibit a negative association between Tobin's Q and derivative usage. Therefore, agency and monitoring problems can another reason contributing to negative relationship between hedging with FCD and firm value in our study.

5. Conclusion

The current research aims to provide an answer to the question that whether hedging risks with foreign currency derivatives is a value creation activity. Based on the most widely used model for exploring the impact of hedging with foreign currency derivatives on firm value, a sample of 93 non-financial Dutch firms for the year of 2012 is considered. Firm value is measured by Tobin's Q, a hedging dummy variable is as a proxy for foreign currency derivatives and other control variables that can affect firm value are considered as well.

Prior studies show mixed results of positive, negative and no effects of hedging with derivative usage on firm value. The outcome of our analysis is supportive of a negative and statistically significant relationship between hedging with foreign currency derivatives and firm value for firms, which are in consistent with studies of Lookman (2004), Fauver & Naranjo (2010) and Khediri (2010) that hedging is negatively related to firm value. And this result is confirmed after a series of controls. It is interpreted as evidence that performing hedging activity can lead to lower firm value.

The above results are in contrary to many US studies that a value premium is expected by hedging, which presents that major difference between US and Netherlands financial markets. There are two main differences: one is that Dutch firms are open than US economy with greater exposure to foreign exchange risks; the other is that US firms pay more attention to shareholder orientation, while Dutch firms focus on broader stakeholder orientation.

In this study, we conclude four reasons that why there is a value discount by hedging with FCD in terms of our samples. The first one is that we only analyze the relation between firm value in 2012 and hedging with FCD. Owing to that the target of Dutch firms to gain a value creation in a long term, our study with only one year research fail to show a positive association between hedging and firm value. The second reason might be that the costs that perform hedging activities are greater than gains from hedging. Thirdly, the endogeneity like credit rating might affect firm value negatively. And then grater agency costs and monitoring problems are the final reasons contribute to negative relation between hedging with FCD and firm value.

Consider to the contribution of this study, it verifies the negative value effect of foreign currency derivatives in Netherlands, contrary to most prior studies using US samples. Additionally, this research will be helpful to guide managers, policy decision persons to determine whether use the derivatives to add firm value for Dutch firms or not.

6. Limitation

There are several limitations to this study that could b addressed in the future. The first limitation is from the approximation of firm value, Tobin's Q. In our study, Tobin's Q is defined as the ratio of total assets minus book value of equity plus market value of equity to the book value of total assets, which is a simple and general method to calculate Tobin's Q. while there are other complicated methods to construct Tobin's Q that are not used in this study.

Another limitation in this study is lack of time-series analysis. In this study, the association between hedging with FCD and firm value is only tested based on year of 2012. Thus, the conclusion of negative relation between hedging with FCD and firm value is biased. In addition, a biased conclusion that hedging may decrease firm value might come from uncontrolled endogeneity.

Appendix:

Appendix 1: empirical evidences on hedging incentives.

Hedging theory	Source	Summary
A. Financial distress	Smith and Stulz(1985)	Based on Smith and Stulz(1985) model, probability of hedging is higher for firms with higher expected financial distress costs. Firm with a higher level of leverage and debt to equity which exposure to a greater financial distress.
	Dolde (1995)	They construct a direct measure of the expected costs of financial distress and find some evidence that hedging mitigates the effects of leverage.
	Berkman and Bradbury (1996)	This study provides evidence on the corporate use of derivative instruments from the 1994 audited financial statements of 116 firms. And they find that greater expected financial distress costs cause greater hedging.
	Gay and Nam (1998)	They find a positive relation between hedging and leverage.
	Nance et al. (1993)	Since direct financial distress costs are less than proportional firm size, Nance et al. (1993) argue that smaller firms are more likely to hedge than large firms.
	Graham and Rogers (2002)	They find a positive relation between hedging and leverage, consistent with the view that greater expected financial distress costs cause greater hedging.
	Wang and Fan (2011)	They collect data from 102 oil and gas firms in U.S during the period 2003-1004 and the results indicate that hedging has a useful effect on higher leveraged firms.
B. Taxes	Smith and Stulz (1985)	When firms face a convex tax function, reducing the volatility of taxable income may reduce the expected value of tax liabilities
	Nance, Smith and Smithson (1993)	They survey 169 firms attempting to test the determinants of real hedging activity. They propose that firms with more convex tax schedules hedge more
	Leland (1988)	Hedging can also increase a firms' debt capacity, therefore generating greater tax advantages from greater leverage.
	Graham and smith (1999)	They conduct a research to empirically test tax convexity theory for a large sample of U.S. firms. The results show that firms facing a convex tax schedule can achieve averagely $120,000 tax savings by reducing income volatility by 5%.
	Graham and Rogers (2002)	They find that tax function convexity does not influence a firm's hedging activities
	Bessembinder (1991)	Result shows that corporate hedging with forward contracts can increase firm value by reducing underinvestment

