BI NORWEGIAN SCHOOL OF MANAGEMENT

GRA 69972 - Master of Science Thesis

Drivers of Derivatives Use

-Evidence from the Oslo Stock Exchange

Abstract: This paper studies the hedging incentives of 180 non-financial Norwegian firms from 1997 to 2007. Our data provides substantial empirical support for the scale economies and foreign exposure drivers of hedging actions. We do not find consistent evidence for the financial distress and underinvestment arguments. Ownership concentration weakly impacts the sample firms' hedging decision. The predicted effect of liquidity is ambiguous due to indeterminate evidence. With presenting time control, these results are robust across different sample time frames. Our findings are similar in both panel and cross-sectional data formats, suggesting that firms' characteristics do not influence the general conclusions.

BI Oslo

29th of August, 2008

Supervisor: Paul Ehling

Shanshan Cui
MSc in Financial Economics

Nicoleta Vaja
MSc in Financial Economics

Acknowledgement

This paper is written as a Master of Science thesis at the BI Norwegian School of Management. We would like to express our great appreciation to our supervisor Paul Ehling for his critical feedback, kind support and patient guidance throughout this paper. We would also like to thank Pål Rydland for his assistance in assessing the Center for Corporate Governance Research database.

Table of Contents

1. Introduction

In the classic Modigliani-Miller framework, risk management activities do not add value to firms. In real life, imperfect capital markets create the incentives for firms to hedge. Theoretical explanations include: financial distress, underinvestment, scale economies, foreign exposure, ownership concentration, liquidity issues and tax considerations[1]. It is of interest to examine firms' hedging motivations, an important part of companies' financial management activities. Extant studies have been done regarding this issue, most of which are based on US data (Nance et al., 1993; Geczy et al., 1997; Allayannis and Ofek, 2001; Guay and Kothari, 2003; Faulkender, 2005; Jin and Jorion, 2006). Evidence in Norway concerning this topic is still lacking (Falch et al., 2002; Aziz and Weinl, 2006).

This empirical research investigates firms' hedging motivations in the Norwegian market. We employ derivatives hedging to proxy for the companies' overall risk management behavior and test the relationship between six motivations and the derivatives use. We target the non-financial firms listed on the Oslo Stock Exchange on the 1st of June 2007 and construct a panel dataset based on these firms from 1997 to 2007. The panel format controls for the grouped nature of the data and is ideal for our study purpose.

The estimation outputs show that large firms benefit from economies of scale associated with the costs of hedging. Foreign exposure positively affects the hedging decision. Unlike the studies done in some other markets, our results do not provide consistent support for the financial distress[2] and underinvestment[3] arguments. The ownership concentration[4] consideration weakly impacts the sample firms' hedging decision. The evidence concerning liquidity is

[1] Hedging adds value to the firm in the context of a progressive tax code (Smith and Stulz, 1985). As there is a unique corporate tax rate of 28% in Norway, we do not test this hypothesis.
For corporate code in Norway, see:
http://www.nationsencyclopedia.com/Europe/Norway-TAXATION.html

[2] Substantial evidence for this factor is provided by Clark et al. (2006) and Judge (2006).

[3] See Geczy et al. (1997).

[4] See Lel (2006).

indeterminate. Therefore it is ambiguous whether this factor is a substitute or a complement to hedging.

We notice that the reporting standard changes in Norway during the sample time. Our robustness check outputs show that with presenting time control this change does not affect our findings. Our results are similar in the cross-sectional data format, suggesting that firms' characteristics do not influence the general conclusions.

The paper is structured as follows. In section 2, we discuss the theoretical background and present our hypotheses. We describe the sample in section 3 and summarize the estimation results in section 4. Section 5 concludes the study.

2. Literature Review and Hypotheses

Based on the predictions of several previous studies, we choose 12 variables to measure the six hypotheses that we examine. We present in Table 1 the *a priori* hypothetical expectations employed in Nance et al. (1993), Geczy et al. (1997), Judge (2006) and Lel (2006) and summarize our predictions for these predictors.

2.1 Financial Distress

The hedging theories stem from relaxing the Modigliani-Miller (1958) assumption that firm value will remain the same in the presence of hedging. The above violations of perfect markets have been studied by Smith and Stulz (1985). They argue that, by reducing the variability of cash-flows, hedging contributes to diminishing bankruptcy costs. That is, hedging reduces the probability of financial distress states and its associated costs[5]. Therefore, we expect risk to be managed more often in distressed firms.

H_1: Firms with higher financial distress probability are more likely to use derivatives.

We use five variables to measure the financial distress factor. First of all, this driver can be captured by the firm's ability to meet its interest payments in the course of ongoing business. We measure this through the Interest Coverage (IC) ratio (Nance et al., 1993; Geczy et al., 1997; Judge, 2006). Since a firm that has a higher IC ratio has a lower probability of going bankrupt, we expect a negative relationship between this ratio and hedging.

Secondly, the leverage of the firm could be represented through the Gearing Ratio (GR). We compute it as the ratio of total equity over total assets. Intuitively, as a firm has an increased leverage, it will have a higher probability of using instrumental hedging tools (Nance et al., 1993; Geczy et al., 1997; Judge, 2006; Lel, 2006). So, this ratio's effect on the derivatives decision should be negative.

[5] According to Ross (1997) and Leland (1998), hedging can increase the debt capacity and, consequently, tax benefits, which helps to increase firm value.

Table 1: Hypotheses Review and Prediction

Evaluation of the *ex ante* expectations of prior empirical research relevant in light of our investigation. The predictions of the previous four studies rely partly on the theoretical assertions made by Warner (1977), Smith and Stulz (1985) and Froot, Schrafstein and Stein (1993). Our own prediction is made by balancing the empirical papers' predictions with our view with respect to the hedging determinants. The `Gearing Ratio / (Price/Earnings ratio) ` variable is suggested by us.

Independent variables	Previous research prediction				Our prediction
	Nance et al. (1993)	Geczy et al. (1997)	Judge (2006)	Lel (2006)	
Financial distress					
Interest Coverage ratio	-	-	-	NA	-
Gearing Ratio[6]	-	-	-	-	-
Dividend Payout ratio[7]	NA	+	NA	+	+
Current Ratio[8]	-	-	NA	NA	-
Size	-	NA	-	NA	-
Underinvestment					
Size	NA	NA	-	NA	-
GR_RD[9]	NA	-	NA	NA	-
GR_KE[9]	NA	-	NA	NA	-
GR_PE	NA	NA	NA	NA	-
GR_MB[9]	NA	-	NA	-	-
Scale Economies					
Size	+	ambiguous[10]	+	+	+

[6] Previous research used Debt-to-Assets as leverage proxy, for which they had positive sign expectations. However we use Equity/Assets. Therefore, we change the sign of previous research expectations to negative to fit our definition.

[7] In these previous studies, Dividend Yield has been used instead. Nevertheless, this does not affect the comparison with our research, since Dividend Yield and Dividend Payout Ratio have similar interpretation.

[8] Nance et al. (1993) and Geczy et al. (1997) do not include CR when testing the financial distress hypothesis, but indicate in their theoretical expectations that an increased CR provides higher short-term liquidity and, consequently, reduces the expected costs of financial distress.

[9] Geczy et al. (1997) used the products: (Debt ratio)*RD; (Debt ratio)*Capital expenditure and (Debt ratio)* (Book-to-market ratio), respectively. For all these products they expected to have a positive sign. Nevertheless, this sign changes when interpreted in terms of our ratios: (Equity ratio)*(1/RD), (Equity ratio*(1/Capital Expenditure) and (Equity ratio)*(1/MB), respectively.

[10] Result obtained from Geczy et al. (1997: 13).

Table 1
Continued.

Independent variables	Previous research prediction				Our prediction
	Nance et al. (1993)	Geczy et al. (1997)	Judge (2006)	Lel (2006)	
Foreign Exposure					
Foreign Revenue percentage	NA	+	+	+	+
Foreign Operations dummy	NA	NA	+	NA	+
Ownership Concentration					
Herfindahl Index[11: a), b)]	NA	NA	NA	+	+
Liquidity					
Current Ratio	-	-	-	NA	-
Dividend Payout ratio	-	-	+	+	-

Thirdly, a measure relating the liquidity constraint as a source of financial distress is the Dividend Payout (DP) ratio. It is possible for companies that pay dividends more often to have an increased exposure to bankruptcy states (Geczy et al., 1997; Lel, 2006). Therefore, we expect a positive influence of DP on the predicted outcome.

In a fourth respect, the Current Ratio (CR) reflects the firm's capability of avoiding financial distress states by increasing its short-term liquidity. A higher CR could result in a lower probability of implementing instrumental hedges (Nance et al., 1993; Geczy et al., 1997).

From the fifth point of view, according to Nance et al. (1993), the expected costs of financial distress could have a greater bearing on the smaller firms than on the larger ones. In view of these expectations, firm Size (S) should be negatively related to the use of derivatives. However, the transaction costs of hedging are usually important in small firms. If these costs are too high, hedging might not

[11] a) Lel (2006) uses Institutional Ownership and Inside Ownership instead. This does not affect the comparison, as the interpretation is similar.
b) Geczy et al. (1997) also use the Institutional Ownership variable, but in the context of testing the asymmetry cost hypothesis of available information between shareholders and managers. Instead, our ownership concentration hypothesis investigates the reduction of firm-specific risk of large shareholders through hedging.

take place. This means that the sign of this variable will not necessarily be negative. See section 2.3 for further discussion.

2.2 Underinvestment

Another implication of imperfect capital markets draws from the fact that external finance is costly. More precisely, the argument of Froot et al. (1993) states that companies which do not hedge their cash-flows might have to underinvest[12] in states where they need external financing, but in which the cost of capital raised is higher than the return on their investment opportunities. In this light, hedging is advantageous to the firm if it is able to remove "unnecessary" fluctuations in the firm's earnings. Moreover, Froot et al. (1993) argue that hedging should be done in a higher proportion for firms with higher investment opportunities and with higher asymmetry costs. In other words, they predict that hedging is done most by firms that are small (higher information asymmetry) and by the ones that have substantial growth prospects (investment opportunities). We anticipate that underinvestment situations positively influence the use of derivatives in Norwegian firms.

