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Foreign exchange risk management

How are the largest non-financial companies in Norway managing their foreign exchange rate exposure?

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Abstract

The purpose of this thesis is to investigate how the largest non-financial companies in Norway manage their foreign exchange rate exposure. This is investigated through the use of a survey distributed to a sample the largest non-financial firms in Norway.

According to our results, the largest non-financial companies in Norway have a predefined strategy for managing foreign exchange risk, which is defined by the board of directors or by the management in the organisation. The companies' main motivation for managing foreign exchange risk is to reduce fluctuations in income, costs or cash flow, and short term derivatives are more commonly used than derivatives with a long horizon. They also have a high degree of natural hedging, which is influenced by the number of foreign subsidiaries and the number of countries they are spread across. Those who only use operational hedging techniques have subsidiaries in more countries than those only using financial derivatives and those using both. The companies in the shipping industry use more types of derivatives than the other industries, while companies in the oil and gas industry use less.

Preface

This master thesis marks the closure of our two year masters degree in Financial Economics at Norwegian School of Economics and Business Administration (NHH). The topic of the thesis is based on our field of specialisation and interests, and we have chosen to study how the largest non-financial companies in Norway are managing their foreign exchange exposure.

Working with this thesis has been both educational and interesting, providing us with insight and knowledge that will surely be useful later on in our professional careers.

We would like to express our gratitude to Associate Professor (Dr. rer. pol.) Carsten Bienz for valuable guidance and useful comments throughout the process. We would also like to thank the respondents that despite their huge workload took the time to participate in our survey.

Bergen, June 2010

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1 Introduction

This chapter will briefly present the topic, the relevance of the thesis and the development in the currency markets. Lastly, former research is presented, and as a result of this the main problem formulation and hypotheses are introduced.

1.1 Topic of the thesis

The purpose of this thesis is to examine how the largest non-financial companies in Norway are managing their foreign exchange rate exposure. This is done through the use of a survey sent out to a sample consisting of the largest non-financial companies in Norway. The data is analysed empirically in order to test a series of hypotheses, which will form the basis for answering the main problem formulation. The thesis focuses on both operational (e.g. pricing, debt-financing or producing abroad) and financial hedging (e.g. forward contracts or options).

1.2 The relevance of the thesis

Previous studies on exchange risk have mostly been concentrated on financial hedging techniques, valuing derivatives and mathematically optimising currency hedging. Less research has been devoted to how the firms actually are managing their foreign exchange rate exposure. Because of this, the topic is interesting to research more thoroughly.

There have previously been completed international surveys on this subject, focusing on other countries and regions.[1] In a Norwegian context, this is a field with very limited research, with the exception of Børsum & Ødegaard (2005) who mainly focused on derivative usage. This thesis explores the use of both financial derivatives and operational hedging among Norwegian firms, which has never been done before. No research has been based on Norwegian data from the last five years, and the topic is for that reason very interesting to study further. In addition, this thesis focuses on the largest firms in Norway which is also something that has never been done before. This makes it particularly interesting to focus on this group of companies.

Within corporate valuation theory, foreign exchange rate issues are often marginalised or neglected, even though it can be a significant determinant for the valuation of a company.[2] The subject is for that reason also very interesting from a corporate valuation perspective, to see if currency

[1] See e.g. Marshall (1999), Loderer & Pichler (2000), Pramborg (2004) and Hansen (2009).
[2] See Damodaran (2002) or Koller, Goedhart & Wessels (2005) for more information about corporate valuation.

fluctuations are a considerable source of concern among the management in large non-financial companies in Norway.

Norway has a small, open economy with a large raw material based export industry, spearheaded by the oil- and fishing industries. Norway is also importing a lot of consumer goods like cars and electronics, which makes the Norwegian economy and the firms operating in it very exposed to foreign exchange risk. Currency risk is particularly important for Norwegian firms when considering the fact that Norway is not a member of the European Union (EU), nor participating in the Euro-monetary collaboration.

This thesis is first and foremost directed towards stakeholders in firms who are exposed to exchange risk, and have to deal with this in their daily work life. It is also likely to be of academic interest to investigate the foreign exchange risk and management among Norwegian firms more closely, and whether they are taking this source of risk seriously and managing the risk properly. Currency fluctuations is, as mentioned, often a neglected source of risk, therefore this thesis takes aim at exploring this more closely by investigating how the largest non-financial companies in Norway are managing their foreign exchange rate exposure.

The thesis is also of current interest due to increased volatility in the currency markets as a result of the financial crisis (see the next subchapter), and the present economic turmoil among the PIGS-countries. [3] Increased volatility translates to increased risk for the companies, making foreign exchange risk management all the more important.

1.3 Development in currency markets

The years before the financial crisis made its appearance and shook financial markets all over the world, companies and investors tolerated high risk in their chase for high returns. Investments were made in currencies with high interest rates and financed by loans in currencies with low interest rates (Currency carry trade).[4] The Euro (EUR) appreciated to all time high levels against US Dollars (USD), Pound Sterling (GBP) and Norwegian Krone (NOK). As a consequence of the crisis, future

[3] The term ”financial crisis” is referring to the global economic downturn that started in 2007. http://www.worldbank.org/financialcrisis
PIGS is an acronym referring to the economies of Portugal, Italy, Greece and Spain.

[4] “A strategy in which an investor sells a certain currency with a relatively low interest rate and uses the funds to purchase a different currency yielding a higher interest rate. A trader using this strategy attempts to capture the difference between the rates, which can often be substantial, depending on the amount of leverage used.” http://www.investopedia.com/terms/c/currencycarrytrade.asp

income and earnings got much more uncertain, forcing companies and investors to deal with more extreme price movements than before. Their willingness to take on risks has decreased and made them more focused on effective financial risk management. Along with awareness of the increased risk, has also the importance of taking events with small probabilities into account become an even more important issue on their agenda.

Just as in other financial markets, participants in the currency markets changed their behaviour dramatically during and after the financial crisis. The result was illiquidity in the currency markets, flight to EUR and USD, leading both of them to appreciate in value. If looking specifically at the situation in Norway, the downscaling of contracts related to investments or speculative activities weakened the NOK.[5]

Figure 1.1: Historical development of USD/NOK and EUR/NOK.
Source: Norges Bank.

1.3.1 The companies' foreign exchange risk management

Managing the foreign exchange risk was challenging for the export companies also before the financial crisis, but the costs of reducing their financial exposure was lower. The reason for this was the growth in the world economy, and market expectations concerning fluctuations in the currency derivative markets (volatility) at an all time low level. This reduced the costs of using derivatives, while the increased liquidity made the spread between buyers and sellers even smaller. This made it possible for companies to hedge high volumes without influencing the market price, which reduced

[5] The demand for NOK decreased and at the same time the supply increased, leading to a large imbalance in the market.

the costs of hedging and risk management even further. These costs increased significantly after the financial crisis, and made hedging of future income more expensive.

As seen in figure 1.1, export companies with income in USD in Norway had a more challenging environment than the ones with income in EUR. During a period of 18 months before the financial crisis (from the 22nd of October 2006 to the 20th of April 2008), USD depreciated 27 per cent compared to NOK (from NOK 6.78 to NOK 4.94). In the same period EUR to NOK was trading between NOK 8.4970 and NOK 7.6250, corresponding to an appreciation of more than ten per cent. Because of the relatively volatile USD/NOK compared to EUR/NOK, the main issues concerning exchange risk management in Norway before the financial crisis was devoted to hedging USD, in case the USD/NOK value would increase even further. This also led companies to move production out of the country, lowering the costs and/or shifting the costs to USD. When the US Dollar value fell to a level not seen since 1980, it was highly unexpected.

1.3.2 Comparing currency projections before and after the financial crisis

One of the methods for quantifying the currency risk is by looking at implied volatility. A relevant measure for this volatility is found in traded currency options, where high volatility is unveiling great uncertainty. As the volatility increases, so does the sample space which in probability theory typically is illustrated with a confidence interval. The chart below show the development in EUR against NOK compared to the projections one year ahead, made in the end of June 2008.

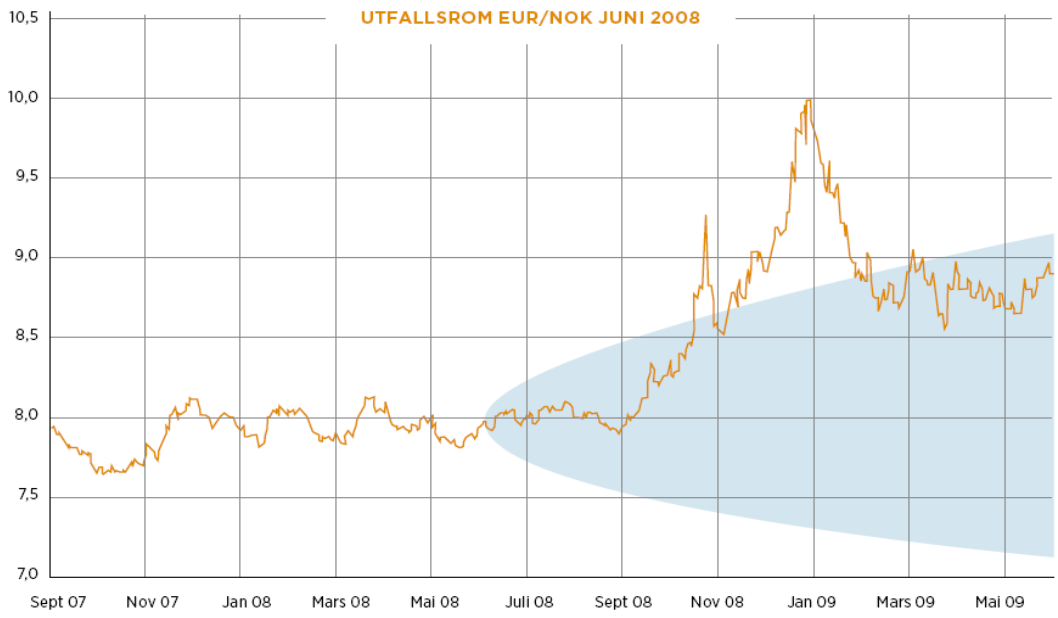

Figure 1.2: Development in EUR/NOK compared to a one-year projection made in the end of June 2008.
Source: Saltvedt and Knutsen (2009).

With a 90 per cent confidence interval the value of EUR to NOK was estimated to be between NOK 9.14 and NOK 7.13 in June 2009 (implying "at-the-money" volatility). As shown in figure 1.2 above, it developed to values way above this range due to the financial crisis, even though calculated with only five per cent probability of doing so. This clearly states the importance for the companies to also take small probabilities into account in their calculations. By comparing this to the same calculation made one year later, one can see the dramatic increase in the uncertainty.

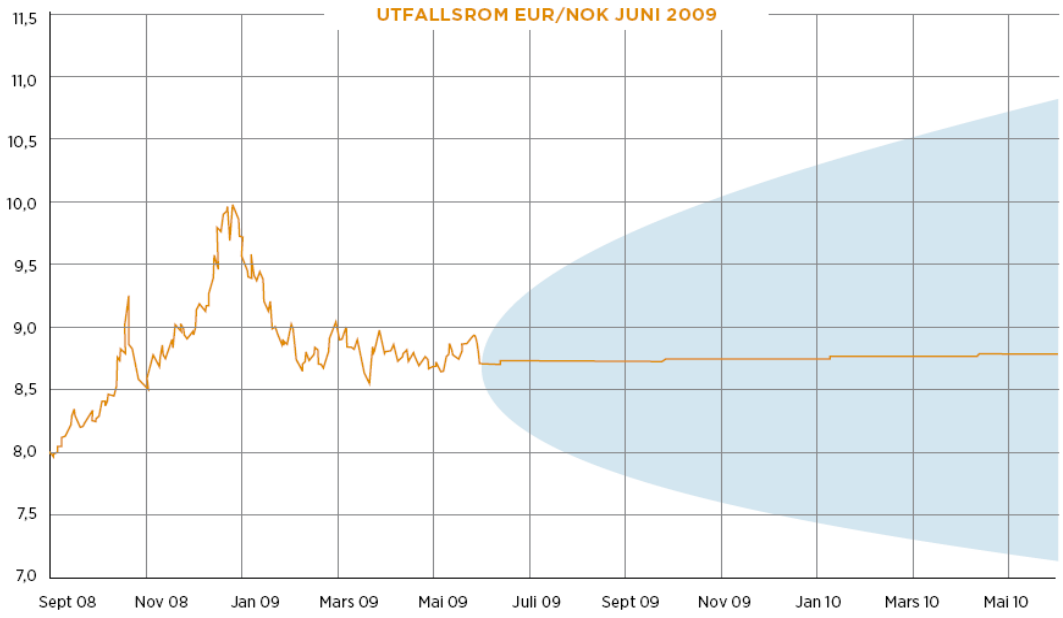

Figure 1.3: Development in EUR/NOK and a one-year projection made in the end of June 2009. Source: Saltvedt and Knutsen (2009).