		problems.
C. Underinvestment	Froot et al. (1993)	Evidence shows that a firm's hedging activity can increase value because it ensures that a firm has sufficient cash flow available to make value enhancing investments.
	Géczy, Minton and Schrand (1997)	They argue that firms with greater growth opportunities and tighter financial constraints are more likely to hedge.
	Gay and Nam (1998)	They find evidence of a positive relation between a firm's derivatives use and its growth opportunities, as proxy by several alternative measures.
	Allayannis and Ofek (2001)	They are argue that a firm with more growth opportunities would face higher underinvestment costs and have a greater incentive to hedge.
	Bartram, Brown and Fehle (2006)	The analysis shows that capital expenditure has a positive and significant relationship with hedging.
Manager utility maximization theory	Smith and Stulz(1985)	They argue that stock options introduce a convexity between managerial wealth and stock value, offsetting the concavity in the managers' utility function. It in turn makes managers behave less risk aversion, which reduces the need for corporate hedging.
	Tufano (1996)	His evidence is consistent with manager utility maximization. Managers who hold more stock tend to hedge more, while managers who hold more options tend to hedge less.
	Graham and Rogers (2002)	They find that derivatives usage is associated to managers' equity positions.
	Knopf, Nam and Thornton (2002)	The results indicate a positive relation between hedging and managerial share ownership, which is consistent with the managerial risk aversion argument.
	Géczy et al.(1997); Haushalter (2000)	They find no evidence that managerial risk aversion or shareholdings affect corporate hedging. Conversely, the results of these studies are consistent with value maximization theory.

Appendix 2 summarizes the empirical evidence on relation between hedging risks and firm value:

Source	Sign	Summary
Allayannis and Weston (2001)	+	They test the potential impact of foreign currency derivatives (FCDS) usage on firm value with a sample of 720 large U.S. nonfinancial firms in the period of 1990-1995.And they find that there is a positive relation between firm value and use of FCDS.
Graham and Rogers (2002)	+	Study results show that hedging can increase debt capacity of firms by 3.03%. This increased debt capacity produces tax savings of 1% to 2% and an

		equivalent increase in firm value.
Guay and Kothari (2003)	Insignificant positive	They use a sample of 234 large non-financial firms using derivatives to survey the impact of hedging on firm value. They propose that derivatives usage does not have a significant influence on firm value.
Lookman (2004)	-	He investigates the impact of hedging on firm value with a sample of oil and gas exploration and production firms. He suggests that hedging does not lead to higher firm value
Nelson, Moffitt and Affleck-Graves (2005)	+	They use a sample of 1,308 publicly-traded US corporations from the period of 1995-1998 and found that firms using derivatives generally have abnormal returns of about 4% per year.
Rogers and Simkins (2006)	+	They find hedging to create a premium of 14.94% -16.08% on firm value, statistically significant at the level of 10% and 1%.
Jin and Jorion (2006)	Insignificantly positive	They use a sample of 119 U.S. oil and gas producers from the period of 1998-2001 to evaluate effect of hedging activities on firm value. In their investigation, hedging gas prices leads to a 3.7% discount in firm value, while oil hedging adds firm value by 0.7%, in both cases without statistical significance.
Mackay and Moeller (2007)	+	For a sample of 34 oil refiners, we find that hedging concave revenues and leaving concave costs exposed each represent between 2% and 3% of firm value.
Júnior& Laham(2008)	+	This paper examines the impact of company's hedging activities on firm value for a sample of non-financial Brazilian companies from 1996 to 2005. The results show that hedging activities do increase the firm value.
Kapitsinas (2008)	+	This paper presents evidence on the use of derivative contracts in the risk management process of Greek non-financial firms. He finds that the value of companies using derivatives is, on average, 4.6% higher than the value of companies that do not use these instruments.
Bartram et al. (2009)	+	They consider a large sample of 7319 non financial firms from 50 countries for the period of 2000-2001 to investigate the relationship between the use of derivatives and firm value. Their results show that hedging is a value enhancing activity.
Magee (2009)	Positive or no relationship	He use a sample of 408 large US firms to investigate the impacts of foreign currency derivatives on Tobin's