H_2: Firms exposed to underinvestment costs (firms with positive NPV projects that have relatively high leverage) are more likely to engage in derivatives hedging.

Five variables will be used to measure this hypothesis. Usually smaller firms have a more restricted access to financing due to higher leverage or higher transactions costs. When these firms meet with growth opportunities, the underinvestment issue is triggered. In consequence, hedging could provide the necessary liquidity for smaller firms to off-set their underinvestment costs. Hence, firm Size (S) could capture this hypothesis and the expected sign should be negative (Judge, 2006).

Previous studies employ the Research and Development (RD), Capital Expenditure (KE), Price/Earnings (PE) and Market-to-Book Value (MB) ratios to

[12] In the same line of reasoning as Froot et al.(1993), Bessembinder (1991) shows that employing derivatives induces a curtailment of underinvestment by diminishing the probability of default states of the firm, which leads to lower sensitivity of debtholder's claim to additional investment.

measure the firm's potential growth opportunities (Nance et al., 1993; Geczy et al., 1997; Judge, 2006; Lel, 2006). Geczy et al. (1997) and Lel (2006) indicate that these predictors might not fully capture the effect of underinvestment on the hedging decision because these ratios reflect only growth prospects, but in which leverage could be low (i.e., the cost of financing is low). Following this reasoning, we use interaction variables[13] of each of these four ratios with GR. As RD, KE, PE and MB capture the firm's potential to grow, they have a positive bearing on the hedging decision. The reason is that instrumental hedging represents a tool for seizing growth opportunities. By dividing GR with each of them, we obtain the variables GR_RD, GR_KE, GR_PE and GR_MB and we expect each of them to have a negative influence on the use of derivatives. That is, high leverage reflects a low gearing ratio and high growth opportunities reflect low (1/RD), (1/KE), (1/PE) and (1/MB) ratios, respectively.

2.3 Scale Economies

Geczy et al. (1997) empirically test the extant theories on US firms. Just like Nance et al. (1993), they find that firms that are larger exhibit a higher propensity to use derivatives. This indicates that large firms enjoy economies of scale in the costs associated with purchasing derivatives.

H_3: Larger firms tend to hedge a larger part of their exposures by purchasing derivatives, as they exhibit economies of scale in the transaction costs of implementing a risk management program.

For the effect of firm size on the hedging decision, empirical studies provide evidence favorable to the transaction costs economies of scale argument rather than to either the underinvestment or financial distress determinants (Nance et al., 1993; Geczy et al., 1997; Clark et al., 2006; Judge, 2006; Lel, 2006). In this light, we expect S to have a positive effect on the hedging decision in Norway as well.

[13] Similar interaction ratios have been used by Geczy et al. (1997) and Lel (2006).

2.4 Foreign Exposure

Foreign exposure[14] is commonly used in the literature to capture foreign exchange risk. Instrumental hedging is in many situations the most feasible tool when dealing with currency risk. Several studies show that foreign exposure has a substantial positive impact on using derivatives (Nance et al., 1993; Geczy et al., 1997; Allayannis and Weston, 1998; Clark et al., 2006; Lel, 2006). We expect this behavior to be met as well in the Norwegian market.

H_4: The probability of employing instrumental hedging tools should increase with the extent of the foreign exposure.

We use the Foreign Revenue Percentage (FR) and the Foreign Operations Dummy (FD) to measure the exposure to foreign exchange risk (Judge, 2006). Between both proxies and the hedging decision we expect positive relationships.

2.5 Ownership Concentration

Lel (2006) finds a positive relationship between high corporate governance (measured through several variables including the type of ownership[15]) and the use of currency derivatives, when the managers' strategy is to hedge foreign currency risk. On the other hand, he discovers that low corporate governance induces managers to use derivatives for speculating rather than for hedging purposes. Deriving from the findings of both Lel (2006) and Tufano (1996), we explore whether Norwegian firms' derivative strategy is a function of ownership concentration. We test whether large shareholders pressure the management to employ derivatives in order to hedge their extensive idiosyncratic risk. We use the Herfindahl Index (HI) as the proxy variable for measuring ownership concentration (Bøhren and Ødegaard, 2000) and expect a higher probability to hedge for the firms with a higher HI.

[14] Until now, it has not been possible to fully seize currency risk (e.g., currency risk of a company that does not engage in international business but has foreign competitors). Therefore, extant research only investigates the foreign exposure component of currency risk.

[15] This evidence is contrary to the one provided by Tufano (1996), who finds a negative effect of the ownership held in large blocks by outside investors on the hedging decision.

H_5: Firms with high ownership concentration are more likely to use derivatives than the ones with low concentration.

2.6 Liquidity

Clark et al. (2006) provide evidence that corporate hedging is negatively related to the liquidity of the company. Higher liquidity provides firms with a better ability to meet their debt obligations and finance their ongoing activity. Therefore, hedging is a tool that compensates for the lack of liquidity.

H_6: Liquidity is a substitute to hedging and should be negatively related to the hedging decision.

Although we have mentioned liquidity effects in the first hypothesis, it could also be regarded as a stand-alone factor (Nance et al., 1993; Geczy et al., 1997; Judge, 2006). We use two indicators from the aforementioned hypothesis, the Current (CR) and the Dividend Payout (DP) ratios. Both are expected to have a negative sign relative to the hedging decision. A higher CR reflects higher liquidity. DP is expected to have a decreasing effect on the dependent variable because liquidity is maintained through the retention of earnings. Therefore, a lower payout ratio implies lower liquidity, which we expect to increase the hedging probability.

3. Data Description

3.1 Data Collection

We empirically investigate the non-financial firms' hedging motivations in Norway. Considering data availability, we define our research population as the listed firms on Oslo Stock Exchange (Oslo Børs) and target the ones listed on the 1st of June 2008 (203). We eliminate the cross-listed companies that do not have any operation in Norway (20) and merge the share names that belong to the same heads (3)[16]. We keep the Norwegian subsidiaries of foreign owned firms in the sample and focus on their activities in Norway. The final sample consists of 180 firms.

We further construct an unbalanced panel composed of the yearly information for the 13 variables for the 180 sample firms from 1997 to 2007 (1980 firm-years and 13 observations in each firm-year). The data resources are DataStream, Annual Reports, CCGR and OBI[17]. See Table 2 for the concrete description for each variable. Half of the firms are present from 1999[18]. The effective sample size varies across different variables, because firms might not provide complete information for all predictors in their presenting time. The last data check was done on the 1st of July 2008, as firms are required to publish 2007 results before this time[19]. Some firms report their financial accounts in foreign currencies; see Appendix I for the exchange rates we use.

We notice that the accounting standard changes during the sample period. The new reporting standard, IFRS, becomes effective in Norway from 2005[20]; the

[16] Wilh. Wilhelmsen Odfjell and Hafslund list both "ser. A" and "ser. B" on Oslo Børs.

[17] CCGR is Center for Corporate Governance Research at the department of Financial Economics at BI. OBI is Oslo Børs Informasjon and the access is provided by BI Library.

[18] Presenting time illustrates the time period when the information of the firms is available based on the data resources. For example the information for Medi Stim is only available from 2001 although the firm has been established for 20 years; we set its presenting time as 7 years.

[19] There are still 5 firms who had not published their reports up until 1st July 2008.

[20] Before IFRS, all listed firms on Oslo Børs have to report complying with Regnskapsloven from 1999; however the specific reporting policies differ between firms. Some companies follow Norway GAAP; there are also cases that follow Sweden or US GAAP. For more information about this regulation change, see "http://www.regjeringen.no/en/dep/fin/Press-Center/Press-releases/2005/Adgang-til-a-anvende-IFRS-i-selskapsregnskapet-for-2005.html?id=103547".

Table 2: Variable Definition and Source

ID	Description	DEFINITION	SOURCE
DU	Derivatives Use	Dummy that takes the value 1 if the firm implements a hedging program and 0 if not	Annual Report
IC	Interest Coverage Ratio	Profit before interest and tax divided by interest payments	DataStream, Annual Report, OBI
GR	Gearing Ratio	Equity ratio = Total Equity/Total Assets	DataStream, Annual Report, OBI
DP	Dividend Payout Ratio	The ratio of dividends per share to earnings per share	DataStream, Annual Report, OBI
CR	Current Ratio	Current Assets/ Current Liabilities	DataStream, Annual Report, OBI
S	Size	Natural log of the firm's total assets	DataStream, Annual Report, OBI
GR_RD	Gearing Ratio/ Research and Development Ratio	(Equity/Total Assets) / (R&D expenses/Net Sales)	DataStream, Annual Report, OBI
GR_KE	Gearing Ratio/ Capital Expenditure Ratio	(Equity/Total Assets) / (Investment in fixed assets/Net Sales)	DataStream, Annual Report, OBI
GR_PE	Gearing Ratio/ Price to Earnings Ratio	(Equity/Total Assets) / (Share price/Earnings per share)	DataStream, Annual Report, OBI
GR_MB	Gearing Ratio/ Market to Book Value Ratio	(Equity/Total Assets) / (The market value of equity/The book value of equity)	DataStream, Annual Report, OBI
HI	Herfindahl Index	$\sum_i^n s_i^2$, where s_i is the ownership percentage share of shareholder i in the firm and n is the number of shareholders	CCGR
FR	Foreign Revenue Percentage	Foreign Sales/Net Sales	Annual Report
FD	Foreign Operations Dummy	A dummy variable which equals to 1 if the firm has offices or subsidiaries outside Norway and 0 if not	Annual Report

statements in 2004 are also required to be adapted. Exceptions exist for special firms[21]; however all are obliged to follow IFRS from 2007. Differences between standards are embodied in the accounting principles. The significant difference arises in the derivatives disclosure guidance (see section 3.3 for further description). The reporting regulations also differ with respect to other variables (i.e., the Equity Ratio). This standard change might disturb the data consistency and impact our estimations. However, the robustness check in section 4.2 indicates that our results are not influenced by this standard change.