In figure 1.3 the 90 per cent confidence interval has become much wider (NOK 7.13-10.83), implying that the financial crisis has greatly influenced the uncertainty of the future currency rate. This illustrates that the Norwegian companies now face a much greater uncertainty regarding their foreign exchange rate exposure.

1.4 Empirical literature review

In this subchapter the most important literature is reviewed to create a foundation for the main problem formulation and the hypotheses. First, the most important international literature is presented, before reviewing the Norwegian contribution.

1.4.1 International literature

Early research in this area focused on determining if the companies' value is influenced by foreign exchange rate fluctuations. Being one of the first, Jorion (1990) examined the relationship between stock returns and exchange rates, by performing an empirical analysis among US multinational companies. He presented evidence showing that the relationship between stock returns (value) and exchange rates differs systematically across multinational companies. The degree of foreign exchange rate exposure on firm value was found to be positively related to the percentage of foreign involvement. More specifically; the empirical evidence suggests that exchange rate fluctuations do affect firm value. Research by Bodnar & Gentry (1993) and Choi & Prasad (1995) also supports this.

In a study conducted by Shin and Soenen (1998), they investigated whether US multinational corporations are exposed to foreign exchange risk or not. They also investigated whether there is difference in the foreign exchange rate exposure for large and small firms, and if industry characteristics are a significant determinant. According to their results, there is empirical evidence that the value of US multinational firms is significantly correlated with contemporaneous changes in the value of the US dollar. The foreign exchange exposure was stable over the sample period from 1983 to 1994. Another interesting finding is the fact that especially small firms have a positive significant foreign exchange rate exposure. This is supportive of the view that hedging is more common in large firms, despite the good availability of hedging instruments. They also find that the foreign exchange rate exposure is largely attributable to a few industries (e.g. electrical equipment and primary metal).

Some research has also been executed to find out if the firms are aware of their currency risk. In a study published in the Journal of Empirical Finance by Loderer and Pichler (2000), they explored the currency risk management practices among Swiss industrial companies by distributing a survey. The purpose of their study was to examine whether industrial firms quantify their risk profile and to what extent they hedge against currency fluctuations. Their main conclusion is that the companies have very little active evaluation of the foreign exchange rate exposure, and to a large extent is naturally hedged.[6] This is contradictive to what they expected; that the firms estimate the risk profile of firm value (or at least of their operating cash flow) and hedge it with derivatives. According to their conclusion, the firms do not think they need to know. This is puzzling, since knowing their risk profile could help firms better to calibrate their risk management tools. Generally they find that the firms fail to properly understand why currency risk reduces firm value and some even manage risk even

[6] Natural hedging is having similar portions of income and costs, and assets and debt, in the same foreign currency.

when it is unnecessary. One of their suggestions for further research is the firms overall approach to risk management, namely, the reduction of economic exposure (long run) with operating hedging on the one hand and the short-run hedging of transaction exposure with currency derivatives (financial hedging) on the other. They propose a reason for this, and explain it with:

"Only the CEOs and the heads of the various divisions may have the integral view and the information that CFOs and treasurers apparently lack. But the division heads may not have the tools or the authority to manage currency risk other than with operating instruments. And the CEOs may not have the incentives to manage currency risk more sensibly. Moreover, CEOs, like academics, may have only a fuzzy notion of the benefits of currency risk management."

In other words, the CFOs and treasurers may lack control over operational means, and the division heads may lack control over financial means and derivatives. This may explain why they manage risk even when it is not necessary. This implies that the currency risk management strategy should be set and executed on top of the corporate hierarchy.

When researchers became more and more attentive of currency risk and how it affects the value of companies, research has been more concentrated on dealing with this risk, focusing mainly on derivatives. Allayannis and Ofek (1997) was one of the first to research whether firms use foreign currency derivatives for hedging or for speculative purposes, using a sample of S&P 500 non-financial firms. They found evidence that firms use currency derivatives for hedging and to reduce the foreign exchange rate exposure that they face. This is supported by Carter et al. (2003).

Other studies have also concentrated on the use of financial hedging among firms. One of the earliest and most quoted contributions in this field is the Wharton survey performed several years by Bodnar et al. (1995, 1996 and 1998). They find that US non-financial firms most commonly use foreign currency derivatives, followed by interest-rate, commodity and equity derivatives. They also find that firms use derivatives mainly to reduce the volatility of the firm's cash flow, and that derivative usage is concentrated among the largest firms in the commodity and manufacturing sector. This is also supported by Chowdhry & Howe (1999) who theoretically show that operational hedging is less important for commodity based firms.

Based on a survey, Bodnar and Gebhardt (1999) present and compare the responses regarding derivative usage among US and German non-financial firms. They investigated three classes of derivative-hedging, namely foreign exchange risk, interest rate risk and commodity risk. Firms in both

countries use foreign currency derivatives most frequently followed closely by interest rate derivatives, with commodity derivatives as a distant third. They also find that German firms are more likely to use derivatives to manage risks from fluctuating financial prices than US firms. This is explained by the fact that Germany is a smaller, more open economy, and as a result is more exposed to financial price risk, especially foreign exchange rates. The general pattern of derivative usage across industry and firm size is very comparable for the two countries. This suggests that the determinants of derivative use are not so much driven by country-specific factors as economic considerations like activities and firm characteristics. A result to note is that the percentage of firms using derivatives increases with firm size. This is a common factor for firms in both countries. As for the foreign exchange risk management and hedging horizon, firms that frequently hedge short-run (less than one year) transactions are noticeably higher than the ones hedging long-run (more than one year). This is also supported by Chowdhry and Howe (1999). According to the authors, this may suggest that firms hedge long term currency risk with operational means and short term currency risk with derivatives, and that these are complementary risk management strategies.

As researchers gained insight about derivative usage, research on the use of operational hedging techniques has become increasingly important. Hommel (2002) have mathematically established that operative hedging through the creation of operational flexibility represents a strategic complement to any variance-minimising financial hedge. He shows that there exists a strategic complement between financial and real option-based operative hedging. Given this, one should expect that firms use both financial and operational hedging techniques. Empirical support is found by Carter et al. (2003) and Hansen (2009) for US and Danish multinational companies, suggesting that operational and financial hedges are complementary risk management strategies.

Pantzalis et al. (2001) examined the relationship between operational hedges and exchange rate exposure among US multinational corporations. They measure exposure as the relation between changes in the value of the dollar and stock returns using a time-series regression and controlling for the overall direction of the market. Operational hedging is measured by breadth and depth, suggesting that breadth (depth) should be associated with lower (higher) levels of exposure. Breadth is proxied by the number of foreign countries in which the firm has subsidiaries and depth is proxied by the number of foreign subsidiaries in the top two foreign countries. They find strong evidence of their hypothesis, suggesting that firms with foreign operations concentrated in few geographic areas (high depth) are more exposed to currency risk, as this makes them less diversified. On the other hand, a firm that is spread out over many countries (high breadth) is able to reduce its exposure, because it is in a better position to structure its operations so that exposures in different countries

cancel each other out. The firms' ability to construct operational hedges effectively reduces exposure to currency risk – implying that multinational corporations with large diversified networks will be more successful in effectively managing operating exposure. These results hold after controlling for factors like the use of financial derivatives, degree of foreign involvement, company size, firm risk and industry diversification. Their findings are also supported by Carter et al. (2003).

One of the recent studies concentrating on operational hedging is a master thesis by Hansen (2009). She surveyed Danish medium-sized non-financial, non-listed companies, to find the relationship between operational and financial hedging. She analysed the results by means of regression in order to find variables that are determinants of currency hedging activities. Her findings support the hypothesis that operational and financial risk management is seen as being complements to each other. Pricing strategy was the most popular hedging strategy used by the companies. The author also found that the company specific factors "multi-nationality" and "foreign exposure" is significant factors in explaining the importance and application of both financial and operational hedging strategies. The size of the companies exhibited significance in explaining the importance and application of financial hedging. This could be because of economies of scale and/or the fact that large firms most likely have greater resources and therefore are better equipped to use financial derivatives.

In a study Marshall (1999) performed a survey among UK, USA and Asia Pacific multinational companies, to investigate differences in how the firms in the respective countries manage their foreign exchange rate exposure. He finds a number of similarities, however, with some notable variations between US and UK companies, and Asian Pacific companies. The firm's main objective for managing foreign exchange risk was to minimise fluctuations in cash flows and earnings. According to his results, the Asian companies are more likely to use external instruments to hedge exchange risk, than UK and US companies. His results also show that size and industry is a significant factor in explaining the importance and use of currency hedging.

Pramborg (2004) sent out a survey to firms in Sweden and Korea and compared their use of hedging techniques to manage foreign exchange risk. As found by Marshall (1999) in his study, there are similarities between firms in the countries, but with notable exception; the aim of hedging activity differed. Swedish firms favoured minimising fluctuations of earnings or protecting the appearance of the balance sheet, while the Korean firms are focused more on minimising the fluctuations of cash-flows. Also, the proportion of firms that used derivatives was significantly lower in the Korean than in the Swedish sample, suggesting that the Korean derivative markets are not so easily accessible

because of strict government regulations and is also less sophisticated than the Swedish market. This is contrary to what Marshall (1999) found in his research, where Asian firms tend to use more derivatives than UK and US companies. This implies that Swedish firms have a relatively high derivative usage. The Korean firms relied to a larger extent on alternative hedging methods such as the use of foreign denominated debt.[7]

A number of studies concentrate on how to theoretically find the optimal currency hedging, but since this is not directly relevant for the thesis' main problem formulation, this will be reviewed in the theory chapter.

1.4.2 Norwegian literature

Very little research on the subject has been done using Norwegian data. The main contribution is a paper written by Børsum and Ødegaard from Norges Bank, published in "Penger og Kreditt" no. 1, 2005, with focus on derivatives among Norwegian non-financial companies in general. Because of the study's importance and relevance to our own study, the results are presented more thoroughly than the previous international studies. It is interesting to compare these results with our own, which is done in the analysis chapter.

Over one-third of the respondents had almost the same amount of income as costs in a foreign currency. As the authors of the paper points out, this indicates that natural hedging is common among Norwegian companies. The firms that have higher income than costs in another currency are typically companies in the energy, industrial and fish industry. The respondents with the opposite income/costs structure are mainly dealing with consumer and/or imported capital goods. When it comes to assets and debt, more than two-third of the respondents answered that they have none or very little of these in a foreign currency. Those who deviate from this result are typically shipping and energy companies. In general also the assets and debt in a foreign currency seems to correspond to each other, which again leads the authors to believe that natural hedging is common.

Moving on to derivatives, the most commonly used instrument among the Norwegian companies are forward contracts. The least preferred instrument is options, while swaps are in between. It is also clear that the companies are focusing their use of these instruments on transactions, and not so much on assets. Another interesting result is that the use of derivatives decreases with the length of the horizon, but increases with the size of the firm. The authors claim that the reasons for this could

[7]Also the article by Alkebäck & Hagelin (1999) focuses on the difference between cultures and countries, looking at Swedish vs. New Zealand and US firms.

be that larger companies are more competent and have more resources and time to spare when considering derivatives. At the same time they address that using invoices in their own local currency (a type of operational hedging technique) are more usual among smaller companies. When reviewing the maturity on the financial hedging, the companies in shipping and energy are the main user of long term derivatives, while short term derivatives are used by everybody. The amount of income versus the amount of costs in a foreign currency influence the use of derivatives, and it also influence the share of total income that the firms hedge.