		Q.Study results show positive relationship between foreign currency derivatives and firm value. But found no relationship between firm value and foreign currency hedging after controlling the dependence of foreign currency hedging on past amount of firm value.
Fauver & Naranjo (2010)	-	Using derivative usage data on over 1746 firms headquartered in the U.S. during the 1991 through 2000 time period, they find a negative association between Tobin's Q and derivative usage.
Khediri (2010)	-	They use a sample of 250 non-financial firms from the French market over the period of 2000-2002 to examine the relation between hedging and firm value. They find that the decision to use derivatives has a negative effect on firm valuation.
Brown and Conrad (2011)	+	They find strong evidence that financial derivative usage can reduce both total risks and systematic risks.
Bashir, Sultan & Jghef (2013).	No relationship	Results of this study are in consistent with the theories of no relationship between the use of derivatives and firm value. The current study finds no significant impact of derivatives usage on firm value while using Tobin's Q is used as valuation measure. However use of FCD is associated with lower firm value while use of IRD adds value only in case when alternative measures of firm value (Alt. Q1 and Alt. Q2) are considered.

Appendix 3 describes how to select the samples and the list of final samples

Product name	**Orbis**		
Update number	**120**		
Software version	**128.00**		
Data update	**27/02/2014 (n°12012)**		
Username	**Universiteit Twente-755**		
Export date	**02/03/2014**		
		Step result	**Search result**
1.	**All active companies and companies with unknown situation**	**1,510,814**	**1,510,814**
2.	**World region/Country/Region in country: Netherlands**	**41,506**	**30,771**
3.	**Accounting practice: IFRS (International Financial Reporting Standards)**	**75,550**	**246**
4.	**Years with available accounts: 2012**	**946,279**	**208**
5.	**Listed/Unlisted companies: Publicly listed companies**	**62,973**	**124**
	Boolean search : 1 And 2 And 3 And 4 And 5		
		TOTAL	**124**

First of all, the search settings are: World region/ Country/ Region in country: Netherlands; Years

with available accounts: 2012; Listed/ Unlisted companies: Publicly listed companies; Accounting practice: IFRS. After setting these four criteria for searching the samples I get 124 firms. The second step is that remove the firms with the SIC of 6000-6999 and remove some firms that have missing data (like leverage, assets, sales, etc.), then I get 93 samples in total. The following table is the list of final sample in this study:

The Standard Industrial Classification (SIC) is a system for classifying industry by a four-digit code. From 0100 till 0999 is the division Agriculture, Forestry and Fishing, from 1000 till 1499 is the division Mining, from 1500 till 1799 is Construction, 1800 to 1999 is not used, from 2000 till 3999 is the division Manufacturing, from 4000 till 4999 is the division Transportation, Communications, Electric, Gas and Sanitary service, from 5000 till 5199 is the division Wholesale Trade, from 5200 till 5999 is the division Retail Trade, from 6000 till 6799 is the division Finance, Insurance and Real Estate, from 7000 till 8999 is the division Services and from 9100 till 9729 is the division Public Administration. Tobin's Q is defined as the ratio of total assets minus the book value of equity plus the market value of equity divided by the book value of assets. Log of total assets is as a proxy for size of firm. ROA as a proxy for profitability of the firm is calculated by net income divided by total assets. The dividend dummy is built for proxy of access to financial markets: it equals to 1 if the firm pay dividends in 2012 and 0 otherwise. Leverage is defined as long-term debt to total assets. The ratio of capital expenditure to total sales is employed as a proxy for investment opportunities. And industry diversification is included at a dummy variable at 4-digit SIC Code which 1 refers to more one than business segments.