3.2 Outliers

We observe in our sample that some data points are far away from their mean values, which might be due to faulty figures or erroneous calculation procedures. A zero interest expense would lead to an abnormally high interest payout ratio, which cannot be justified by economic theories. These outliers will disturb the estimation outputs. We will take out the outliers to lower the variables' kurtosis, whilst trying to remove as few data points as possible to keep sample efficiency. GR_KE, GR_MB, GR_RD and GR_PE are calculated from the GR, KE, MB, RD and PE ratios, which are obtained directly from the databases. We will do the data processing only to the original data. See Appendix II for the detailed processing procedures.

3.3 Hedging Variable

We analyze the firms' risk hedging motivation and consider the hedging action as the dependent variable. We use derivatives hedging as the proxy for the firms' overall risk management behavior and employ a binary value to measure it. A hedging observation is equal to "1" if derivatives are used in that firm-year and "0" otherwise. We focus on the decision of firms to use derivatives rather than on the notional amount of these instruments. Sample firms might hedge in some years, but not in other periods; therefore the hedging observation values for the same firm can vary across time.

The detailed derivatives hedging information for the sample firms is obtained from their 1997-2007 annual reports.

[21] See "http://www.iasplus.com/europe/0209accountingdirective.pdf".

IFRS expands the transparency requirements for firms' disclosure of their risk management behavior. Under IFRS, firms have to report not only the fair value but also the principal amount and maturity information of the derivatives used[22]. This enables us to obtain complete information about the derivatives use for all presenting firms with published annual reports in that year. Relevant information is presented in the specialized financial risk management section of the reports.

For the remaining observations under other accounting standards, detailed quantitative hedging disclosure is not required and the revealing styles vary across reports. Hedging information is usually found in the footnotes and we check the entire body of such reports. For the statements that do not disclose hedging information or the information is not enough for us to justify whether derivatives are used, we set the corresponding hedging observations as missing. Some of these missing data could be saved back by tracking the information revealed in later annual reports.

Certain companies use derivatives that do not qualify as hedging instruments (i.e., the specific forward exchange contracts used by the firm REM in 2006) and we classify them as non-users. See Appendix III for detailed data collection procedures for the hedging observations.

Some firms might not report derivatives use data prior IFRS. Therefore, the hedging observations in those firm-years are missing. Consequently, the information collected from statements under other standards is not complete and may bear special characteristics. Simply mixing the hedging observations reported under different standards could lead to biased outputs and render unreliable results. This issue lies in the same line with the standard change mentioned in section 3.1. See section 4.2 for further discussion.

There is a dispute about the proxy for the hedging activity. Some articles (Judge, 2006) regard both the derivatives and the natural hedging activities (such as foreign debt) as the hedging variable; however this method is not necessary for

[22] See "http://www.iasb.org/NR/rdonlyres/5710E66C-FCB2-41FF-B146-7F7B9BC97EF3/0/IFRS7.pdf".

our paper. We find that all the derivatives users are at the same time hedging naturally (e.g. foreign debt) in our sample. We further do a comparison test for the 12 predictors and find most of them to significantly differ between the derivatives users and the non-users. See Table 3 in section 3.6 for further discussion. We thus argue that in our research derivatives use could effectively represent the firms' means to hedge.

3.4 Independent Variables

We collect the information of the Interest Coverage Ratio, Equity Ratio, Dividend Payout Ratio, Current Ratio, Total Assets, Research and Development Expenses (R&D), Capital Expenditure, Price-to-Earnings Ratio and Market-to-Book Ratio mainly from DataStream. Firms' annual reports and OBI are used as supplements for the missing information from DataStream, especially for the Dividend Payout Ratio and R&D. Some of the zero value observations for these two variables are set as missing in DataStream. We then take the natural log of Total Assets as the firms' size and calculate GR_RD, GR_KE, GR_PE and GR_MB afterwards.

Herfindahl Index is from CCGR. The information provided for this ratio is limited and only covers 2000-2006[23].

Foreign Revenue Percentage and Foreign Operations Dummy are collected from the annual reports. They measure two different aspects of the firms' foreign exposure. Foreign Revenue Percentage represents the firms' foreign currency revenue/loss, while the Foreign Dummy illustrates their geographical operation abroad. Firms operating only in Norway may also have foreign revenue/loss. We collect the FR data based on the geographical segment reporting information in the reports. For the firms which do not report the segment data or do not specify the revenue in Norway[24], we set their FR as missing. The criteria we use for FD are the firms' foreign subsidiaries or presentation offices. We set FD to "1" if the firm has subsidiaries or offices outside Norway and "0" otherwise. FD will also be

[23] HI data for 2007 is still not available on the 1st July 2008 in CCGR.

[24] Some firms divide their geographical area broadly and only report the segment revenues for Europe or Nodic Area.

set as missing if it is unreported or unclear.

3.5 Control Variables

We introduce time and industrial sector control dummies.

As the financial market has become increasingly liquid, more firms tend to join the market and use derivatives. The time impact possibly differs across different years due to different macroeconomic situations. Thus we will include year dummies to mitigate this potential influence. The idiosyncratic features of different industrial sectors can also interfere with the hedging decision. As Jin and Jorion (2006) illustrated, the US oil and gas sector has distinguished hedging characteristics compared with others because it has very liquid exchanges for the underlying in the US. We control for the features inherent to different industries by including sector dummies in the regressions. We base on the Global Industry Classification Standard (GICS) and classify the sample firms into 9 sectors: Energy, Materials, Industrials, Consumer Discretionary, Consumer Staples, Healthcare, Information Technology, Telecom Services and Utilities[25]. GICS is also employed by Oslo Børs.

3.6 Statistical Summary

Table 3 summarizes the firms' statistical characteristics.

Panel A displays the statistical summary for the whole sample observations across 11 years. All the variables have statistically significant high kurtosis; most observations also present significant skewness. Thus, the variables of our sample firms are far away from the normal distribution. Only half of the total firm-year observations report hedging information, 64% of which employ derivatives.

Panel B and C describe the statistical summary for the groups of derivatives and non-derivatives users. Due to cross-variable observation deletion[26], the observations in Panel B and C do not sum up to the corresponding observation numbers in Panel A. Panel D describes the outputs of Mann-Whitney

[25] According to MSCI&SP, the codes for these 10 sectors are as follows: 10=Energy, 15=Materials, 20=Industrials, 25=Consumer Discretionary, 30=Consumer Staples, 35=Health Care, 40=Financials, 45=Information Tech, 50=Telecom Services, 55=Utilities. The sector "Financials" is taken out as we do not target on these firms in our research. For more information, see "http://en.wikipedia.org/wiki/Global_Industry_Classification_Standard".

[26] Firm may not report derivative information across all its presenting years.

Table 3: Statistical Summary

This table presents the statistical summary of the variables. Panel A displays the univariate summary statistics of all the observations. The null hypothesis for skewness/kurtosis tests is that there is no significant skewness/kurtosis. Panel B and C describes the statistical summary of the variables for the derivatives users and non-users. Panel D displays the Mann-Whitney test results. The null hypothesis is that the two groups are from the same population.

Variable	IC	GR	DR	CR	S	HI	FR	GR_RD	GR_KE	GR_PE	GR_MB	FD	DU
PANEL A: Whole Sample													
Obs	1348	1372	1264	1379	1378	839	807	552	1201	732	1066	1208	981
Mean	-4.464	0.529	15.551	2.366	13.752	0.187	0.523	179.121	32.383	0.065	168.164	0.866	0.638
St. Dev.	151.981	0.265	23.699	2.664	2.024	0.235	0.343	895.498	365.878	0.551	426.900	0.341	0.481
Skewness	-4.428	0.053	1.478	4.468	0.027	2.260	-0.154	15.162	33.438	26.624	13.367	-2.147	-0.575
Skewness Test P-Value	0.000	0.423	0.000	0.000	0.684	0.000	0.074	0.000	0.000	0.000	0.000	NA	NA
Kurtosis	47.687	-0.169	1.276	28.881	0.730	4.798	-1.297	283.436	1143.649	716.201	270.795	5.612	1.330
Kurtosis Test P-Value	0.000	0.201	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	NA	NA
PANEL B: Derivatives Users													
Obs	617	622	591	618	622	382	505	265	553	412	529	626	626
Mean	5.643	0.467	19.404	1.935	14.862	0.196	0.611	278.628	39.054	0.043	125.827	0.939	1.000
Std. Dev.	93.904	0.212	25.045	1.905	1.778	0.219	0.309	1247.064	534.987	0.057	248.191	0.239	0.000
Skewness	-11.225	0.520	1.112	6.860	0.090	2.032	-0.481	11.363	23.182	5.542	7.766	-3.679	NA
Kurtosis	182.239	2.845	3.207	80.618	3.081	7.325	2.163	153.980	542.403	45.797	105.751	14.538	NA
PANEL C: Non-Users													
Obs	324	346	332	344	348	253	261	180	298	155	277	350	355
Mean	-14.132	0.655	10.986	3.240	12.535	0.129	0.363	68.691	34.067	0.145	223.484	0.757	0.000
Std. Dev.	236.528	0.274	22.338	3.828	1.506	0.190	0.344	261.891	74.737	1.193	718.083	0.429	0.000
Skewness	-2.688	-0.645	2.010	3.013	-0.894	3.362	0.550	9.326	7.996	12.262	9.936	-1.199	NA
Kurtosis	23.263	2.997	6.009	14.914	6.614	14.917	1.944	103.278	95.382	151.883	125.725	2.438	NA
PANEL D: Differenes between Derivatives Users and Non-Users (Mann-Whitney Test)													
Z-Value	-5.013	-11.261	-6.630	-5.475	-17.943	-4.866	-9.218	-6.505	-6.260	-1.242	-.727	-8.219	NA
Asymp. Sig (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.214	0.467	0.000	NA

U test[27], a non-parametric approach to compare the variables to see if they come from the same population. Ten of the twelve predictors significantly differ between the derivatives users and the non-users.