To summarise the hedging motives, 86 per cent of the respondents said that their goal was to reduce the fluctuations in income and costs. Almost one-third also stated that they thought that these fluctuations could result in liquidity problems. At the same time almost one-half of the companies said that they saw the currency risk as relevant for the owners/investors (see the theory chapter for more on this subject). This could also be the reason that 70 per cent stated that they had a predefined strategy towards the currency risk, typically manifested by the board of directors.

1.5 Main problem formulation

In the previous subchapters the empirical literature review was presented. Based on theory and findings from this chapter, we have constructed the main problem formulation followed by the hypotheses. The main problem formulation for this thesis is:

How are the largest non-financial companies in Norway managing their foreign exchange rate exposure?

This is investigated through the use of data from an empirical survey among the 500 largest non-financial companies in Norway.[8] In order to answer the main problem formulation, a selection of different hypotheses is tested, which provides important insights to answer the question above. The hypotheses are mainly based on previous research.

1.5.1 Hypotheses

Hypothesis 1:

H_2: The companies' main motivation for managing foreign exchange risk is to reduce fluctuations in income, costs or cash flow.

Several studies have shown that the main motivation for managing foreign exchange risk is to reduce fluctuations in income, costs or cash flow (Marshall 1999, Bodnar et al. 1994, 1995 and 1998, Pramborg 2004, Børsum & Ødegaard 2005).

Hypothesis 2:

H_3: The companies have a predefined strategy for managing foreign exchange risk which is defined by the board of directors or at corporate level in the organisation.

According to Børsum and Ødegaard (2005), the companies have a predefined strategy towards currency risk, typically manifested by the board of directors. The risk management strategy should be defined and executed at the top level of the corporate hierarchy, in order to attain an integrated and complete risk management strategy (Loderer & Pichler 2000).

Hypothesis 3:

H_4: Short term derivatives are more commonly used than long term derivatives.

According to previous research, the derivative usage is mostly concentrated on short term derivatives (Børsum and Ødegaad 2005, Loderer and Pichler 2000, Chowdhry and Howe 1999, Bodnar and Gebhardt 1999).

[8] Size is measured by revenues in 2008, taken from http://www.norgesstorstebedrifter.no.

Hypothesis 4:

H_5: Operational hedging strategies are more frequently combined with short term derivatives than with long term derivatives.

Long term currency hedging is often done with operational means, while short term hedging is done with derivatives (Bodnar and Gebhardt 1999), making them complimentary strategies (Hommel 2002, Carter et al. 2003 and Hansen 2009).

Hypothesis 5:

H_6: There is a high degree of natural hedging among the companies.

According to Børsum and Ødegaard (2005) companies often have a similar portion of income and costs, and assets and debt, in the same foreign currency. This suggests that natural hedging is common. This is also supported by Loderer and Pichler (2000).

Hypothesis 6:

H_7: The number of foreign subsidiaries, and the number of countries they are spread across, influences the degree of natural hedging and the use of hedging approaches.

A large international network of subsidiaries provides the company with additional operational flexibility, thus reducing the need for other hedging techniques. A company with a broad network has the possibility to choose the location for its activities and optimise according to exchange rate fluctuations. Companies with many subsidiaries in few countries are more exposed to foreign exchange risk (as they are less diversified), consequently increasing the need for other hedging techniques (Pantzalis et al. 2001, Hommel 2003, Hansen 2009).

Hypothesis 7:

H_8: There is a positive and significant relationship between company size and the use of derivatives.

Larger companies are more likely to be active abroad and should therefore be more exposed to foreign exchange risk. This increases the need for various hedging techniques to reduce the risk profile of their foreign currency activities. There may also be economies of scale, as larger firms may have greater resources to utilise the use of derivatives (Bodnar & Gebhardt 1999, Hansen 2009).

Hypothesis 8:

H_9: Companies in energy, commodity and shipping industries are more sophisticated in their use of derivatives than companies in other industries.

The term “sophisticated” is measured by a larger share of respondents using financial hedging techniques, and at the same time using more types of derivatives. According to Børsum and Ødegaard (2005) and Bodnar et al. (1995), financial hedging is more frequently used within energy, commodity and shipping. Chowdhry & Howe (1999) also show theoretically that operational hedging is less important for commodity based firms, thus one should expect that hedging with financial means are more frequent.

2 Theoretical background

The previous chapter presented the background for our thesis, followed by an empirical literature review and finally the main problem formulation and the hypotheses. This chapter will review the theoretical aspect of foreign exchange risk management. In the first section foreign exchange exposure is defined, followed by a discussion if, and by whom, this exposure should be hedged. Subchapter 2.3 describes optimal currency hedging from an academic point of view, while subchapter 2.4 reviews the different hedging approaches and tools available.

2.1 Foreign exchange exposure

The need for foreign exchange risk management is caused by, as financial literature calls it, companies' foreign exchange exposure[9]. On that account, a definition of foreign exchange exposure is necessary before the methods for managing foreign exchange risk can be discussed.

"*Foreign exchange exposure is a measure of the potential for a firm's profitability, cash flow, and market value to change because of a change in exchange rates*".[10]

Assuming that the company is exposed to foreign exchange risk adds responsibility to the financial manager. It requires him or her to measure this exposure, and maximise the profitability, net cash flow and market value of the firm based on these measures. Foreign exchange rate exposure can be measured in more than one way, and is usually divided into three main types: Transaction, economic, and translation exposure.[11] These types of exposure are illustrated in the figure below, followed by a more detailed explanation. In addition, tax exposure is also occasionally discussed in financial literature, but is only briefly mentioned in the following.

[9] In this thesis, foreign exchange exposure is termed foreign exchange rate exposure.
[10] Etteman, Stonehill and Moffett (2004, p. 197)
[11] E.g. Marshall (1999), in addition to the footnote above

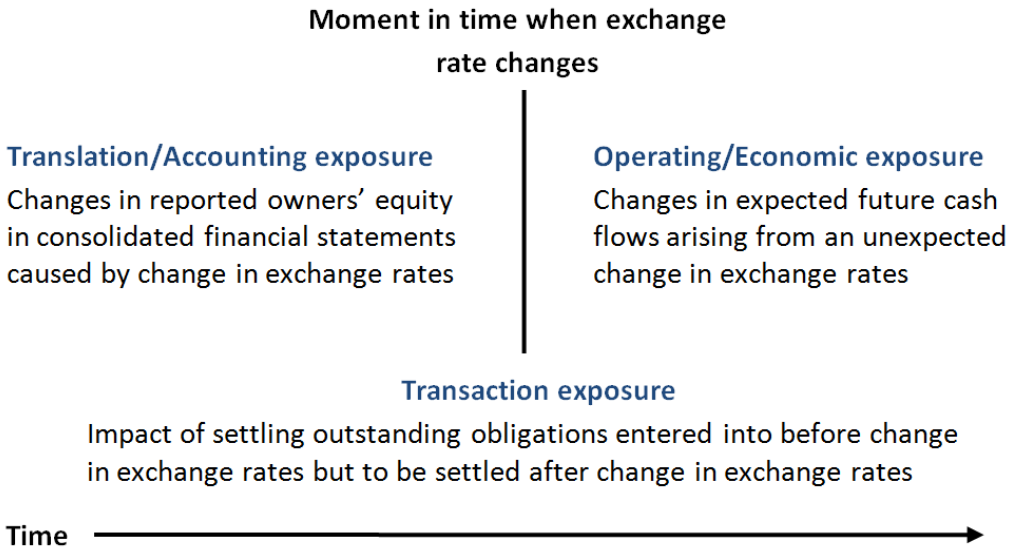

Figure 2.1: Conceptual comparison of transaction, economic, and translation exposure. Source: Etteman, Stonehill and Moffett (2004).

The **transaction exposure** is the changes in a company's cash flows from existing contractual obligations, as a result of fluctuations in foreign exchange rates. This exposure has a timeframe equal to the horizon of the already established contractual agreements, and the cash flows only include those determined in the contracts. The most typical issues in this case is the accounts receivables and payables that is affected by changes in foreign exchange rates, but also investments and loans denominated in foreign currency.

Moving on to the **economic exposure** (also known as operating, competitive or strategic exposure), the horizon is undetermined. The relevant measure is now the change in the company's present value as a consequence of changes in all future operating cash flows caused by unexpected change in exchange rates. Typically these changes influence future costs, prices and/or sales volume. The main difference between transaction and operating exposure is that the first one only measures changes in already contracted cash flows, while the latter focuses on changes in all expected future cash flows.

The **translation exposure** (also known as accounting exposure) measures the impact of changes in foreign exchange rates from an accounting point of view. These changes are formed from the "translation" of e.g. subsidiaries' financial statements in foreign currency, to the reporting currency of the parent company. The **tax exposure** becomes an issue as the taxation varies from country to country. This gives the financial manager the possibility to minimise the worldwide after-tax consequences of foreign exchange losses, and to maximise after-tax gains.

From the survey conducted by Marshall (1999), among multinational companies in UK, USA and Asia Pacific, the results show that the majority of the respondents in each region placed transaction risk as the most important. This had no significant difference between the regions, the size of the companies, the degree of internationalisation, or industry sector. What influenced the importance of translation risk is mainly the relative strength of the currency of which the company reports their financial statement in. Also the economic risk was considered important, but the companies gave this less attention because it is difficult to quantify this exposure.

From a theoretical point of view, the operational exposure should be the most relevant for companies exposed to foreign currencies, since it includes changes in all expected future cash flows. Though, out in the real world this exposure seems difficult to measure, leaving transaction exposure as the most common exposure to measure and manage.

2.2 Should foreign exchange rate exposure be hedged?

Multinational companies are affected by several factors, among these changes in exchange rates, interest rates, and commodity prices. A lot of the hedging techniques are similar for all of the above. Foreign currency derivatives are more commonly used than both interest rate and commodity derivatives, according to a survey on U.S. and German non-financial firms by Bodnar and Gebhardt (1999). This confirms the relevance of this thesis and highlights the importance of focusing on hedging foreign exchange risk. This being said, the impact that interest rates can have on the exchange rates should not be neglected. This is briefly discussed in the next section concerning optimal hedging. As the term hedging is quite wide, so is its definition:

"*Hedging is the taking of a position, acquiring either a cash flow, an asset, or a contract that will rise (fall) in value and offset a fall (rise) in the value of an existing position*".[12]

The main purpose for hedging foreign exchange rate exposure is to protect potential losses due to changes in foreign currencies. This will, by definition, also eliminate the company from gaining value if the opposite situation occurs, which raises the following question: Should foreign exchange rate exposure be hedged?