Company name	US SIC Primary code	Log of Tobin's Q	Hedging by FCD	Log of total assets	ROA	cash dividends dummy	leverage	Investment opportunity	Industrial diversification
Airbus Group N.V.	3728	0.061	1	4.964	1.33	1	0.038	0.058	1
Koninklijke Ahold NV	5411	0.119	1	4.178	5.48	1	0.173	0.028	0
Koninklijke Philips N.V.	3639	0.104	1	4.464	0.88	1	0.128	0.043	1
Heineken NV	2082	0.171	1	4.556	8.20	1	0.318	0.068	0
Randstad Holding NV	7361	0.115	1	3.832	0.44	1	0.000	0.004	1
Akzo Nobel NV	2834	0.106	1	4.254	-12.08	1	0.189	0.054	1
Koninklijke KPN NV	4899	0.053	1	4.350	3.08	1	0.552	0.178	0
X5 Retail Group N.V.	5411	0.106	0	3.861	-1.32	0	0.245	0.057	0
Koninklijke DSM N.V.	2899	0.080	1	4.078	2.32	1	0.161	0.075	0
Koninklijke Bam Groep NV	1521	-0.009	1	3.824	-2.81	1	0.187	0.003	1
TNT Express N.V.	4789	0.151	1	3.652	-1.85	1	0.043	0.017	0
Stmicroelectronics N.V.	3674	-0.036	1	3.935	-10.49	1	0.059	0.110	1
Nutreco N.V.	2048	0.163	1	3.450	6.27	1	0.171	0.026	1
Royal Imtech N.V.	1731	0.106	1	3.595	-5.92	1	0.011	0.015	1
Asml Holding N.V.	3674	0.475	1	3.897	16.52	1	0.096	0.036	0
Postnl N.V.	4311	0.020	1	3.668	14.54	0	0.347	0.047	1
Wolters Kluwer NV	7372	0.170	1	3.817	4.91	1	0.228	0.040	1
Corbion N.V.	2064	0.052	1	3.340	-2.92	1	0.281	0.023	1
Koninklijke Boskalis Westminster NV	1629	0.133	1	3.689	5.12	1	0.124	0.041	1
Fugro NV	8713	0.146	1	3.620	6.99	1	0.280	0.122	0
USG People N.V.	7361	-0.005	0	3.130	-14.23	1	0.161	0.007	0

SBM Offshore N.V.	1389	0.069	1	3.681	-1.26	1	0.301	0.182	1
Arcadis NV	8711	0.160	1	3.248	5.02	1	0.170	0.014	0
Sligro Food Group N.V.	5141	0.153	1	2.986	7.18	1	0.181	0.017	0
Heijmans NV	1522	-0.068	1	3.142	-6.44	1	0.047	0.012	1
Gemalto N.V.	3679	0.380	1	3.434	7.41	1	0.001	0.056	0
Aalberts Industries NV	3492	0.141	1	3.291	6.91	1	0.135	0.051	1
Vimetco N.V.	3354	-0.031	1	3.608	-2.65	1	0.273	0.121	0
Oranjewoud N.V.	7378	-0.055	1	3.049	2.11	0	0.056	0.015	1
Ziggo N.V.	3669	0.228	0	3.715	3.72	1	0.568	0.182	0
ASM International NV	3674	0.204	1	3.190	1.03	1	0.008	0.048	0
Koninklijke Vopak N.V.	4226	0.299	1	3.701	6.40	1	0.415	0.348	0
Ballast Nedam N.V.	1629	-0.016	1	2.947	-4.63	1	0.122	0.019	1
Brunel International NV	8748	0.394	0	2.623	10.52	1	0.000	0.006	1
TKH Group N.V.	3357	0.135	1	3.017	2.77	1	0.195	0.037	1
Tomtom NV	3669	0.002	1	3.237	7.47	0	0.101	0.049	0
Royal Ten Cate NV	2299	0.031	1	2.967	2.41	1	0.238	0.016	0
Macintosh Retail Group NV	5999	0.005	1	2.687	-25.92	1	0.083	0.022	1
Qiagen NV	3826	0.133	1	3.495	3.06	0	0.208	0.081	0
Stern Groep NV	5511	-0.047	0	2.703	-1.37	1	0.077	0.090	1
Advanced Metallurgical Group N.V.	8711	0.011	1	2.856	0.25	0	0.280	0.040	0
Nord Gold N.V.	1041	-0.032	1	3.347	1.93	1	0.158	0.396	0
Grontmij NV	8711	0.011	0	2.863	-4.30	0	0.184	0.012	0
Accell Group NV	3751	0.048	1	2.780	3.85	1	0.026	0.019	0
Core Laboratories N.V.	1389	0.941	0	2.683	33.95	1	0.368	0.034	0
Koninklijke Wessanen NV	2023	0.077	1	2.529	-15.74	1	0.180	0.008	1
Amsterdam Commodities N.V.	5149	0.245	1	2.425	10.17	1	0.061	0.020	0
Telegraaf Media Groep N.V.	2711	-0.025	0	2.903	-1.89	1	0.099	0.047	1
Unit4 N.V.	7372	0.225	1	2.788	3.96	1	0.147	0.079	0
Ordina NV	4899	-0.173	0	2.501	0.14	0	0.029	0.013	0
Beter Bed Holding NV	2514	0.490	0	2.045	13.01	1	0.009	0.028	1
Astarta Holding N.V.	0119	-0.005	1	2.815	6.92	1	0.237	0.146	0
AVG Technologies NV	7372	0.490	1	2.510	13.38	1	0.263	0.051	1
Head N.V.	3949	-0.079	1	2.568	0.34	0	0.186	0.025	0
Teleplan International NV	4899	0.169	0	2.208	9.67	0	0.311	0.016	0
Roto Smeets Group N.V.	2741	-0.082	1	2.246	-16.56	0	0.026	0.019	1
Milkiland N.V.	2022	-0.091	0	2.511	3.94	0	0.143	0.121	0
Kendrion N.V.	3089	0.134	1	2.362	7.78	1	0.112	0.066	1
Cinema City International N.V.	7832	0.050	1	2.737	4.54	0	0.376	0.312	0