Table 4 further describes the Spearman correlation matrix, which relaxes the normal distribution assumption[28]. We calculate the "pair wise" correlation coefficients to make full use of all available information[29]. Normally, correlations lying in the range of [-1, -0.5] and [0.5, 1] are considered large[30], which can easily cause multicollinearity in estimations. The results in Table 4 illustrate that our correlations are generally acceptable. All variables are significantly related with DU except GR_PE and GR_MB, the same as what our Mann-Whitney test results show. Though GR_PE and GR_MB do not have significant correlation with DU, the mean values of both predictors are lower in the group of derivatives users than in the group of non-users. This mean value comparison provides us with some evidence to use these two ratios as proxies for the underinvestment problem. We also notice that the kurtosis of GR_MB, GR_RD and GR_KE is very high. This might reduce the explanation power of these three ratios.

The average value of IC in the whole sample is negative. It is due to the high proportion of negative profit observations. The financial situation in such firms may vary. If a firm has few interest expenses whilst reporting negative EBIT, its IC would be a very large negative figure; however this firm can possibly be reluctant to use derivatives due to the small leverage bearing. Table 5 shows that non-users report more extreme negative IC observations than the users. The 1% percentile value of IC in derivatives users group is -172.2639 while the 1% fence in the non-users group is -1053.89. This special distribution might weaken the adequacy of IC to explain the hedging behavior in the overall market. Introducing

[27] See "http://www.ats.ucla.edu/stat/stata/whatstat/whatstat.htm#wilc".

[28] The commonly used Pearson matrix assumes that the variables are normally distributed; however Spearman method relaxes this requirement. Spearman approach converts the variables in ranks and then correlates them. For more information, please see "http://www.ats.ucla.edu/stat/stata/whatstat/whatstat.htm#wilc".

[29] The results from "list wise" differ from the ones using "pair wise" due to ignored information. There would be 145 observations left when choosing "list wise" correlation method. For example, the correlation between GR_MB and DU is 0.2614 and significant at 5% level under "list wise"; however it is -0.0275 based on 806 "pair wise" observations and not significant.

[30] See "http://en.wikipedia.org/wiki/Correlation".

Table 4: Spearman Correlation Matrix (Pair wise)

This table displays the Spearman correlation coefficients of the variables using the "pair wise" method.* indicates observations significant at 5% level

	DU	IC	GR	DR	CR	S	GR_RD	GR_KE	GR_PE	GR_MB	HI	FR	FD
DU	1.0000												
IC	0.1764*	1.0000											
GR	-0.3603*	0.1070*	1.0000										
DR	0.2194*	0.4576*	-0.0724*	1.0000									
CR	-0.1780*	0.0509	0.4321*	-0.0770*	1.0000								
S	0.5795*	0.2555*	-0.3611*	0.3710*	-0.1702*	1.0000							
GR_RD	0.3066*	0.3182*	-0.1653*	0.3418*	-0.2558*	0.4753*	1.0000						
GR_KE	-0.2151*	0.1212*	0.4070*	-0.0112	0.1132*	-0.3188*	-0.0234	1.0000					
GR_PE	-0.0533	0.2125*	0.2728*	0.2532*	0.0657	-0.0077	0.2928*	0.1230*	1.0000				
GR_MB	-0.0275	0.0687*	-0.0288	-0.0011	0.1172*	0.0438	0.0634	-0.0067	-0.0374	1.0000			
HI	0.1987*	0.0779*	-0.3117*	0.1302*	-0.1944*	0.2134*	0.1205*	-0.2247*	0.1509*	-0.1925*	1.0000		
FR	0.3338*	0.0691	-0.1424*	-0.0244	0.0481	0.2662*	0.1715*	-0.1506*	-0.0971*	0.1475*	-0.0437	1.0000	
FD	0.2632*	0.0286	-0.0909*	-0.0891*	-0.0229	0.1706*	0.1817*	0.0009	-0.0658	0.1344*	-0.0049	0.5249*	1.0000

the panel data format and examining the hypotheses though multivariate tests may decrease this impact.

Table 5: IC Description

This table describes the IC ratio: observations for non-users are indicated by "DU=0", observations for derivatives users are indicated by "DU=1" and observations for the whole sample are indicated by "All".

	IC		
Percentiles	DU=0	DU=1	All
1%	-1053.89	-172.2639	-800.69
5%	-220.54	-8.47	-100.39
10%	-100.39	-2.69	-20.15
25%	-12.205	1.14	-0.52
50%	0.905	3.7	2.66
75%	9.73	8.44	7.93
90%	100.97	23.96	28.81
95%	258.86	68.17	93.76
99%	578.25	219.73	443.59
Obs	324	617	1348
Mean	-14.13205	5.643394	-4.463593
Std. Dev.	236.5281	93.90376	151.9813
Variance	55945.54	8817.916	23098.33
Skewness	-2.688231	-11.22501	-4.423426
Kurtosis	23.2626	182.2393	50.50567

Appendix IV displays the effective sample proportions of the variables for the 1980 firm-year observations. The effective sample proportion for each variable changes across time. The firms with different presenting time might bear distinguished characteristics, which could be reflected on the corresponding observations. Mixing the observations of firms without considering the effect of presenting time might lead to a potential bias. This stresses the importance of the robustness check concerning the sample time frame in section 4.2.

Above all, the statistical summary above supports the six hypotheses separately and forms a solid foundation for our model building in section 4.

4. Estimation Outputs

4.1 Regression Model

Given the binary dependent variable, we utilize the Logistic regression for the analyses. To make full use of available data, we formulate multiple models while including at least one variable from each theoretical hedging motivation. We use the panel data format, which takes the grouped nature of the data into account.

Defining $x_1, x_2, \cdots, x_n$ as the explanatory indicators and μ_i as the disturbance term, the model is expressed as follows[31]:

$$\log\left[\frac{\text{Prob}(DU_{it}=1)}{\text{Prob}(DU_{it}=0)}\right] = \beta_0 + \beta_1 x_{1it} + \beta_2 x_{2it} + \cdots + \beta_n x_{nit} + \mu_i = \beta' X_{it} + \mu_i.$$

According to Twisk (2003), there are two approaches to estimate logit regressions in panel data: Generalized Estimating Equations (GEE) and random-effects analysis.

Random-effects analysis fits the following model (named as Cluster-Specific Model in Stata):

$$\Pr(DU_{it} = 1 | X_{it}, \mu_i) = \beta' X_{it} + \mu_i,$$

whereas the GEE fits the following model (named as Population-Averaged model in Stata):

$$\Pr(DU_{it} = 1 | X_{it}) = \beta^{*\prime} X_{it}.$$

$\text{Var}(\mu_i)$ makes β^* differ from β. "The population-averaged model specifies only a marginal distribution", while "the cluster-specific model does fully specify the distribution (μ_i is either given a distribution – i.e., a random effect models –or is considered fixed like X_{it} – i.e., a fixed effects model)." [32] We consider that the heteroskedasticity might influence our results. Without the homoskedasticity assumption, we prefer the GEE estimator and use heteroskedasticity-robust standard errors, just as if a random sample were available with heteroskedasticity present in the population model (Kohler and Kreute, 2005).

The drawback of GEE is that by taking the average it cannot capture the

[31] See "http://www.stata.com/support/faqs/stat/repa.html".

[32] See "http://www.stata.com/support/faqs/stat/repa.html".

individual development over time. Every research is a trade-off; we are more interested in testing the validity of the hypotheses than the time varying trend. Twisk suggests: "If one is interested in the relationship between a dichotomous outcome variable and several other predictor variables, GEE analysis will probably provide the most 'valid' results." (Twisk, 2003: 142).

4.2 Regression Results

Table 6 reports the panel estimation results using heteroskedasticity-robust standard errors.

The regression outputs strongly support the scale economies hypothesis, as Size is always positive and significant at the 1% level. This finding is contrary to our negative sign prediction with respect to either the financial distress or the underinvestment motivation, which implies that transaction costs have a substantial influence on the smaller firms' decision to hedge. Our evidence contributes to the findings provided by Nance et al. (1993), Judge (2006) and Lel (2006). This indicates that economies of scale in purchasing derivatives represent an incentive to use derivatives commonly met in large firms.

OSE listed firms with larger foreign exposure are also likely to hedge more. All FD and FR coefficients are significant at the 5% level, but FD appears to be more significant. This might indicate that firms with foreign operations tend to hedge more frequently than the ones that only trade internationally[33]. Our findings with respect to this determinant of derivatives use lie in the same line as the evidence from China, Hong Kong, UK and US[34].

Evidence regarding the underinvestment hypothesis indicates that GR_PE has a substantial negative impact on the predicted outcome, in Model 5. This implies that firms with growth opportunities (P/E) usually hedge more and to an even higher degree when they are highly levered. Contrary to our finding, Judge (2006) obtains poor results for a related proxy (PE) using UK data. This might be due to

[33] The firms that only engage in export/import activity.

[34] See Clark et al. (2006), Judge (2006) and Geczy et al. (1997), respectively.

Table 6: Estimation Summary

This table presents regression estimates of 6 logit models. We show both the coefficient and elasticity for each predictor. The coefficients are the natural log of the odds ratios. The elasticity measures the percentage change in the probability of the predicted hedging decision for 1% change in the independent variable. The discrete change of the dummy variable is from 0 to 1. P-values are in parentheses and are calculated under GEE, using semi-robust standard errors. ***,**,* indicates significance at the 1%, 5% and 10% levels, respectively. We introduce year and sector dummies into the models. GEE models are estimated via a quasi-likelihood approach; therefore the common results (i.e. R^2) are not available. We set the cut-off value of the logit regression predictions as 0.5 and use the percentage of the correctly estimated predictions to measure the explanatory power of the models. The null hypothesis of the Wald Chi-Square test is that all of the regression coefficients are simultaneously equal to zero.