[12] Etteman, Stonehill and Moffett (2004, p.199)

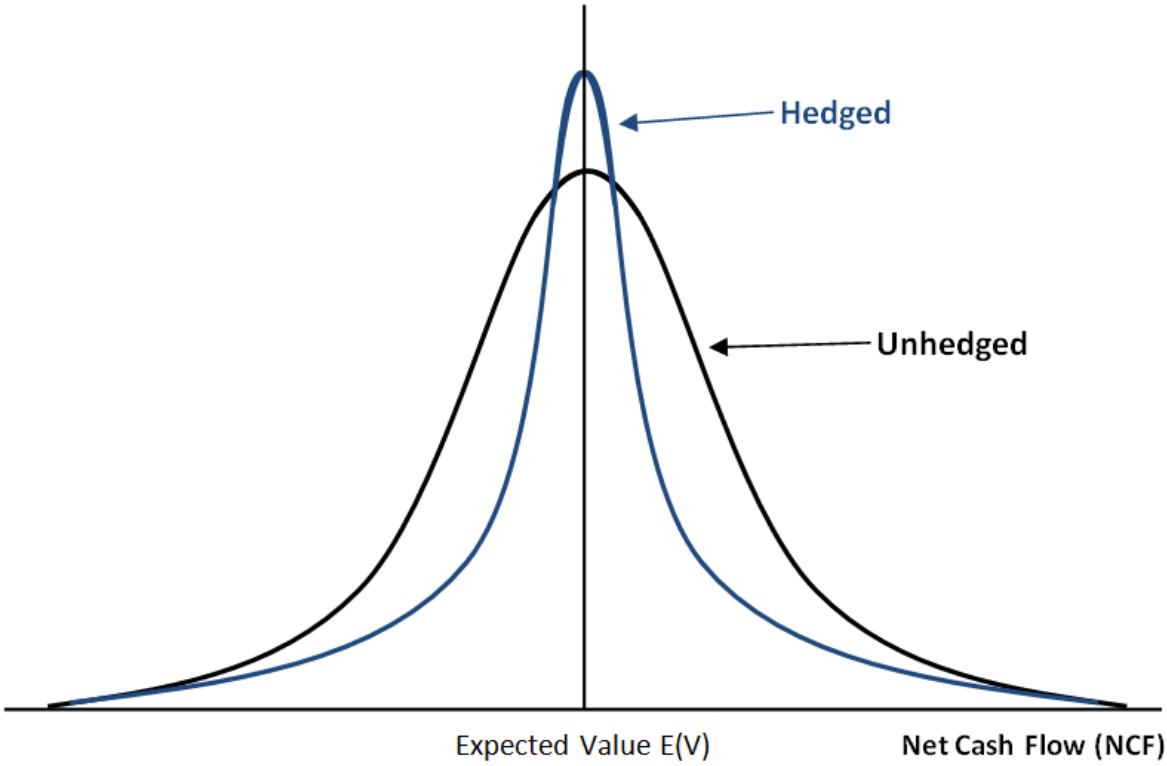

Figure 2.2: Impact of hedging on the expected Cash Flows of the firm.
Source: Etteman, Stonehill and Moffett (2004).

As illustrated in figure 2.2 above, hedging future cash flows will narrow the distribution/reduce the variation of the expected value. In other words, hedging will reduce risk in the expected value of the future cash flows. What is also important to notice is that, in theory, the expected value will not increase as a result of the hedging. If that was the case, the distribution would have shifted to the right in the diagram, returning a higher expected value. In reality, the exact opposite could happen. As hedging is not free, it would actually decrease the expected value, shifting the distribution slightly to the left. Because of this, hedging can only create value if the expected value in reality increases with more than what it costs.

As concluded above, hedging the foreign exchange rate exposure reduces the variance of the expected value. At the same time, depending on the cost of the hedge, the expected value can decrease. The question whether this reduction in variance is reason enough to hedge or not is highly debated. The following subchapters will discuss some of the main arguments from both points of view.

2.2.1 Is hedging the responsibility of the investor or the company?

The Capital Asset Pricing Model (CAPM) theory tells us that investors can diversify their investments, making most of the company specific risk non-relevant.[13] This only applies when the investors' ownership in a company represent a small fraction of their total portfolio of stocks. This is one of the main arguments stating that companies should leave the foreign exchange risk management to the investors. There are two issues making this argument less reliable. First of all, in contradiction to the CAPM theory, empirical studies have shown that most investors in fact do not diversify.[14] According to this, the foreign exchange risk hedging should often be the company's responsibility. The second reason why hedging of foreign exchange risk should be on the company's agenda, can be explained by where this specific risk origins. Fluctuations in currencies are connected to the country's macroeconomics, and have a tendency to be systematic. According to the CAPM theory, the only relevant risk for the investor is what he or she is not capable of diversifying, namely the covariance between the company and the market. Assuming that a change in a foreign exchange rate not only affects the company's cash flow, but also influences the country's macroeconomics, the risk becomes highly relevant for the domestic market as a whole. Looking directly at the CAPM equation the exchange risk will influence the company's beta, and as a result also the company's value. This implies that the foreign exchange risk can affect even a diversified investor, making hedging at the company level highly relevant for both companies and investors.[15] This argument will not hold under the assumption that the investor is perfectly and globally diversified, but this is highly unrealistic.

Another relevant theory is the principal-agent problem.[16] This theory explains the potential conflict between investors' and managers' objectives. The investors are the principals and the managers their agents. While investors want the managers to increase the value of the company, the managers might have their own agenda to please. Within this theory it is claimed that the management are more risk-averse than the investors.[17] This is argued with the fact that the management have a high share of their portfolio invested in the company (in the form of human capital), while the investor are able to diversify the risk. In a foreign exchange risk perspective, this could lead the management to hedge the risk, even when it is not necessary from an investor perspective. The costs of the hedging could reduce the cash flow, something the investors might dislike as it at the same time reduces the value of the company. But as concluded in the last paragraph, reducing the currency risk might

[13] For more detailed information about the CAPM theory, see Bodie, Kane & Marcus (2005).
[14] See e.g. Goetzmann & Kumar (2008), Villonga & Amit (2006) and Polkovnichenko (2005).
[15] Børsum & Ødegaard (2005) and Loderer & Pichler (2000)
[16] See e.g. Brealey, Myers & Allen (2008)
[17] Etteman, Stonehill & Moffett (2004)

actually increase the company value according to the CAPM theory, even though the cash flow is unchanged or slightly reduced.

As a final remark to this discussion, even though some claim that investors can see through the currency risk and use it as a factor in their valuation, the company's management has a better position to evaluate the risk than the investors. No matter how much the company communicates with the public; the management will often possess an advantage in their knowledge about the company's real risks and returns. It is also realistic to believe that markets are not in equilibrium as many theories are based on, due to unexpected events and imperfections of both structural and institutional character. This can put the management in the best position to both recognise and take advantage of such disequilibrium conditions, through what Etteman, Stonehill and Moffett (2004) calls selective hedging. Even though such strategies could lead the management to hedge for speculative reasons, they are often in a better position to know the company's real risk. This could be an advantage when it comes to hedging decisions.

2.2.2 Summing up

As presented in this section of the thesis, foreign exchange risk management and hedging is widely discussed both in financial journals and literature. This is also the reason why we focus on how the largest companies in Norway actually manage their foreign exchange risk. How and who should be responsible for hedging the foreign exchange rate exposure depends on both the investors and the company, and also their risk awareness and risk aversion. A numerous amount of papers and text books show how hedging should be done optimally, within complex models based on a lot of assumptions. The next section of this chapter will discuss some of these theories, before moving on to the main topic of this thesis; how are the largest non-financial companies in Norway actually managing their foreign exchange rate exposure?

2.3 Optimal currency hedging

A lot of the literature and articles in financial journals concerning currency risk hedging have been dedicated to mathematically calculating optimal hedging strategies. Even though this is not the main focus in this thesis, it is still relevant to review some of the theories and strategies, before presenting the results from the survey.

2.3.1 The Currency Hedge Ratio

One of the most basic theories from international business literature is called the Currency Hedge Ratio.[18] The Currency Hedge Ratio, in this case termed beta (β), shows the percentage of the foreign exchange rate exposure that should be hedged by financial instruments.

$$\boldsymbol{\beta} = \frac{\text{value of currency hedge}}{\text{value of currency exposure}}$$

To find the optimal hedge ratio, a portfolio of two assets is considered: the exposure represented by a spot asset and the financial instruments as a hedge asset. The goal of the portfolio is that if the exchange rate movements lead to lost value (Δ spot), the loss is covered by an opposite change in the hedge asset's value (Δ futures). It is optimal to have a portfolio that for any given movement in the exchange rate, ends up with a total change in the value equal to 0 (ΔV = 0).

$$\Delta \textbf{ position value} = \Delta \text{ spot} - \Delta \text{ futures}$$

To find the optimal currency hedge ratio it is possible to use the same technique as in Markowitz' portfolio theory: Minimising the variance of the two assets, only in this case the variance at the end of a period.[19] The result gives us the percentage of the total exposure that should be hedged. Etteman, Stonehill and Moffett (2004) show an example where a multinational firm is expecting a payment denominated in a foreign currency at a future point of time (t_1). The amount of the total exposure that should be hedged must be determined now (t_0). This gives us the following expected value of the future payment:

$$\mathbf{E}\left(\mathbf{X_1^{\$}}\right) = X_1 \times E(S_1)$$

where $E(X_1^{\$})$ is the amount of expected value of the foreign currency payment at time 1 (in $)

X_1 is the amount of the foreign currency to be received

$E(S_1)$ is the now unknown, but expected spot rate at time 1

Since the firm in the example does not know what the spot rate will be in the future, they form a portfolio also including forward contracts to hedge the foreign exchange exposure. This will give

[18] Etteman, Stonehill & Moffett (2004)
[19] Bodie, Kane & Marcus (2005)

them a guaranteed exchange rate for a self chosen amount of U.S. dollars at time t_1. The result is the following expected value of the formed portfolio at the end of the period:

$$\mathbf{E}\left(\mathbf{P_1^{\$}}\right) = X_1 E(S_1) + X_f[E(F_1) - F_0]$$

where X_f is the amount of the foreign currency sold forward at time 0

F_0 is the current price of the futures contract

$E(F_1)$ is the expected futures price at time 1

The only unknown component is the future spot rate. To find the amount that the firm should hedge, one calculates the amount that minimises the variance of the expected return. The first step is to calculate the variance of the expected portfolio's value:

$$\underset{\mathbf{X_f}}{\mathbf{MIN}}\,\mathbf{var}\left[\mathbf{E}(\mathbf{P_1^{\$}})\right] = X^2 \mathrm{var}(S_1) + {X_f}^2 \mathrm{var}(F_1) + 2XX_f \mathrm{cov}(S_1, F_1)$$

The next step is setting the equation to zero and differentiating it with respect to X_f, which results in the following:

$$2X_f \mathrm{var}(F_1) = -2X\mathrm{cov}(S_1, F_1)$$

Since we want to find the amount of foreign currency that should be sold forward, the equation is solved for this variable. Doing this, gives the amount that minimises the portfolio's variance at the end of the period:

$$\mathbf{X_f} = \frac{-2X\mathrm{cov}(S_1, F_1)}{2\mathrm{var}(F_1)} = \frac{-X\mathrm{cov}(S_1, F_1)}{\mathrm{var}(F_1)}$$

The final operation is to rearrange the equity to represent the relative size of the optimal hedge amount to the amount of the original exposure, revealing the optimal hedge ratio:

$$\frac{\mathbf{X_f}}{\mathbf{X}} = \boldsymbol{\beta} = \frac{-\mathrm{cov}(S_1, F_1)}{\mathrm{var}(F_1)}$$

Using actual figures from the mentioned example in the literature show how this theoretical optimal hedge ratio can be used by companies out in the real world. Assume that a firm expects to receive

1 000 000 in 90 days in a foreign currency, and wants to how much of it they should hedge. The variance of the 90-day forward is from market data known to be 0.005573, while the covariance between the spot rate and the forward rate is 0.0054998. By inserting the figures into the optimal hedge ratio the relative amount is discovered:

$$\boldsymbol{\beta} = \frac{X_f}{X} = \frac{-0.0054998}{0.005573} = -0.986865 = \mathbf{98.69}\ \%$$

98.69 per cent of the total amount should be hedged, or sold forward, or 0.9868 x 1 000 000 = 986 865. Since the spot rate and the futures rate is not perfectly correlated, this makes the relative amount to be hedged less than 1. Even though they are not perfectly correlated, they still give a result close to hedging the whole amount. This is quite typical for most major currencies, returning optimal hedge ratios mostly from 0.97 and up. For that reason, it is highly unlikely that the companies in practice calculate the optimal hedge ratio, as they rather would hedge the whole amount as if the beta was 1.

The currency hedge ratio is also the basis for several dynamic currency hedging models. These models calculate a dynamic strategy for hedging foreign exchange risk, based on e.g. estimates of the joint distribution of spot and futures currency returns (e.g. by using the GARCH model). This results in a sequence of dynamic time-varying optimal hedge ratios, constructed upon the estimated parameters of a conditional covariance matrix. This subject will not be discussed further in this thesis but are widely discussed in financial literature.[20]

2.3.2 Adding the interest rate risk

The optimal hedge rate explained above is very simplified. Several more advanced models has been constructed and published in financial journals, and one of those articles is written by Lioui and Poncet (2002). In this article the authors add several assumptions regarding states, domestic and foreign economy, exchange rate derivatives, the foreign investment, and portfolio strategies. The result is a much more complex model with several components giving clear economic interpretations. The details of this model will not be discussed, but some of the most interesting results are commented.