Interxion Holding N.V.	7379	0.310	0	2.913	3.86	0	0.352	0.643	0
Neways Electronics International NV	3679	-0.009	1	2.011	-0.40	1	0.007	0.015	0
BE Semiconductor Industries NV	3674	-0.040	1	2.560	4.29	1	0.005	0.058	0
Exact Holding NV	7372	0.381	1	2.313	9.09	1	0.017	0.028	1
Nederlandsche Apparatenfabriek 'Nedap' N.V.	3679	0.304	0	2.118	10.29	1	0.127	0.064	1
Simac Techniek NV	7379	0.039	0	1.909	2.91	1	0.000	0.018	0
Crown Van Gelder N.V.	2621	-0.173	1	1.859	-33.58	0	0.000	0.030	1
Batenburg Techniek N.V.	1796	-0.053	1	1.910	1.26	1	0.000	0.012	1
Docdata NV	3652	0.218	0	1.920	9.03	1	0.000	0.078	0
Xeikon N.V.	3523	-0.191	1	2.417	3.43	0	0.020	0.023	0
Hydratec Industries N.V.	3084	-0.014	1	1.932	5.49	0	0.077	0.042	0
AFC Ajax NV	7941	0.235	0	2.015	10.11	0	0.023	0.183	0
Value8 NV	3679	0.017	0	1.599	5.74	0	0.000	0.031	0
Fortuna Entertainment Group N.V.	7999	1.670	0	1.978	12.96	1	0.144	0.042	0
H.E.S. Beheer NV	4226	0.337	0	2.334	11.85	1	0.279	0.230	0
C/Tac NV	7379	0.034	0	1.601	2.03	0	0.069	0.013	0
ICT Automatisering NV	7372	-0.028	0	1.680	-11.14	1	0.000	0.013	0
Holland Colours NV	2851	-0.025	1	1.612	4.17	1	0.088	0.016	0
DPA Group N.V.	7361	0.164	0	1.821	1.76	0	0.000	0.003	1
Plaza Centers N.V.	4949	-0.191	1	2.981	-8.18	0	0.131	0.036	0
AD Pepper Media International NV	7311	-0.007	1	1.507	-16.42	0	0.000	0.006	0
Cryo-Save Group N.V.	8082	-0.062	0	1.745	-30.75	1	0.058	0.054	0
Catalis S.E.	4899	-0.121	0	1.395	0.42	0	0.000	0.030	0
N.V. Koninklijke Delftsch Aardewerkfabriek 'DE Porceleyne Fles Anno 1653'	3262	-0.088	1	1.313	0.85	0	0.006	0.033	0
Funcom N.V.	7321	0.225	1	1.398	-188.00	0	0.160	0.584	0
Photon Energy N.V.	8741	0.052	0	2.061	-9.38	0	0.403	0.125	0
Jubilant Energy NV	1382	0.101	0	2.573	-2.02	0	0.822	3.474	0
Tie Kinetix N.V.	7372	0.124	0	0.958	7.18	0	0.015	0.083	0
Roodmicrotec N.V.	3679	-0.029	0	1.118	-0.62	0	0.107	0.123	0
Pharming Group NV	2834	0.470	0	1.226	3	0	0.116	0.058	0
Nedsense Enterprises N.V.	7372	0.017	0	1.202	-8.89	0	0.231	0.300	0
And International Publishers NV	7379	-0.165	0	1.103	13.84	0	0.000	0.014	0
Spyker N.V.	3711	0.158	0	1.145	814	0	0.070	0.063	1
Unilever NV	2099	0.388	1	4.664	107.00	1	0.215	0.042	1

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