	MODEL 1		MODEL 2		MODEL 3		MODEL 4		MODEL 5		MODEL 6	
	Coeff.	Elast.	Coeff.	Elast.	Coeff.	Elast.	Coeff.	Elast.	Coeff.	Elast.	Coeff.	Elast.
IC	-0.000642	-0.000132			-0.000712*	-0.000138**	-0.000854	-0.000194*				
	(0.109)	(0.102)			(0.054)	(0.049)	(0.102)	(0.095)				
GR											-0.723521*	-0.168127*
											(0.079)	(0.083)
DP	0.002488	0.000512	0.003204*	0.000681*					0.004438*	0 .000676*	0.004836***	0.001123***
	(0.197)	(0.198)	(0.099)	(0.100)					(0.084)	(0.087)	(0.006)	(0.007)
CR			-0.063898***	-0.013573***	-0.041775	-0.008112	-0.056665**	-0.012871 **				
			(0.000)	(0.000)	(0.184)	(0.187)	(0.032)	(0.036)				
S	0.548456***	0.112835***	0.522967***	0.111089***	0.546351***	0.106085***	0.806546***	0.183209***	0.652861***	0.099531***	0.477296***	0.110911***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GR_RD							0.000213	0.000048				
							(0.207)	(0.215)				
GR_KE	0.000615	0.000127	-0.000240	-0.000051								
	(0.539)	(0.544)	(0.777)	(0.776)								
GR_PE									-5.565223***	-0.848443***		
									(0.005)	(0.003)		
GR_MB					-0.000173	-0.000034						
					(0.234)	(0.232)						

FR	0.791387*	0.162813*	0.869537**	0.184708**	0.771912 *	0.149882*						
	(0.057)	(0.058)	(0.027)	(0.029)	(0.067)	(0.075)						
FD							2.015419*	0.461602**	1.349428**	0 .267649**	1.653164***	0.390927***
							(0.080)	(0.025)	(0.012)	(0.028)	(0.002)	(0.000)
HI	1.111578*	0.228687*	0.778463	0.165362	1.480222	0.287414	0.462988	0.105169	0.740121	0 .112834	0.368600	0.085652
	(0.082)	(0.087)	(0.175)	(0.182)	(0.105)	(0.115)	(0.295)	(0.295)	(0.282)	(0.299)	(0.361)	(0.364)
Constant	-7.357194***		-6.834979***		-7.046367***		-12.328050***		-8.977812***		-7.037574***	
	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
Sector Dummy	Yes		Yes		Yes		Yes		Yes		Yes	
Year Dummy	Yes		Yes		Yes		Yes		Yes		Yes	
Number of obs	474		487		424		325		368		612	
Number of groups	117		119		109		91		109		144	
Number of Hedgers	310		312		281		187		256		371	
#Non-hedgers	164		175		143		138		112		241	
% Predicted Correctly	79.96%		80.29%		81.37%		78.15%		81.25%		78.10%	
Wald chi2	90.01***		89.78***		77.24***		56.84***		45.57***		75.32***	
Prob > chi2	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	

the fact that GR_PE better captures this factor than PE alone.

The evidence for the underinvestment problem provided by GR_KE and GR_MB is weak compared to GR_PE. The possible interpretation is their high kurtosis, as indicated in section 3.6. The extreme figures in these two ratios might disturb their corresponding outputs. Using a different sample set that contains fewer extreme figures might help enhance the explanation power of these two ratios.

The coefficients of GR_RD in the regressions are seldom significant and most of them carry a positive sign, which is against our hypothesis. For instance, the 1% change in GR_RD in Model 5 is associated with a very small insignificant change in the hedging probability (i.e., the elasticity is 0.000048). This finding indicates that GR_RD might not work well as a predictor for the underinvestment problem in our sample. The poor results might be due to data resource bias. We have the fewest observations (552) for GR_RD, which could make this variable inadequate in explaining the hedging behavior in the overall market. Another possible explanation is given by Geczy et al. (1997), who note that, in the presence of foreign denominated debt, R&D expenses are not significantly related with derivatives use. They also indicate that the choice of financial instruments will influence significance level of R&D. In our study, the omitted impacts from the foreign debt and from the choice of derivatives might make the coefficient of GR_RD insignificant.

Our results supporting the underinvestment argument in Norway are similar to the findings provided by Nance et al. (1993) and Geczy et al. (1997) for the US, and, by Lel (2006) for a panel cross-country estimation.

Financial distress incentives are significantly captured by GR. This proxy is significant at the 10% level in Model 6. The negative sign shows that highly leveraged Norwegian firms turn to hedging frequently to ensure that debt obligations are met. Besides reducing the probability of lower tail events, hedging helps enhance the firm's debt capacity and, ultimately, firm value[35] (Graham and Rogers, 2002). The evidence provided by this proxy is more substantial than the

[35] This result is obtained through increased tax benefits.

results obtained by Block and Gallagher (1986), which find a statistically insignificant association between leverage[36] and hedging.

IC provides weak significant support for the financial distress hypothesis. The coefficients of IC are usually very small, though sometimes significant. As indicated in section 3.6, the large number of negative observations for IC might cause this ratio to have almost zero coefficient values. It may illustrate that this ratio might not adequately capture financial distress incentive to hedge. This view is in line with the findings for IC of Nance et al. (1993) and Geczy et al. (1997), but contrary to the evidence provided by Judge (2006). The latter study provides strong evidence for this proxy and for the corresponding hypothesis, using UK data. A possible explanation might be that the costs entailed by financial distress states are lower in Norway than in the UK. This assertion is substantiated by the fact that the court fees associated with bankruptcy proceedings are higher in the UK[37].

The CR coefficients[38] confirm our sign expectation, referring to both financial distress and liquidity implications. Hence, it is ambiguous whether this predictor reveals financial distress incentives to hedge or indicates that liquidity is a substitute to this action.

DP is positive and substantially significant in Model 6. This finding can have two interpretations as well. The first is that DP may express financial distress incentives to hedge. The second is that liquidity might be positively related to the derivatives decision. Based on the not very significant results for GR and IC, our outputs do not provide strong evidence for the financial distress argument in the Norwegian market. In the context of the liquidity explanation, the positive sign for DP might highlight speculation purposes in liquid derivatives users.

[36] Block and Gallagher (1986) use the debt-equity ratio to measure the leverage.

[37] See “http://www.tkgl.no/Filer/PDF/Doing%20business%20in%20Norway.pdf” for a description of bankruptcy procedures in Norway and “http://www.taxaid.org.uk/tax_debt.cfm?secnav=10” for corresponding procedures in the UK.

[38] They are significant in models 2 and 4.

Consequently, the results for DP and CR provide indeterminate results for the liquidity argument. This is contrary to the findings of Nance et al. (1993) and Geczy et al. (1997) for the US and of Clark et al. (2006) for Hong Kong and China that provide evidence according to which liquidity acts as a substitute to using derivatives. Our findings might stem from the fact that we do not use enough variables for measuring this factor so as to obtain a clearer view with respect to its influence on the hedging decision.

Ownership concentration has a relatively weak effect on the predicted outcome, as HI is significant at the 10% level in Model 1 and weakly insignificant in Model 3. These results indicate that this factor either has a weak influence on the hedging decision in Norwegian firms or that the data we have collected is not comprehensive enough to adequately capture the behavior of the predicted outcome in OSE listed firms. We tend to believe that the former view is the cause for the weak explanation power of HI. We are supportive of this explanation because, according to Bøhren and Ødegaard (2000), the largest owner in OSE listed firms possesses a considerably lower fraction of stock relative to other European counterparts. This implies that the average large holder of OSE equity has a lower firm-specific risk that needs to be hedged than the average large shareholder in other European markets. Therefore, OSE equity holders maybe choose not to alter the firm's hedging practices. Moreover, Bøhren and Ødegaard (2000) also find that equity holding is very fragmented and held in large part by small individual equity owners. For these shareholders, the costs of actively interfering with the risk management practices of the company will probably not be recovered. Consequently, they might not influence these practices.

In summary, the 11 years panel results provide strong evidence for the scale economies incentive to hedge. Substantial results are obtained as well for the foreign exposure factor. Underinvestment evidence indicates that firms with high PE ratios and high leverage are more likely to use derivatives. We do not find consistent support for the financial distress driver, which can possibly be explained by the prescriptions of the Norwegian law that entail low bankruptcy costs. Liquidity effects are ambiguous due to conflicting signs of its two

measuring proxies. One potential finding with respect to this hypothesis is that liquid derivatives users might use these instruments both for speculating and for hedging purposes. We argue that ownership concentration has weak influence on the hedging decision in this market. This result can be explained by the fact that large shareholders are smaller relative to other European markets and that stock holding is very fragmented.

4.3 Robustness Check：Sub-Sample Tests

In this section, we examine the consistency of the results by running models in the time sub-sample. If the results are unchanged, this will show that how the sample time frame is defined does not influence our research.

As indicated in section 3.1, the reporting standard changes in Norway from 2004. Therefore, we choose 2004 as the cut-off time point and run the 6 models on the 2004-2007 time sub-sample. See Table 7 for the outputs.

Size shows a significant positive association to the hedging decision, giving strong support for the scale economies implication. The evidence for financial distress is weaker. Though we consistently find the expected signs for IC and GR, the coefficients of both proxies become less significant. DP gives similar outputs, while all of the coefficients of CR become insignificant. The indeterminate sign for CR makes the conclusion concerning the liquidity factor more ambiguous. GR_PE becomes insignificant, while GR_MB gives some foundation for the underinvestment argument. Unreported results also disclose a significant relationship between GR_KE and DU. This finding confirms our hypothesis stated in section 4.2 that using a different sample set with fewer extreme figures might help increase the explanation power of both GR_MB and GR_KE.[39] The findings concerning ownership concentration are weaker, as we do not find any significant results for HI. FD remains similar, whilst the evidence is different for FR: none of the FR coefficients are significant.