By including variables like interest rate risk they discover that even though futures contracts are known to be more difficult to price than forwards, the optimal strategy by using them is simpler.

[20] Chakraborty & Barkoulas (1999), Poomimars, Cadle & Theobald (2003) and Chan (2008)

Since they are no longer assuming that financial markets across countries are complete, a problem concerning that the interest rate risk cannot be perfectly hedged emerge. When hedging the exposure with forward contracts the profits and losses up till the due date is locked in until the maturity of the contract. Taking into account that these profits and losses should be discounted back to the current date, reveals the interest rate risk. This affects the company since it now demands additional hedging. If futures contracts are used, the market-to-market mechanism will eliminate this risk as profits and losses is collected instantly. To sum up the findings, using futures instead of forwards will eliminate the interest rate risk, which for risk averse companies is very valuable. However, this is just two out of several other hedging approaches.

Further theoretical deduced models including a broader spectre of hedging tools, become more and more complex and includes even stricter assumptions. Because of this, we have limited ourselves to highlight some of the most popular hedging techniques from a more practical point of view. This is done in the next section of this chapter.

2.4 Financial and Operational hedging approaches

The previous sections discussed foreign exchange rate exposure, if this exposure should be hedged or not, and at last how a theoretical approach to how the optimal hedging can be calculated. But if a company has decided to hedge their foreign exchange rate exposure, what kind of techniques is available? The following subchapters will take a closer look at some of the most popular hedging techniques available, both financial instruments and operational approaches. After this is done, the two methods are compared up against each other.

2.4.1 Financial approach

The financial approach mainly consists of financial instruments like futures or forward contracts, swaps or options. These instruments allow the company to hedge positions that are exposed to foreign exchange rates and, as mentioned earlier in the thesis, minimise the variance of future cash flows. The optimal use of financial hedging can be found by solving a variance-minimisation problem as shown in the previous section of this chapter. This could be used to increase expected value, but this is only the case if the value of the hedging position is larger than what the instruments costs. Before we discuss the use of financial derivatives any further, we will give a short description of the instruments mentioned above.

A forward or futures contract is an agreement between two parties to buy or sell an asset at a predefined point in time. For e.g. an export company these instruments are usually used to hedge a

cash flow in another currency expected to be received in the future. This lets the company know exactly what amount they will receive, eliminating any fluctuations in the value of the cash flow. The main difference between forward and futures contracts is that the latter is publicly traded in financial markets and margined daily. A forward contract is a private agreement, with no transfers between the parties before the maturity of the contract.

A swap is not very different from a forward or futures contract, but as the name reveals the parties involved agrees to exchange something within a given timeframe. This is typically used to exchange a stream of cash flow against another. In a currency hedging perspective a swap could, as an example, be used to swap fixed interest rates on a loan in one currency with an identical loan in another currency.

The last financial instrument described is an option. Also this derivative has many similarities with a forward or futures contract, but with one big difference; at maturity of the contract, the option holder has the right, but is not obligated to sell or buy the underlying asset. The agreement still includes a specified price (called the strike price) and timeframe, but if the agreed price in the contract is in the option holder's disfavour he has the possibility to rather buy the asset spot. Continuing the example with the export company, with an option the expected payment is secured at a certain level. But if the currency at the maturity of the option trades at a more favourable price spot than in the agreement, the company could increase its profit by selling the currency in the spot market.

All of the descriptions above expose one great limitation concerning financial hedging instruments; it's time horizon. They can very well cover planned transactions and minimise short term risk, but recalling operating exposure which includes all future cash flows, these instruments could fall a bit short. On the other hand, this kind of hedging is easy to quantify, which makes it attractive to a majority of foreign exchange rate exposed companies.[21] Another downside when it comes to solely using a financial approach is if a change in currencies alters the company's competitive position or leads to lost business opportunities, as this cannot be hedged with derivatives. This is where the operational approach could be used as a complementary strategy.

2.4.2 Operational approach

The operational approach typically includes changing the localisation of production facilities, or buying inputs and using suppliers from a foreign country so the costs will correspond to the same

[21] Marshall (1999)

currency as the income. Having approximately the same amount of costs and income in the same currency is also known as natural hedging. Other strategies could be changing prices as the currency fluctuates, choosing and timing new markets segments, and adjusting the product mix. If the company has foreign exchange rate exposed assets, it can neutralise this effect by raising a loan in the same currency. This would also increase the costs in the foreign currency, at the same time increasing the degree of natural hedging against income in that currency. Another well known operational strategy is to invoice the customers in the company's own currency, transferring the exchange risk to the other party.

The main purpose of using operational hedging techniques is to minimise, and find the correct response to, the total effect of all future changes in other currencies the company is exposed to.[22] This could also include the effect of achieving extra profit when the foreign exchange rate changes in a favourable matter.[23]

2.4.3 Financial versus operative hedging

Which of the two approaches that serve as the most important, depends on company specific characteristics. Operational flexibility decides to which extent the company is able to use operational techniques and at the same time the importance of these. Hommel (2003) found that by utilising a real options framework, operative hedging through the creation of operational flexibility serves as a complementary strategy to any variance-minimising financial hedge. Using a real options perspective is a constructive way to value the flexibility, and has been the framework in a large amount of the research on operational hedging. Hommel (2003) also states that operational flexibility creates an asymmetric exposure profile, which as a result alters the composition of the financial hedge portfolio. How much of each of the approaches that should be used will differ from company to company, based on the amount of investments they have made in flexibility. Based on these arguments, a pure exporting company's most important approach is financial instruments. On the contrary, a company with subsidiaries in different countries with different currencies should utilise operational hedging e.g. through shifting production according to fluctuations in currencies. This makes it possible not only to minimise the risk, but also benefit from developments in the foreign currencies.

It is worth mentioning that researchers have different opinions on what conditions that makes an operational approach relevant for a company. Chowdhry and Howe (1999) states that multinational

[22] Glaum (1990)
[23] Bartram, Dufey & Frenkel (2005)

firms will engage in operational hedging only when both exchange rate uncertainty and demand uncertainty are present. They argue that exchange rate uncertainty cannot alone justify delocalisation because it can be hedged with foreign exchange instruments. As the demand uncertainty is lower in the short term, operational hedging is more important in the long run. Hau (1999) on the other hand, claims that this conclusion is based on a model with assumptions that lack proper microfoundations. By correcting the model he finds that demand uncertainty is not necessary for a multinational firm to delocalise, and thereby use operational hedging.

3 Data and methodology

The previous chapter presented relevant foreign exchange risk theory and the different hedging approaches available. This chapter will present methodology, the sample selection and the methods used for analysis, before finally presenting descriptive statistics from the survey.

3.1 Research methodology – theoretical framework

To execute an empirical study, a dataset is needed for analysis. To answer the hypotheses, we used a survey to gather the data needed for the research ourselves. This is called primary data. The alternative would have been use of secondary data, which is data collected by others, often for other purposes. The main problem with secondary data is often limited availability for the data needed for a given study.

There are two main types of previously research done in the field of foreign exchange risk management. The first type is based on publicly available data about currency exposure and hedging, like annual reports or databases (secondary data). The advantage with this method is elimination of selection biases, and that data for the whole sample can be attained. The main problem with secondary data is the availability. Very little research has been done in this field, concentrating on Norwegian corporations, thus limiting the secondary data available.[24] Also, the firms do not publish a whole lot of information about their foreign exchange risk and hedging activities, if they choose to publish anything at all. Annual reports for non-listed companies are often not available, and there are different accounting standards that may influence how the firms report their currency exposure and derivative usage. At best, there is some information in the financial statement notes in the public traded firms. This limits the possibilities to access secondary data by observation.

The second type of research is based on surveys. The immediate advantage with this method is the possibility to collect exactly the data needed for the study. This is called primary data, and is the main method applied in this thesis. Generally, surveys allows for the use of more qualitative questions, like motivations and thoughts. One of the main weaknesses with surveys based on voluntary participation is the danger of selection biases (e.g. only the respondents that take interest in the subject or have the time available, complete the survey).

[24] The exception is Børsum and Ødegaard (2005), but the data is not publicly available.

There are some general points that have to be considered when using a standardised questionnaire. Gripsrud and Olsson (2000) list some guidelines for question formulation, which was used when making the questions. They are summarized in the list below.

1. Use easy and clear language.
2. Avoid leading questions.
3. Avoid implicit alternatives.
4. Avoid implicit assumptions.
5. Avoid generalisations.
6. Avoid iterative questions.

Gripsrud and Olsson (2000) also stress the importance of the survey layout and pre-testing the questionnaire, in order to insure validity and reliability.

3.2 Methodology implementation

3.2.1 Target population definition

For the purpose of this study we have focused on the largest non-financial firms in Norway. There are two main reasons for this. First, according to earlier international studies, larger firms are more likely to be exposed to foreign exchange risk. Since this thesis aims to study how they are managing their foreign exchange rate exposure, the firms in our sample should at least to some degree be exposed to currency risk. Second, a study concentrating on the largest companies in Norway has never been done before. This makes it particularly interesting to focus on this group of companies.

Financial companies are left out of the target population, since they often are both provider and demander of hedging products. This is also done for the same reason in several earlier studies.[25]

3.2.2 Final sample used in the study

A list of the 500 largest Norwegian companies was used as a starting point for our sample in the study. The list was provided to us by Norges Største Bedrifter, which is published by Findexia Forlag.[26] This list displays the 500 largest companies in Norway, based on revenues from the 2008 financial statements. The selection process is illustrated in table 3.1 below and explained in detail in the following paragraphs.

[25] Bodnar & Gebhardt (1999), Pramborg (2004), Børsum & Ødegaard (2005) and Hansen (2009)
[26] Published annually since 1966. http://www.norgesstorstebedrifter.no and http://www.findexaforlag.no

Table 3.1: Sample selection process.

Step	Action	Number of companies included
Step 1	Restricting to the 500 largest companies.	500
Step 2	Excluding non-financial companies.	458
Step 3	Excluding companies with common corporate management/duplicates	449
Step 4	Excluding companies without available contact information	438

Step 1: Restricting to the 500 largest companies.

The first step of the selection process was to limit our sample to the 500 largest companies in Norway, ranked by their revenues in 2008. As mentioned above, this list was provided to us by Norges Største Bedrifter.

Step 2: Excluding non-financial companies.

This was done because financial companies just as often are a provider as a demander of currency derivatives. This makes the financial companies less relevant to compare with other industries. Excluding all the non-financial companies, the sample was lowered to 458 companies.

Step 3: Excluding companies with common corporate management/duplicates.

To avoid sending out several identical surveys to the same person/company, the companies that were duplicates or have common corporate management were excluded. This reduced the sample by nine companies.

Step 4: Excluding companies without available contact information.

Some companies did not have accessible contact information. We strained ourselves trying to find contact information to all the companies, searching the websites and other sources. But, for 11 companies this was not possible to attain, and therefore had to be excluded in the final sample.

As a result of the steps above, the final sample consisted of 438 companies. The analyses are based on the 176 answers received from the final sample. The complete list of the 500 largest companies can be found in appendix C.

3.2.3 Questionnaire design

As mentioned earlier, data on foreign exchange risk management among the (largest) firms in Norway is not readily accessible in any official databases, or in the accounting reports. Therefore, to collect the data needed to answer our hypotheses, we designed our own questionnaire. The structure of the design was inspired by earlier empirical studies like the ones conducted by Marshall

(1999), Loderer and Pichler (2000), and in particular Børsum and Ødegaard (2005), before tailoring the questionnaire to suit our requirements. This also gave us the opportunity to compare our results with theirs. A complete version of the questionnaire is presented in appendix B.

Our questionnaire had to be designed in a way that would help us answer the hypotheses. To insure the validity of the survey, a lot of time was used on previous research and theory before making the questions. Even so, there is still a possibility that some of the respondents may have misunderstood or had problems understanding some of the questions.

In order to achieve a highest possible response rate, a target response time of approximately five minutes was set as an upper limit. This was also done to insure that the respondents would not get tired or bored while answering the survey, and aborting before completing all the questions.

A "funnel approach" was used when designing the survey, starting with wide and general questions before narrowing down to specifics. Questions about industry affiliation, and if they are a public limited company, private limited company or in the government sector, got the respondents warmed up before the more specific questions. Following the warm up questions the rest of the questions were structured in a logical way, starting with questions about currency exposure, followed by questions about hedging, before asking reasons for their earlier answers.

The questionnaire was also made with a dynamic approach, using routing of questions. This was necessary to get the answers needed from our respondents and to insure that the respondents did not have to answer any irrelevant questions. E.g. if the respondent answered "No" on the question if the firm has any income, costs, assets or debt in another currency than NOK, then that firm is not exposed to foreign exchange risk. It would then be irrelevant for the respondent to answer any questions about currency hedging. In total the questionnaire consisted of between 3 and 17 questions, depending on previous answers.

All the questions in the survey were to the extent possible designed as closed-end questions, with predefined alternatives. But, we also included an "other – please specify" alternative. This was done to catch any potentially unforeseen alternatives. Some respondents might also be put-off if they could not provide their best alternative, which in worst case could have lowered the survey response rate. Predefined alternatives also make it possible to analyze the answers using statistical methods, which was essential in order to test the hypotheses.

The questionnaire was written in Norwegian, and not English. This was a deliberate choice from our side. Since the working language in most of the Norwegian companies is Norwegian, we feared that a survey written in English could lower the response rate. Writing in Norwegian would also minimise the risk of any misunderstandings on the respondent's side, which could potentially lead to distorted answers and lower the validity of the study.

3.2.4 Survey implementation

To create, distribute and manage this questionnaire an online survey service called Questback was used.[27] Questback allowed us to collect primary data in an easy and effective way. Additionally, it provides quick response and the data is already converted into numerical form suitable for analysis.

To ensure that the respondents would understand the questions and the technical terms used, the survey was distributed to a test-panel. The test-panel consisted of a heterogeneous group of people, where some had experience with currency hedging from top-management level, others were NHH master students, and some were employees not dealing with exchange risk at all. Still, all the members in the test-panel had the basic qualifications necessary to answer the questions. This ensured that our survey would be of a certain quality as well as comprehensible by most people in our final sample.

E-mail was used to communicate with our respondents, and it was challenging and tedious to collect and identify all the e-mail addresses since many of the company websites provide very little information about this. We tried as far as possible to send the survey to an email with a specific name behind it, believing it would give the best response rate. We also tried to the largest extent possible to target the employees we thought would be best qualified to answer the survey, preferably people with responsibility on a company-group level, like CFOs or CEOs. If people in the top-management group could not be contacted, the survey was sent to an information manager, or least preferably to a non-specific company mail address.

The survey was distributed on the 12th of March 2010. A reminder was sent out on the 13th of April 2010 to those who had not answered. The mail started with an introduction, describing the purpose of the survey. We then presented some brief information about the survey, and attached a web-link to the survey at the bottom. Brief instructions were also included on the first page in the questionnaire. The e-mails and the questionnaire can be found in appendix A and B respectively.

[27] http://www.questback.com

3.3 Survey response

After sending out the initial survey and later a reminder to our sample selection of 438 firms, we ended up with a total of 176 usable responses. This gave us a response rate of 40.2 %. This is a quite satisfying response rate and higher than most comparable surveys. This is confirmed in table 3.2 below, showing that the average response rate was 31.3 % among other comparable surveys and that only one survey achieved a higher response rate than ours.

Table 3.2: Survey response comparison.

Author(s)	Response rate
Hansen, M.A., 2009	34.9 %
Børsum, Ø.G. & Ødegaard, B.A., 2005	36.9 %
Pramborg, B., 2004	26.0 %
Loderer, C. & Pichler, K., 2000	28.8 %
Alkebäck, P. & Hagelin, N., 1999	76.6 %
Bodnar, G.M. & Gebhardt, G., 1999	14.6 %
Marshall, A.P., 1999	30.0 %
Bodnar, G.M. et al., 1998	20.7 %
Bodnar, G.M. et al., 1996	17.5 %
Bodnar, G.M. et al., 1995	26.5 %
Average	**31.3 %**
Our survey	**40.2 %**

Even though a lot of time and resources was used to find contact information to the person best suitable to answer the questionnaire, we did get a few e-mails from persons stating that they were not the right person or not qualified to answer the survey. In those cases we were provided with contact information to a more competent person. The few who chose to give us a reason why they did not participate mostly stated that they principally do not participate in surveys.

3.4 Method of analysing

In this thesis both cross-tabulation with Chi-square test and regression analysis is used to statistically test several of the hypotheses from chapter 1.5. The remaining part of this chapter briefly presents the theory and application of these statistical methods. This theory is taken from Gripsrud and Olsson (2000), Thrane (2003) and Ringdal (2001). SPSS and STATA were used to perform the statistical tests.

3.4.1 Variables

Measurements are usually divided into four different types of scales: nominal, ordinal, interval or ratio variables.

- *Nominal variables* are variables with no natural order or ranking, e.g. industry or location.

- *Ordinal variables* are variables where one can rate the values, but not say anything about the value compared to another. E.g. “greatly dislike, moderately dislike, indifferent, moderately like, greatly like.”
- *Interval variables* are equally spaced variables, like temperature. The difference between 20 Celsius and 21 Celsius is taken to be the same as the difference between 40 Celsius and 41 Celsius. Interval variables do not have a true zero.
- *Ratio variables* are equally spaced variables, with a true zero point, e.g. sales or income.

In addition to these variables, some of the tests that are being performed in this thesis include dummy variables. *Dummy variables* are variables that either have the value 0 or 1 to signal if a characteristic is present or not. This variable type can also be computed based on other variables, e.g. giving all the respondents who only use financial hedging techniques the value 1, while giving both the ones only using operational hedging techniques, and the ones using both of these techniques, the value 0. In the analysis, these variables will be denoted with their reference group.

3.4.2 Pearson’s Chi-square (χ^2)-test

In market research the dependency and correlation between several variables is an important subject. The chi-square test can be useful if one want to test for significant relations between variables when the variables are nominal. This can be presented in a cross table. When the variables are interval or ratio, regression analysis can be used (presented in next subchapter).

Chi-square measures the degree of deviation between a theoretical model and the observed data. If there is no dependency between the variables in a cross table, the chi-square value will be closer to zero. A high chi-square value signals big deviations between the expected theoretical model and the results. The formula for chi-square (χ^2) is given by:

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

O is the observed frequencies in the sample and E is the expected frequencies from a theoretical model with no dependency (or statistical independence) between two variables in a cross table. The formula finds O and E for each cell in the cross table, and the squared difference $(O – E)^2$. This result is divided by the expected frequency (E). The sum of this calculation from all the cells in the cross table gives the chi-square (χ^2).

Because the chi-square value is not standardised and varies from zero to infinite ($0 \leq \chi^2 < \infty$), interpreting the value is not easy. This is solved by comparing the value to a chi-square distribution and calculating a p-value. This reveals the level of significance. An important premise for the chi-square test is that the number of observations is at least five in each cell in a cross-tabulation. [28]

To test for significance a 90 per cent confidence interval is used. This means that one can with 90 per cent degree of certainty say that the result is applicable for the entire population.

3.4.3 Regression analysis

Regression analysis is a quantitative method for analysing the relation between a dependent variable and one or several independent variables. A bivariate regression-line in a general form is given by:

$$\boldsymbol{Y} = \alpha + \beta(X) + \varepsilon$$

where Y is the dependent variable, α is the constant, β is the regression coefficient of X and X is the independent variable. The regression coefficient β is the slope of the equation, i.e. the given change in Y, as a result of a one-unit change in X. ε represent the residual part, and is the part that cannot be explained by the variables. To measure the explanatory power of the equation, R^2 is used. A higher R^2 means that the regression displays more explanatory power than a lower R^2.

Regression analysis builds on the principle of ordinary least squares. This method aims to minimise the distance from the different observations to the estimated regression-line. In other words; to find the line that minimises the combined deviations from the observed values. [29] To test if our regressions are significant, a 90 per cent confidence interval is used, like with the chi-square test. This is lower than the more commonly used 95 per cent confidence interval, but this is done because of a relatively low number of observations.[30]

3.4.4 Assumptions of the ordinary least squares regression model

The ordinary least squares regression model is according to Ringdal (2001) based on eight assumptions, divided into three main categories: model specification, regression residuals, and independent variables in multiple regressions. These will briefly be reviewed in this section, together with some of the methods for testing if the assumptions hold.

[28] For more detailed information about the chi-square test, see Gripsrud and Olsson (2000) pp. 223-227 or Ringdal (2001) pp. 324-340.
[29] For more detailed information about regression analysis, see Thrane (2003) or Ringdal (2001).
[30] http://www.kunnskapssenteret.com/articles/2654/1/Hypoteseproving/Hypoteseproving.html

Model specification

1. All relevant independent variables are included, while irrelevant independent variables are excluded.
2. The relationship between the independent variables and the dependent variable are linear.
3. It is an additive model, meaning that there is no statistical interaction between the independent variables.

Excluding relevant independent variables in a regression model could lead to results that wrongfully attribute the common variance they share with other variables, to those included. This would also inflate the residuals. Including irrelevant independent variables could lead to results that wrongfully attribute common variance they share with other included variables, to the irrelevant ones. Both cases would influence the estimates of the regression coefficients. Statistical techniques have been used to test the model specification of the regression models in this thesis.[31]

The regression model would still make a straight line, even if the relationship between dependent and independent variables is non-linear. This can lead to results showing relationships that in reality do not exist. A reason for non-linearity could be that the variable has a skewed distribution. A way of discovering this could be to look at scatter plots of the observations to see if there is a linear relationship (see figure 3.1).

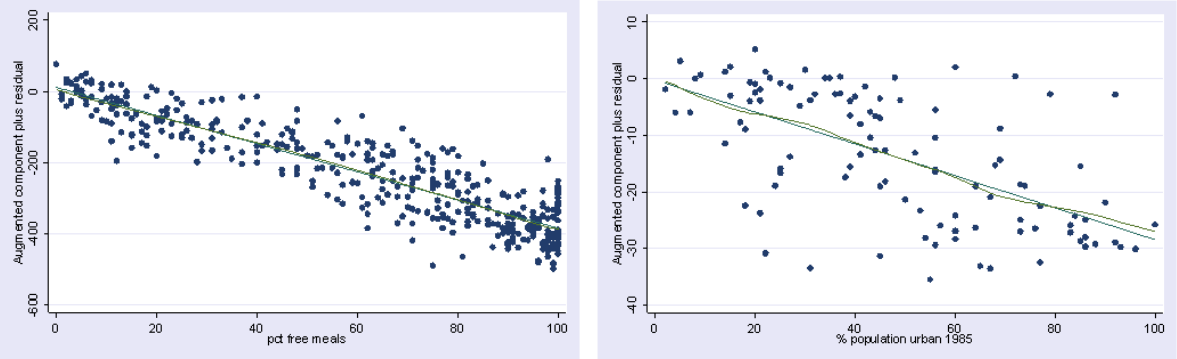

Figure 3.1: Using "acprplot" in STATA to graph an augmented partial residual plot.[32]

When it comes to the third assumption, statistical interaction can be built into the model manually.[33] This can reveal how the interaction affects the results, to see if the difference is significant enough to be considered.

[31] In STATA, "linktest" could be used to test single-equation models, while "ovtest" performs a regression specification error test for excluded variables.
[32] http://www.ats.ucla.edu/stat/stata/webbooks/reg/chapter2/statareg2.htm
[33] Ringdal (2001)

Regression residuals

4. The residuals of all independent variables have the same variance (homoskedasticity). $\mathrm{Var}(\varepsilon_i) = \sigma^2$.
5. The residuals are normally distributed. $\mathrm{E}_i \sim \mathrm{N}(0, \sigma^2)$.
6. The residuals are uncorrelated with each other and the independent variables (autocorrelation/serial correlation). $\mathrm{Cov}(\varepsilon_i, \varepsilon_j) = 0, \mathrm{Cov}(\varepsilon_i, \mathrm{X}_i) = 0$.
7. The residuals are expected to have an average of zero. $\mathrm{E}(\varepsilon_i) = 0$.