The change in FR could be caused by the reporting standard change or the special characteristics of firms with different presenting time. The proportion of the firms

[39] In the 2004-2007 sub-sample set, the kurtosis of GR_MB 11.86 and the kurtosis of GR_KE is 546.21, both of which are much lower than those in the whole set.

Table 7: 2004-2007 Sub-Sample Robustness Check

This table presents the robustness check results done on the 2004-2007 sub-sample. We show both the coefficient and elasticity for each predictor. The coefficients are the natural log of the odds ratios. The elasticity measures the percentage change in the probability of the predicted hedging decision for 1% change in the independent variable. The discrete change of the dummy variable is from 0 to 1. P-values are in parentheses and are calculated under GEE, using semi-robust standard errors. ***,**,* indicates significance at the 1%, 5% and 10% levels, respectively. We introduce year and sector dummies into the models. GEE models are estimated via a quasi-likelihood approach; therefore the common results (i.e. R^2) are not available. We set the cut-off value of the logit regression predictions as 0.5 and use the percentage of the correctly estimated predictions to measure the explanatory power of the models. The null hypothesis of the Wald Chi-Square test is that all of the regression coefficients are simultaneously equal to zero.

	MODEL 1		MODEL 2		MODEL 3		MODEL 4		MODEL 5		MODEL 6	
	Coeff.	Elast.	Coeff.	Elast.	Coeff.	Elast.	Coeff.	Elast.	Coeff.	Elast.	Coeff.	Elast.
IC	-0.000095	-0.000019			-0.000025	-0.000005	0.000023	0.000005				
	(0.665)	(0.663)			(0.928)	(0.928)	(0.949)	(0.949)				
GR											-0.702279	-0.154646
											(0.190)	(0.192)
DP	0.002382	0.000474	0.006373*	0.001332					0.007989*	0.001077	0.008127**	0.001789**
	(0.219)	(0.230)	(0.100)	(0.104)					(0.092)	(0.103)	(0.023)	(0.024)
CR			-0.031513	-0.006588	0.025401	0.004681	-0.012001	-0.002746				
			(0.436)	(0.433)	(0.663)	(0.663)	(0.840)	(0.840)				
S	0.716027***	0.142531***	0.674635***	0.141033***	0.834832***	0.153852***	0.772786***	0.176855***	0.868037***	0.116975***	0.623941***	0.137395***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
GR_RD							0.000131	0.000030				
							(0.275)	(0.275)				
GR_KE	-0.001283	-0.000255	-0.001107	-0.000232								
	(0.210)	(0.203)	(0.124)	(0.120)								
GR_PE									-3.134031	-0.422336		
									(0.388)	(0.348)		

GR_MB					-0.000978*	-0.000180*						
					(0.078)	(0.078)						
FR	0.427305	0.085058	0.615133	0.128594	0.730175	0.134564						
	(0.403)	(0.402)	(0.220)	(0.220)	(0.237)	(0.237)						
FD							1.697270*	0.399711**	1.794070**	0.347338**	1.504865**	0.356885***
							(0.052)	(0.024)	(0.017)	(0.043)	(0.014)	(0.010)
HI	0.957305	0.190559	0.582527	0.121778	1.476548	0.272114	0.075547	0.017289	-0.534230	-0.071992	0.031617	0.006962
	(0.153)	(0.158)	(0.341)	(0.347)	(0.244)	(0.244)	(0.847)	(0.847)	(0.610)	(0.597)	(0.947)	(0.947)
Cons	-9.286544***		-8.803346***		-11.007670***		-11.360540***		-12.108380***		-8.749749***	
	(0.000)		(0.000)		(0.000)		(0.000)		(0.001)		(0.000)	
Sector Dummy	Yes		Yes		Yes		Yes		Yes		Yes	
Year Dummy	Yes		Yes		Yes		Yes		Yes		Yes	
Number of obs	288		297		260		205		240		375	
Number of groups	115		117		109		88		108		144	
Number of hedgers	190		191		172		120		165		229	
Number of non-hedgers	98		106		88		85		75		146	
% Predicted Correctly	78.47%		79.12%		81.54%		75.61%		80.42%		78.93%	
Wald chi2	48.16		47.14		46.46		47.8		35.64		59.23	
Prob > chi2	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	

with short presenting time is higher in the 2004-2007 sub-sample set than in the whole sample set. These firms might not encounter the same amount of risk as the others. They might focus on local operations and have few foreign revenues. They may not have gained the capabilities to make full use of the financial market services either. Hence, the features of these firms with short presenting time could influence our estimations.

We run Model 1-Model 3 (with FR) only for the firms with presenting time longer than 9 years in the 2004-2007 sub-sample set. See Table 8 for the regression outputs. We pick the presenting time cut-off value as 9 because half of the sample firms present information before 1999. The results show that FR becomes significant, supporting the foreign exposure driver. The evidence concerning the other incentives remains similar. The unreported results suggest that foreign exposure will become more significant if we adjust firms' presenting time boundary longer than 9 years.

The proper setting of the sample time frame together with the presenting time boundary is very important. When selecting a narrow sample time frame close to 2007, a large proportion of the short presenting firms would be expected. Therefore, a high boundary can help isolate the disturbance of presenting time more effectively. On the other hand, a low boundary would be enough for samples with wider time frame. Unreported results based on the 2003-2007 sub-sample show that the 5 year boundary for presenting time could help enhance the significance level of FR notably. Further tests have also been done by running the models in the whole sample set only for firms with presenting time higher than 9 years and the unreported results provide stronger evidence for the foreign exposure incentive as compared with Table 6.

Overall, the robustness check outcomes above illustrate that the sample firms' presenting time will impact our estimations. We can interpret a firm's presenting time as its ability to access financial markets. The presenting period we collect in our study is counted from the time when the firm's relevant information is available. This usually overlaps with the time point when the firm becomes listed on Oslo Børs. Going public is often considered as an important signal indicating that the firm wants to actively join the market. The longer the firm is listed, the more access it might gain concerning the use of financial market services. Our

Table 8: 2004-2007 Sub-Sample Robustness Check for Firms with Presenting Time Longer than 9 Years

This table presents the robustness check results for 2004-2007 sub-sample firms with presenting time longer than 9 years. The coefficients are the natural log of the odds ratios. The elasticity measures the percentage change in the probability of the predicted hedging decision for 1% change in the independent variable. The discrete change of the dummy variable is from 0 to 1. P-values are in parentheses and are calculated under GEE, using semi-robust standard errors. ***,**,* indicates significance at the 1%, 5% and 10% levels, respectively. We introduce year and sector dummies into the models. GEE models are estimated via a quasi-likelihood approach; therefore the common results (i.e. R^2) are not available. We set the cut-off value of the logit regression predictions as 0.5 and use the percentage of the correctly estimated predictions to measure the explanatory power of the models. The null hypothesis of the Wald Chi-Square test is that all of the regression coefficients are simultaneously equal to zero.

	Model 1		Model 2		Model 3	
	Coeff.	Elast.	Coeff.	Elast.	Coeff.	Elast.
IC	-0.000984	-0.000184			-0.000915	-0.000171
	(0.186)	(0.197)			(0.302)	(0.294)
GR						
DP	0.002617***	0.000489*	0.007283*	0.001407*		
	(0.091)	(0.097)	(0.094)	(0.099)		
CR			0.043683	0.008441	0.076476	0.014257
			(0.603)	(0.598)	(0.392)	(0.372)
S	0.534621**	0.099936***	0.653089***	0.126198***	0.800947***	0.149316***
	(0.014)	(0.003)	(0.002)	(0.000)	(0.005)	(0.000)
GR_RD						
GR_KE	-0.008197***	-0.001532***	-0.005016**	-0.000969*		
	(0.008)	(0.005)	(0.049)	(0.051)		
GR_PE						
GR_MB					-0.001353***	-0.000252***

					(0.006)	(0.004)
FR	1.288831**	0.240921**	1.251485*	0.241828**	1.099900**	0.205048**
	(0.049)	(0.034)	(0.052)	(0.041)	(0.045)	(0.024)
FD						
HI	1.122993	0.209921	2.333903	0.450987	-0.194951	-0.036344
	(0.531)	(0.545)	(0.171)	(0.185)	(0.911)	(0.911)
Cons	-7.002005**		-9.444297***		-10.654430***	
	(0.020)		(0.001)		(0.008)	
Sector Dummy	Yes		Yes		Yes	
Year Dummy	Yes		Yes		Yes	
Number of obs	176		178		177	
Number of groups	67		67		68	
#Hedgers	119		119		118	
#Non-hedgers	57		59		59	
% Predicted Correctly	82.39%		80.34%		83.05%	
Wald chi2	31.71		21.24		25.24	
Prob > chi2	0.000		0.003		0.001	

results confirm this view and further demonstrate the relationship between the presenting time and the firm's hedging decision: firms with long presenting time tend to hedge more frequently. Nevertheless, our results with respect to the six hedging hypotheses mostly remain consistent if we control for this aspect. We thus conclude that, with presenting time control, our estimations are robust to the sample time frame setting and argue that the standard change does not influence our results.

4.4 Further Check: Cross-Sectional Tests

Most previous research is based on cross-sectional data and does not consider firm-specific characteristics. Not taking into account the latter effect might influence our results. We redo the models from section 4.1 on the whole sample without taking into account the grouping of the data into firms. If the overall results for the six hypotheses remain similar, this will indicate that our general conclusions are consistent across different data formats.

The regression outputs are presented in Appendix V. We find that the cross-sectional format gives results relatively similar to the estimation outputs in section 4.2.

S, FR and FD are significant at the 1% level, providing strong support for the scale economies and foreign exposure hypotheses, respectively. GR_PE is also significant at the 1% level and GR_MB becomes significant. The evidence for the latter two proxies provides stronger support for the underinvestment incentive relative to the panel estimation of this sample.