Of the assumptions concerning the regression residuals, testing for heteroskedasticity and if they are normally distributed are often what gets the most consideration (assumption four and five). The first are usually tested by reviewing scatter plots of the residuals of the regression versus the predicted values. An indication of heteroskedasticity is seen if the pattern of the plots is wider towards the end of the chart (see figure 3.2). This could also be statistically tested by using White's or the Breusch-Pagan test. To test if the residuals are normally distributed reviewing a histogram or kernel density plot is used (see figure 3.2). Having heteroskedasticity or non-normalised residuals will not affect the estimated coefficients, but will influence the results as it no longer is assured that the p-values for the F-test and t-tests are valid. A way of dealing with heteroskedasticity is by running a regression with robust standard errors (e.g. by using the Huber-White sandwich estimators). As this would help minor concerns with heteroskedasticity, we will assume that this applies for our dataset and use robust standard errors in the regressions in our analysis. Regarding the normal distribution of residuals, this can be tested by visually reviewing the distribution (see figure 3.2). In reality the ordinary least squares regression model only requires the residual to be identically and independently distributed.[32] Though, one should be are aware of that the absence of normal distribution could make it hard to draw conclusions to the whole population.

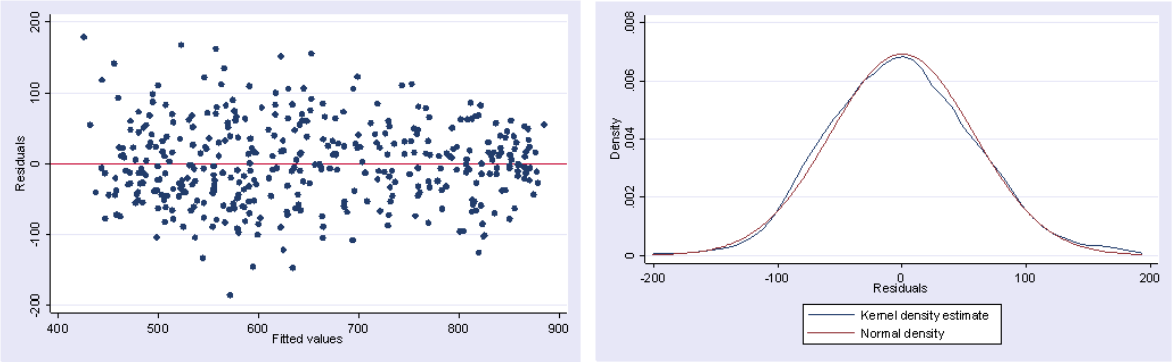

Figure 3.2: Searching for heterskedasticity and normalised regression residuals, using "rvfplot" and "kdensity" in STATA.[34]

Assumption number six is only an issue when dealing with time series or in cases where the same respondents are sampled repeatedly. Autocorrelation can be tested with the Durbin-Watson statistic, but since this not relevant for the dataset in this thesis the test will not be performed.[35]

Independent variables in multiple regressions

8. The independent variables cannot be perfect correlated, both by pairs and group (Multicollinearity).

A perfect linear relationship between the independent variables would lead to unstable estimation of the regression's coefficients and inflated standard errors. A common way to test for multicollinearity is to calculate the variance inflation factor (vif) or the tolerance (1/vif). A vif above 10 or a tolerance below 0.1 are seen as a signal that multicollinearity should be investigated further.

All the regression diagnostic tests can be found in appendix D. Before presenting the analyses and testing the hypotheses, the dataset showing the respondents survey answers is reviewed. This is done in the next sub-chapter.

3.5 Descriptive statistics

This chapter presents detailed descriptive statistics for all the questions included in the distributed survey. The purpose of this chapter is to allow for a better understanding of the achieved results and provide the reader with additional background information about the foreign exchange risk management of the largest non-financial companies in Norway. No results or conclusions are

[34] http://www.ats.ucla.edu/stat/stata/webbooks/reg/chapter2/statareg2.htm
[35] In STATA, "estat dwatson" performs a Durbin-Watson test.

presented in this chapter, but it gives an impartial presentation of the respondent's answers. For all questions the frequency is presented in addition to the corresponding percentage. Also included are the respondents who chose to not answer the question. When it is possible the mean and median values is presented.

3.5.1 Company characteristics

Table 3.3: Descriptive statistics for the 2008 revenue of the companies ('000 NOK).

Variable	Mean	Std. Deviation	Median	Min.	Max.
Revenues	9 259 860	50 450 415	2 266 298	983 542	656 000 000

Note. N = 176

The mean revenue of the companies in our survey was approximately NOK 9.26 billion in 2008, while the standard deviation is 50.5 billion. The median value is NOK 2.27 billion. The lowest revenue is 983 million NOK, while the highest revenue is NOK 656 billion.

Table 3.4: Company type and industry affiliation

Variable	Percentage	Frequency
Company type		
Public limited company	18.8	33
Private limited company	71.6	126
Government sector	4.5	8
Not answered	5.1	9
Total	**100**	**176**
Industry		
Oil and gas	9.7	17
Energy, others	6.8	12
Supply	2.8	5
Shipping	4.5	8
Manufacturing /production	21.6	38
Fish industry	4.5	8
Other consumer goods	10.2	18
Capital goods	5.7	10
IT/telecom/media	6.3	11
Building/construction/real estate	8.0	14
Transportation	4.0	7
Government sector	3.4	6
Others	12.5	22
Total	**100**	**176**

Note. N = 176

As can be seen from the table above, the respondents of the survey are mainly private limited companies, consisting of 71.6 per cent of the total. 18.8 per cent are public limited companies, while

4.5 per cent are a part of the government sector. More than 5 per cent of the companies chose to leave this question unanswered.

Moving on to the industry distribution, “Manufacturing/production” with its 21.6 per cent contains the largest share of respondents. “Other consumer goods” is the second largest category with 10.2 per cent of the respondents (excluding “Others”), consisting mainly of grocery corporations. Almost as many is found in the oil and gas industry, counting 9.7 percent of the total. The rest of the respondents are divided quite equally among the rest of the industries, with “Energy, others” and “building/construction/real estate” as the leading industries with 6.8 and 8.0 per cent.

3.5.2 Foreign exchange rate exposure

Table 3.5: Foreign currency exposure and currency most exposed to.

Variable	Percentage	Frequency
Exposed to foreign currencies		
Yes	76.1	134
No	23.9	42
Total	**100**	**176**
The currency the companies are most exposed to		
Euro (EUR)	45.5	61
US Dollars (USD)	26.9	36
Pound sterling (GBP)	3.0	4
Nordic currencies (SEK, DKK, ISK)	15.7	21
Other	8.2	11
Not answered	0.7	1
Total	**100**	**134**

Note. N = 134 - 176

Over 75 per cent of the companies that answered the survey state that they are exposed to foreign currencies. When asked about which currency they are most exposed to, 45.5 per cent answer Euro. 26.9 per cent have placed US Dollars as their most important currency, while 15.7 per cent are most exposed to Nordic currencies. Only 3.0 per cent placed Pound sterling as the most important currency, while almost all of the 8.2 per cent that has answered “Other” has listed several of the mentioned currencies instead of placing one of them as the most important.

Table 3.6: Number of foreign subsidiaries, including and excluding sales division, and countries.

Variable	Percentage	Frequency
Number of foreign subsidiaries		
0	43.3	58
1	7.5	10
2	3.7	5
3	3.7	5
4	3.7	5
5	3.0	4
6 - 10	7.5	10
11 - 20	9.0	12
More than 20	18.7	25
Total	**100**	**134**
Number of foreign subsidiaries excluding sales divisions		
0	59.7	80
1	3.7	5
2	3.0	4
3	3.7	5
4	3.7	5
5	2.2	3
6 - 10	5.2	7
11 - 20	5.2	7
More than 20	4.5	6
Not answered	9.0	12
Total	**100**	**134**
Number of countries the subsidiaries are spread across		
0	34.3	46
1	9.0	12
2	3.0	4
3	7.5	10
4	6.0	8
5	3.7	5
6 - 10	9.0	12
11 - 20	9.0	12
More than 20	8.2	11
Not answered	10.4	14
Total	**100**	**134**

Note. N = 134

When asked about foreign subsidiaries, more than 40 per cent of the respondents say that they do not have any. When asked to exclude foreign subsidiaries that are strictly sales divisions, almost 60 per cent answer that they have none. When sales divisions are included, 7.5 per cent state that they have one foreign subsidiary, while 2, 3, 4 and 5 subsidiaries all have between 3 and 4 per cent responses each. Looking at the same number of subsidiaries when sales divisions are excluded, the figures are much the same except now only 3.7 per cent state that they have one subsidiary and only 2.2 per cent has five. 18.7 per cent answers that they have more than 20 foreign subsidiaries including sales divisions, while this number decreases to 4.5 per cent when excluding sales divisions.

It is also worth mentioning that when asked to subtract sales divisions 9.0 per cent leave the question unanswered.

The amount of countries the foreign subsidiaries are spread across varies from respondent to respondent. As the earlier table implies, the most frequent answer is zero, holding 34.3 per cent of the respondents. The remaining respondents are almost evenly distributed among the rest of the answer options. The number of companies answering between one and five countries is lower than the number of respondents that answered six or more.

Table 3.7: Share of income and costs in foreign currencies.

Variable	Percentage	Frequency
Share of income in foreign currency		
0 %	14.9	20
1 – 25 %	29.1	39
26 – 50 %	10.4	14
51 – 75 %	14.9	20
76 – 99 %	22.4	30
100 %	4.5	6
Not answered	3.7	5
Total	**100**	**134**
Share of costs in foreign currency		
0 %	4.5	6
1 – 25 %	41.0	55
26 – 50 %	20.9	28
51 – 75 %	23.1	31
76 – 99 %	6.0	8
100 %	0.7	1
Not answered	3.7	5
Total	**100**	**134**

Note. N = 134

By reviewing what the companies answered on the question concerning share of income and costs in foreign currencies, almost 15 per cent state that they do not have any income of that sort. In comparison to this, only 4.5 per cent say that they do not have any costs in foreign currencies. 29.1 per cent answered that between 1 and 25 per cent of their total income is in another currency than Norwegian Krone (NOK), while over 40 per cent claim that their share of costs in foreign currencies is between those figures. Moving on, one can see that there are more respondents stating that the share is between 51 and 75 per cent, than between 26 and 50 per cent, both in the case with income and costs. When looking at the upper level of the share of income and costs in foreign currencies, we can see from the table above that over 20 per cent of the respondents say that the share of income is between 76 and 99 per cent. As for costs, only 6.0 per cent place themselves in that interval. 4.5 per

cent state that all of their income is in foreign currencies, while 0.7 of them have all of their costs in a different currency than NOK.

Table 3.8: Share of assets and debt in foreign currencies.

Variable	Percentage	Frequency
Share of assets in foreign currency		
0 %	26.9	36
1 – 25 %	36.6	49
26 – 50 %	9.0	12
51 – 75 %	12.7	17
76 – 99 %	6.0	8
100 %	1.5	2
Not answered	7.5	10
Total	**100**	**134**
Share of debt in foreign currency		
0 %	28.4	38
1 – 25 %	30.6	41
26 – 50 %	9.0	12
51 – 75 %	9.7	13
76 – 99 %	10.4	14
100 %	3.0	4
Not answered	9.0	12
Total	**100**	**134**

Note. N = 134

When looking at the respondents' assets and debt in foreign currencies, the most common answer is a share of 0 or between 1 and 25 per cent. 26.9 per cent say that they do not have any assets in foreign currencies, while 28.4 per cent say this about debt. 36.6 per cent answer that between 1 and 25 per cent of their total assets are valued in a different currency than NOK, and 30.6 per cent says this about their share of debt. The distribution among the rest of the categories is quite equal to each other. For assets, between 51 and 75 per cent is more common (12.7 per cent), as for debt, the interval between 76 and 99 per cent reads a considerable higher frequency than assets (10.4 per cent).