CR becomes insignificant in models 2 through 4, but it becomes significant at the 5% level in unreported results. Moreover, DP becomes insignificant. The outputs for these two proxies have implications for both the financial distress and liquidity drivers. The outputs for CR and DP indicate that liquidity effects still remain ambiguous. GR becomes more significant in Model 6 (not always significant in unreported results). The overall importance of the financial distress incentive on the hedging decision remains similar (i.e., not consistently strong). Weak results are obtained for the ownership concentration implication as well, as HI becomes insignificant in all models.

Consequently, the general conclusions for the six hypotheses remain similar. We argue that firm-specific reasons do not influence the overall results in our sample.

5. Conclusion

The panel estimation of the whole sample and the robustness check of the 2004-2007 time sub-sample provide strong support for scale economies as a driver for employing derivatives. Foreign exposure is significant in FD, whereas FR is affected by the firms' presenting time. This effect is shown by the robustness tests. Controlling for it, FR becomes significant.

We do not find consistent support for the underinvestment and financial distress hypotheses. The proxies for both arguments are not always significant in different specifications. The evidence for the financial distress determinant is potentially impacted by the low bankruptcy costs in Norway.

Weak results for the ownership concentration incentive might be related with the equity holding structure of OSE listed firms, as indicated in section 4.2. The outputs concerning the liquidity hypothesis are mixed. The ambiguous results concerning this factor may indicate that liquid firms use derivatives both for hedging and for speculating purposes.

The results above are maintained across the cross-sectional and panel formats, showing that firm-specific characteristics do not impact the overall findings in our sample. We suggest controlling for firms' presenting time when measuring the foreign exposure factor, in addition to controlling for time and sector effects.

Future research could investigate hedging drivers using notional amounts based on time series data. It might also be of interest to examine the incentives for hedging different types of risks (currency, commodity and interest-rate risks).

References

Articles

Allayannis, George and E. Ofek. 2001. “Exchange-rate exposure, hedging and the use of foreign currency”. *Journal of International Money and Finance*. Vol. 20: 273–96.

Allayannis, George, and James P. Weston. 1998. “The use of foreign currency derivatives and firm market value.” *The Review of Financial Studies.* Vol. 14: 243-276.

Aziz, Rashid and Michael Philipp Weinl. 2006. “Financial distress as a determinant of hedging behavior: An empirical study based on the Oslo Stock Exchange”. *Master of Science thesis.* BI Norwegian School of Management.

Bartram, Sohnke M., Gregory W. Brown and Jennifer Conrad. 2007. “The Effects of Derivatives on Firm Risk and Value”. *Social Sciences Research Network.* Working paper.

Bessembinder, H.. 1991. “Forward contracts and firm value: investment incentive and contracting effects”. *Journal of Financial and Quantitative Analysis*. Vol. 26: 519–532.

Block, S. B., and T. J. Gallagher. 1986. “The use of interest rate futures and options by corporate financial managers.” *Financial Management*. Vol 15: 73-78.

Bøhren, Øyvind and Bernt Arne Ødegaard. 2000. “The ownership structure of Norwegian firms: Characteristics of an outlier”. *The Corporate Governance Program.* BI Norwegian School of Management.

Clark, Ephraim Alois, Amrit P. Judge and Wing Sang Ngai. 2006. “The Determinants and Value Effects of Corporate Hedging: An Empirical Study of Hong Kong and Chinese Firms”. *Social Sciences Research Network.* Working paper.

Falch, Henrik, Faisal Kahn and Kjetil Storås. 2002. “Finanisell Risikostyring – Karlegging og empirisk studie av derivatbruk i selskaper notert på Oslo Børs.” *Master of Science thesis.* BI Norwegian School of Management.

Faulkender, M.. 2005. “Hedging or market timing? Selecting the interest rate exposure of corporate debt”. *Journal of Finance*. Vol. 60: 931–62.

Froot, Kenneth A., David S. Scharfstein and Jeremy C. Stein. 1993. “Risk Management: Coordinating Corporate Investment and Financing Policies”. *Journal of Finance.* Vol. 48: 1629-1658.

Geczy, Christopher, Bernadette A. Minton and Catherine Schrand. 1997. “Why firms use currency derivatives?”. *Journal of Finance.* Vol. 52. No.4: 1323-1354.

Graham, J. and D. Rogers. 2002. “Do firms hedge in response to tax incentives?”. *Journal of Finance*. Vol. 57: 815–839.

Jin, Yanbo and Philippe Jorion. 2006. “Firm Value and Hedging: Evidence from U.S. Oil and Gas Producers”. *Journal of Finance*. Vol. 61: 893-919.

Judge, Amrit P.. 2006. “Why and how UK firms hedge”. *European Financial Management.* Vol 12. No. 3:407-441.

Lel, Ugur. 2006. “Currency hedging and corporate governance: a cross-country analysis”. *International Finance Discussion Papers (Board of Governors of the Federal Reserve System).* Number 858: May.

Leland, Hayne E.. 1998. “Agency costs, risk management and capital structure”. *Journal of Finance*. Vol. 53: 1213-1243.

Modigliani, Franco, and Merton H. Miller. 1958. “The cost of capital, corporation finance, and the theory of investment”. *American Economic Review.* Vol. 48. No. 3: 261-297.

Nance, Deana R., Clifford W. Smith and Charles W. Smithson. 1993. “On the determinants of corporate hedging”. *Journal of Finance.* Vol. 48. No. 1: 267-284.

Ross, Michael P.. 1997. “Corporate hedging: What, why and how?”. *University of California, Berkely.* Working paper.

Smith, Clifford W. and Rene M. Stulz. 1985. “The Determinants of Firms’ Hedging Policies”. *Journal of Financial and Quantitative Analysis.* Vol. 20. No. 4: 391-405.

Tufano, P.. 1996. “Who manages risk? An empirical examination of risk management practices in the gold mining industry”. *Journal of Finance.* Vol. 51. No. 19: 1097–1137.

Warner, J.. 1977. Bankruptcy costs: Some evidence. *Journal of Finance.* Vol. 32: 337-348.

Books

Brooks, Chris. 2004. *Introductory Econometrics for Finance*. 5th edition. Cambridge: University Press.

StataCorp. 2007. *Stata User's Guide: Release 10*. College Station, Texas: Stata Press.

Ulrich, Kohler and Frauke Kreute. 2005. *Data Analysis using Stata*. College Station, Texas: Stata Press.

Twisk, Jos W.R.. 2003. *Applied Longitudinal Data Analysis for Epidemiology: A Practical Guide*. Cambridge: Cambridge University Press.

Websites

Encyclopedia of the Nations. 2008. *Norway Taxation*. [Online]. Available from URL: <http://www.nationsencyclopedia.com/Europe/Norway-TAXATION.html>. [Accessed on August 10th, 2008].

Espen Knudsen. 2005. *Adgang til å anvende IFRS i selskapsregnskapet for 2005*. [Online]. Ministry of Finance of Norway. Available from URL: <http://www.regjeringen.no/en/dep/fin/Press-Center/Press-releases/2005/Adgang-til-a-anvende-IFRS-i-selskapsregnskapet-for-2005.html?id=103547>. [Accessed on August 4th, 2008].

International Accounting Standards Board. 2008. *Technical Summary of IFRS 7 Financial Instruments: Disclosures*. [Online]. Available from URL: <http://www.iasb.org/NR/rdonlyres/5710E66C-FCB2-41FF-B146-7F7B9BC97EF3/0/IFRS7.pdf>. [Accessed on August 4th, 2008].

National Institute of Standards and Technology of the United States. 2008. *What are outliers in the data?*. [Online]. Washington. Available from URL: <http://www.itl.nist.gov/div898/handbook/prc/section1/prc16.htm>. [Accessed July 11th, 2008].

Official Journal of the European Commuities. 2002. *Regulation (EC) NO 1606/2002 of the European Parliament and of the Council of 19 July 2002 on the application of international accounting standards.* [Online]. Available from URL: <http://www.iasplus.com/europe/0209accountingdirective.pdf>. [Accessed on August 4th, 2008].

Oslo Stock Exchange. 2008. *Aksjer.* [Online]. Available from URL:

<http://www.oslobors.no/ob/aksjer?menu2show=1.1.1.>. [Accessed July 1st, 2008].

StataCorp LP. 2008. *What is the difference between random-effects and population-averaged estimators?*. [Online]. Available from URL: <http://www.stata.com/support/faqs/stat/repa.html>. [Accessed July 17th, 2008].

TaxAid. 2008. *Bankruptcy*. [Online]. Available from URL: <http://www.taxaid.org.uk/tax_debt.cfm?secnav=10> . [Accessed August 3rd, 2008].

Thommessen. 2008. *Doing buiness in Norway*. [Online]. Available from URL: <http://www.tkgl.no/Filer/PDF/Doing%20business%20in%20Norway.pdf>. [Accessed August 3rd, 2008].

UCLA Academic Technology Services. 2008. *What statistical analysis should I use? Statistical analyses using Stata*. [Online]. Available from URL: <http://www.ats.ucla.edu/stat/stata/whatstat/whatstat.htm#wilc>. [Accessed on August 4th , 2008].

Wikipedia. 2008. *Correlation - Interpretation of the size of a correlation*. [Online]. Available from URL: <http://en.wikipedia.org/wiki/Correlation>. [Accessed on August 4th, 2008].

Wikipedia. 2008. *Global Industry Classification Standard*. [Online]. Available from URL:

<http://en.wikipedia.org/wiki/Global_Industry_Classification_Standard>. [Accessed July 25th, 2008].

Wikipedia. 2008. *Mann-Whitney U*. [Online]. Available from URL:

< http://en.wikipedia.org/wiki/ Mann-Whitney_U>. [Accessed July 10th, 2008].

William Sribney. 2007. *Comparing RE and PA models (What is the difference between random-effects and population-averaged estimators?)*. [Online]. Stata Corp. Available from URL: <http://www.stata.com/support/faqs/stat/repa.html>. [Accessed on August 4th, 2008].

Appendix

Appendix I: Exchange Rates

This table presents the forex rates we use in this research. The data collection date is 1st of July 2008 from Datastream.

	1 FOREIGN CURRENCY=? NORWEGIAN KRONE							
	DK	SK	C$	U$	BD	CD	I£	€*
1997	1.091227	0.919118	5.125577	7.078000	7.078000	8.548949	2.088010	8.1116003
1998	1.112966	0.964785	5.170631	7.458500	7.458500	9.122169	2.040646	8.1927147
1999	1.108647	0.917011	5.370569	7.867600	7.867600	9.578748	1.909467	8.2271493
2000	1.115573	0.987654	5.984440	8.969400	8.969400	10.805839	2.156244	8.3639655
2001	1.059322	0.872220	6.016847	9.221800	9.221800	11.271906	2.236655	7.8865
2002	0.995917	0.809389	5.175983	7.946400	7.946400	9.686936	1.604696	7.406
2003	1.060783	0.859107	4.842615	6.709400	6.709400	8.133752	1.524845	7.8755
2004	1.104118	0.904159	4.921260	6.705900	6.705900	8.136514	1.468324	8.212
2005	1.070893	0.868056	5.047956	6.350900	6.350900	7.715008	1.442099	7.971
2006	1.048548	0.840689	5.552471	6.129100	6.129100	7.185411	1.356002	7.8195
2007	1.087075	0.876808	5.611672	5.995300	5.995300	7.046000	1.485036	8.099

For Euro before 1999, we use the DataStream estimated Exchange Rate

Appendix II: Outliers

The National Institute of Standards and Technology (NIST) of the United States eliminates outliers following the rules below:

1. lower outer fence: Q1 - 3*IQ
2. upper outer fence: Q2 + 3*IQ

In order to take out the outliers in the GR, DP, CR, RD, KE, PE and MB variables, we combine the NIST method with our own. More precisely, we base on the NIST method and then adjust the fence by browsing the data. In this manner, we could remove fewer observations whilst keeping the level of kurtosis the same (or very close) to the level obtained by using the NIST method.

As the IC observations exhibit extremely high kurtosis, we implement a stricter rule to remove its outliers. We exclude the upper and lower 1% of the data; the observations lying beyond 5 standard deviations away from the median are also excluded (Bartram, Brown and Conrad, 2007).

With respect to S, FR and HI, we focus on their lower tail distribution, as it is reasonable to assume these variables to have high value observations. As they do not exhibit extreme low values, we do not remove outliers from them.

FD is not considered, as it is a dummy variable.

Outlier Removal Table

	IC	GR	DR	CR	RD	KE	PE	MB
N	1378	1375	1265	1389	1183	1249	927	1110
Minimum	-22359.6	-1.80989	-0.46	0	0	0	0	-166.94
Maximum	334388	4.854227	225.6	1011.99	234.0646	184.3029	1182.1	255.15
Mean	458.9402	0.532527	15.71736	4.173273	0.444667	1.288965	29.75471	1.122445
Median	2.65	0.488782	0	1.57	0	0.062878	12.2	0.00799
Std. Deviation	12769.74	0.304588	24.41482	33.33754	7.228345	10.33456	78.8358	9.394989
Q1	-0.6875	0.331673	0	1.1	0.025113	4.5	0.001713	0.03794
Q2	8.11	0.734122	29.2	2.51	0.228848	24.4	1.47	0.234225
IQ	8.7975	0.402449	29.2	1.41	0.203736	19.9	1.468287	0.196285
Lower bound	-5326.56	-0.87567	0	0	0	-0.56873	-54.8	-20
Upper bound	5312.679	1.941469	116.8	50	10	30	500	20
Outliers removed	30	3	1	10	6	9	4	4
N (after removal)	1348	1372	1264	1379	1177	1240	923	1106

Appendix III: Hedging Variable

Some firms state that they employ financial instruments to hedge risks during a certain period but do not specify the instruments' name. The instruments used may refer to foreign currency debt in addition to derivatives. For these firms, we will examine the detailed hedging activities in the entire body of their annual reports together with their relevant publications or news. If the summarized information is still ambiguous and cannot provide enough evidence for us to justify if they use derivatives or not, we will set the corresponding hedging observations as missing.

Some firms do not publish annual reports in all of their presenting years or the published reports do not contain information about hedging. Thus, the hedging observation is missing in these periods. Tracking information from the reports disclosed in later periods could help save some missing data. Some firms may state in their annual reports that they have not used financial derivatives to hedge risks before a certain year; therefore we could set all the hedging variables' value before this time as 0. In other cases, sample firms, especially the ones following the IFRS standard, specify the opening date and maturity of their derivatives positions. We could then predict that they have been using derivatives since the opening date of those contracts and will set the hedging observations to "1" in these previous years.

Appendix IV: Effective Sample Proportion

This table provides summary statistics for the effective sample proportion of each variable corresponding to the relevant time period.

	DU	IC	GR	DR	CR	S	RD	KE	PE	MB	GR_RD	GR_KE	GR_PE	GR_MB	HI	FP	FD
1997	9%	42%	42%	38%	43%	43%	26%	39%	23%	28%	11%	38%	22%	27%	1%	8%	27%
1998	13%	44%	44%	41%	44%	45%	41%	41%	28%	36%	12%	39%	26%	34%	1%	13%	29%
1999	18%	49%	48%	44%	49%	49%	44%	45%	34%	40%	15%	44%	30%	39%	1%	18%	34%
2000	27%	52%	55%	50%	56%	54%	48%	50%	36%	43%	20%	50%	31%	42%	51%	24%	40%
2001	32%	60%	60%	54%	61%	60%	53%	54%	38%	47%	23%	54%	27%	44%	56%	30%	48%
2002	38%	64%	66%	58%	67%	66%	61%	62%	39%	51%	28%	59%	26%	49%	58%	33%	56%
2003	53%	73%	73%	67%	74%	74%	69%	69%	41%	54%	32%	68%	27%	52%	65%	43%	67%
2004	69%	86%	86%	73%	87%	87%	79%	81%	54%	65%	39%	77%	39%	59%	74%	56%	82%
2005	89%	90%	94%	89%	93%	94%	84%	89%	66%	76%	46%	86%	52%	73%	80%	72%	93%
2006	99%	96%	98%	93%	98%	99%	89%	96%	75%	87%	51%	94%	63%	85%	79%	77%	99%
2007	97%	94%	95%	95%	93%	95%	61%	62%	78%	88%	29%	58%	62%	86%	1%	74%	98%
All	50%	68%	69%	64%	70%	70%	59%	63%	47%	56%	28%	61%	37%	54%	42%	41%	61%

Appendix V: Cross-Sectional Estimation Summary

This table presents the cross-sectional results for the whole sample. We show both the coefficient and elasticity. We show both the coefficient and elasticity for each predictor. The coefficients are the natural log of the odds ratios. The elasticity measures the percentage change in the probability of the predicted hedging decision for 1% change in the independent variable. The discrete change of the dummy variable is from 0 to 1. P-values are in parentheses and are calculated using robust standard errors. ***,**,* indicates significance at the 1%, 5% and 10% levels, respectively. We introduce year and sector dummies into the models. The number of dummies included varies across different equations, considering the model convergence when regressing.

	MODEL 1		MODEL 2		MODEL 3		MODEL 4		MODEL 5		MODEL 6	
	Coeff.	Elast.	Coeff.	Elast.	Coeff.	Elast.	Coeff.	Elast.	Coeff.	Elast.	Coeff.	Elast.
IC	-0.000862	-0.000155			-0.001476*	-0.000243*	-0.001296	-0.000313				
	(0.187)	(0.188)			(0.055)	(0.055)	(0.238)	(0.241)				
GR											-1.221370**	-0.264357**
											(0.014)	(0.016)
DP	-0.003357	-0.000604	-0.002993	-0.000252					0.004730	0.000697	0.006951	0.001505
	(0.495)	(0.492)	(0.538)	(0.534)					(0.487)	(0.488)	(0.138)	(0.140)
CR			-0.097993	-0.008251	-0.083183	-0.013726	-0.018187	-0.004392				
			(0.162)	(0.136)	(0.453)	(0.451)	(0.843)	(0.843)				
S	0.898224***	0.161621***	0.797132***	0.067115***	0.787801***	0.129998***	0.897657***	0.216776***	0.850113***	0.125282***	0.693982***	0.150208***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GR_RD							0.000013	0.000031				
							(0.970)	(0.970)				
GR_KE	0.001343	0.000241	0.000239	0.000020								
	(0.588)	(0.590)	(0.927)	(0.927)								
GR_PE									-16.023520***	-2.361407***		
									(0.000)	(0.000)		
GR_MB					-0.000765*	-0.000126*						
					(0.064)	(0.059)						

FR	2.242356***	0.403478***	2.334504***	0.196556***	3.067457***	0.506172***						
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)						
FD							1.366621	0.326805	2.468407***	0.517110***	1.351496***	0.320267***
							(0.170)	(0.119)	(0.001)	(0.001)	(0.003)	(0.003)
HI	1.171238	0.210746	1.112108	0.093635	2.009792	0.331643	1.240687	0.299615	1.454166	0.214302	0.169907	0.036775
	(0.263)	(0.263)	(0.287)	(0.301)	(0.116)	(0.121)	(0.148)	(0.144)	(0.298)	(0.290)	(0.781)	(0.781)
Cons.	-12.346490***		-45.329700***		-10.537980***		-13.351260 ***		-11.663060 ***		-27.906470 ***	
	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
Sector dummies	Yes		Yes		Yes		Yes		Yes		Yes	
Year Dummies	Yes		Yes		Yes		Yes		Yes		Yes	
Number of obs.	427		462		380		296		343		612	
Pseudo Rsq.	0.4074		0.4203		0.4412		0.3946		0.4778		0.3762	