3.5.3 Corporate strategy

Table 3.9: Methods used to measure foreign exchange rate exposure.

Variable	Percentage	Frequency
Methods used to measure foreign exchange rate exposure		
Rough estimates	32.1	43
Cash Flow and/or Value at Risk	66.4	89
Scenario analysis	11.9	16
Stress analysis	7.5	10
No method	7.5	10
Other methods	11.2	15
Total checked values		**183**
Respondents that checked more than one option		**38**

Note. N = 134
Multiple selections are possible. Percentage based on frequency divided with total respondents, not total checked values.

Cash Flow and/or Value at Risk are the most common method used to measure foreign exchange rate exposure among the respondents of our survey (66.4 per cent). The second most used method is rough estimates counting more than 30 per cent of the respondents, while 11.9 per cent are using scenario analysis. Both stress analysis and no method used have 7.5 per cent response and 11.2 per cent answered "Other methods". Examples from the latter are use of external consulting, that the measuring takes place in the parent company outside of Norway, and more balance sheet related measures. 38 respondents have checked more than one option.

Table 3.10: What level the strategy for managing foreign exchange exposure is defined.

Variable	Percentage	Frequency
At what level the strategy for managing foreign exchange rate exposure is predefined		
Board of directors, general assembly etc.	52.2	70
Corporation level (CEO, CFO etc.)	36.6	49
Division level (Division manager etc.)	2.2	3
Employee level (controller etc.)	0.7	1
Has no predefined strategy	7.5	10
Not answered	0.7	1
Total	**100**	**134**

Note. N = 134

The most frequent answer among the respondents is that strategy for managing foreign exchange rate exposure is predefined by the board of directors, general assembly etc. (52.2 per cent). 36.6 per cent state that the strategy is predefined at corporate level. 7.5 per cent say that they do not have a predefined strategy.

Table 3.11: The financial crisis' influence on the foreign exchange risk management.

Variable	Percentage	Frequency
The financial crisis' influence on the foreign exchange rate management		
Increased focus	29.9	40
Decreased focus	0.0	0
Unchanged focus	69.4	93
Not answered	0.7	1
Total	**100**	**134**

Note. N = 134

As seen from the table above, about 70 per cent of the respondents have the same focus on managing foreign exchange risk exposure after the financial crisis as they had before. Almost 30 per cent say that they have an increased focus as a consequence of the financial crisis.

3.5.4 Risk management

Table 3.12: Hedging techniques used for managing foreign exchange rate exposure.

Variable	Percentage	Frequency
Operational hedging techniques used to manage foreign exchange rate exposure		
Pricing policies	24.6	33
Changes product mix	2.2	3
Adapting to markets and market segments	11.2	15
Buys factor inputs in the same currency as the exposed income	32.8	44
Choice of the subsidiaries localisation	4.5	6
Invoice the customers partly or totally in NOK	10.4	14
Has moved or planning to move parts of the operation abroad	6.0	8
Borrows or places funds in other currencies	41.0	55
Do not use operational hedging techniques	23.9	32
Other operational techniques	4.5	6
Not answered	0.7	1
Total checked values, excl. Not answered		**216**
Respondents that checked more than one option		**47**
Financial hedging techniques/derivatives used to manage foreign exchange rate exposure		
Forwards/Futures contracts	75.4	101
Swaps	34.3	46
Options	26.1	35
Do not use financial hedging techniques	17.9	24
Other financial techniques	5.2	7
Not answered	1.5	2
Total checked values, excl. Not answered		**213**
Respondents that checked more than one option		**53**

Note. N = 134
Multiple selections are possible. Percentage based on frequency divided with total respondents, not total checked values.

The most commonly used operational hedging technique among the respondents is to borrow or place funds in other currencies (41.0 per cent). Buying factor inputs in the same currency as the exposed income is the second most frequently selected technique, with 32.8 per cent. Pricing policies is used by 24.6 per cent, which is almost the same share of respondents who claim to not use operational hedging techniques at all (23.9 per cent). Adapting to markets and market segments, and invoice the customers partly or fully in NOK, are both used by approximately 11 per cent. Among the answers in "Other operational techniques" is making reservations about changes in currencies in offers to foreign customers.

Forward and futures contracts are used by more than 75 per cent, while swaps are used by almost 35 per cent. Options are also widely used as more than one out of four (26.1 per cent) states that this is a part of their financial hedging approach.

Table 3.13: The average maturity on the respondents' derivatives.

Variable	Percentage	Frequency
The average maturity on the derivatives		
0 – 6 months	33.3	36
6 – 12 months	37.0	40
Total short term	**70.4**	**76**
1 – 2 years	21.3	23
More than 2 years	6.5	7
Total long term	**27.8**	**30**
Not answered	1.9	2
Total	**100**	**108**

Note. N = 108
26 respondents did not receive this question due to their answers on the previous question (either said that they do not use financial instruments or left the question unanswered).

Over 70 per cent of the respondents that use financial instruments mostly buy derivatives with a short horizon. 33.3 per cent of the total mostly buy derivatives with the length of zero to six months, while 37 per cent choose a length between six and twelve months. 27.8 per cent say that they mainly buy derivatives with a long term horizon, where a length of between one and two years is the most common (21.3 per cent).

Table 3.14: Main reason why the respondents do not use long term derivatives more frequently.

Variable	Percentage	Frequency
The main reason why the firms do not use long term derivatives more frequently		
Estimates of future cash flow is not good enough	21.1	16
Future transactions are hedged individually	32.9	25
Long term exposure is hedged with operational techniques	15.8	12
Fluctuations in currencies are irrelevant in the long run	2.6	2
It would demand too large positions	9.2	7
It would be too expensive	3.9	3
Other reasons	13.2	10
Not answered	1.3	1
Total	**100**	**76**

Note. N = 76
58 (26 + 32) respondents did not receive this question due to their answers on the previous question (either said that they do use long term derivatives or they left the question unanswered).

Most of the respondents do not use long term derivatives more frequently because they hedge future transactions individually (32.9 per cent). 21.1 per cent said that this was based on problems with estimating future cash flows. 15.8 per cent use operational techniques to manage currency fluctuations in the long run, while 9.2 per cent claim that this would demand too large positions in financial derivatives. The most frequently answer among other reasons is that only short term exposure is relevant to hedge.

Table 3.15: The most important hedging approach.

Variable	Percentage	Frequency
Which of the two hedging approaches the respondents considers as the most important		
Operational hedging techniques	26.1	24
Financial hedging techniques/derivatives	46.7	43
Equally important	27.2	25
Total	**100**	**92**

Note. N = 92
42 respondents did not receive this question since it is only relevant for those who answered that they use both operational and financial hedging techniques.

Almost half of the respondents who use both operational and financial hedging techniques consider the financial approach as the most important. 26.1 per cent answered that the operational approach is the most important, while 27.2 per cent consider both of them equally important.

3.5.5 Motivation

Table 3.16: The main motivation for managing foreign exchange rate exposure.

Variable	Percentage	Frequency
The main motivation for managing foreign exchange rate exposure		
Reduce fluctuations in income and costs in foreign currencies	51.1	47
Reduce fluctuations in cash flows in foreign currencies	19.6	18
Reduce the risk of financial distress	2.2	2
Reduce risk for the owners of the company	17.4	16
Simplify estimates in budgets and planning	1.1	1
Secure liquidity for future projects/investments	1.1	1
Exploit the company's expertise on foreign currencies	1.1	1
Exploit the differences in interest rates in different currencies	0.0	0
Follow the dominating strategy in the industry	1.1	1
Other motivations	5.4	5
Total	**100**	**92**

Note. N = 92
42 respondents did not receive this question since it is only relevant for those who answered that they use both operational and financial hedging techniques.

Half of the respondents who use both financial and operational hedging techniques stated that their main motivation for managing foreign exchange rate exposure is to reduce fluctuations in income and costs in foreign currencies. 19.6 per cent of the respondents stated that reducing fluctuations in foreign currency cash flows as the most important reason, with 17.4 per cent answering that their main motivation is to reduce risk for the company's owners.

Table 3.17: The main motivation for using operational techniques to manage foreign exchange rate exposure.

Variable	Percentage	Frequency
The main motivation for using operational techniques to manage foreign exchange rate exposure		
Reduce fluctuations in income and costs in foreign currencies	37.5	6
Reduce fluctuations in cash flows in foreign currencies	18.8	3
Reduce the risk of financial distress	12.5	2
Reduce risk for the owners of the company	0.0	0
Simplify estimates in budgets and planning	0.0	0
Secure liquidity for future projects/investments	0.0	0
Exploit the company's expertise on foreign currencies	0.0	0
Exploit the differences in interest rates in different currencies	0.0	0
Follow the dominating strategy in the industry	0.0	0
Other motivations	12.5	2
Not answered	18.5	3
Total	**100**	**16**

Note. N = 16
118 respondents did not receive this question since it is only relevant for those who answered that they only use operational hedging techniques.

A majority use operational techniques to reduce fluctuations in income and cost, while 18.8 per cent state that reducing fluctuations in cash flows is the most important reason. Only 16 respondents were routed to this question and three of them chose not to answer.

Table 3.18: The main motivation for using financial techniques to manage foreign exchange rate exposure.

Variable	Percentage	Frequency
The main motivation for using financial techniques to manage foreign exchange rate exposure		
Reduce fluctuations in income and costs in foreign currencies	33.3	5
Reduce fluctuations in cash flows in foreign currencies	0.0	0
Reduce the risk of financial distress	6.7	1
Reduce risk for the owners of the company	33.3	5
Simplify estimates in budgets and planning	0.0	0
Secure liquidity for future projects/investments	0.0	0
Exploit the company's expertise on foreign currencies	6.7	1
Exploit the differences in interest rates in different currencies	0.0	0
Follow the dominating strategy in the industry	0.0	0
Other motivations	13.3	2
Total	**100**	**15**

Note. N = 15
119 respondents did not receive this question since it is only relevant for those who answered that they only use financial hedging techniques.

One third of the respondents who only use financial hedging techniques answered that reducing fluctuations in income and costs in foreign currencies as the main reason why they use financial techniques to manage foreign exchange rate exposure. One third stated reducing risk for the owners of the company as the most important reason. As in the previous question, very few respondents were routed to this question (15 respondents).

Table 3.19: The main reason why the respondents do not manage their foreign exchange rate exposure.

Variable	Percentage	Frequency
The main reason why the respondents choose not to manage their foreign exchange rate exposure		
Fluctuations in currencies has no significant impact on the company's cash flow and competitive position	37.5	3
Not able to quantify the foreign exchange rate exposure good enough to be hedged with these techniques	12.5	1
It is too expensive	0.0	0
The most appropriate financial instruments is unavailable	0.0	0
The financial strength of the company is solid enough to withstand currency fluctuations	0.0	0
Insufficient of knowledge and expertise of the foreign exchange rate exposure	0.0	0
Fluctuations in currencies are irrelevant in the long run		
Chooses to be exposed after considering the risk	12.5	1
Other reasons	37.5	3
Total	**100**	**8**

Note. N = 8
126 respondents did not receive this question since it is only relevant for those who answered that neither uses operational or financial hedging techniques even though they are exposed to foreign exchange rate risk.

Only eight respondents answered this question, where three (37.5 per cent) answered that fluctuations in currencies has no significant impact on the company's cash flow and competitive position. 37.5 per cent stated other reasons for why they do not manage their foreign exchange rate exposure.

Table 3.20: The main reason why the respondents do not use operational techniques to manage their foreign exchange rate exposure.

Variable	Percentage	Frequency
The main reason why the respondents choose not to use operational hedging techniques		
Fluctuations in currencies has no significant impact on the company's cash flow and competitive position	20.0	3
Not able to quantify the foreign exchange rate exposure good enough to be hedged with these techniques	0.0	0
Financial instruments are better suited	60.0	9
It is too expensive	0.0	0
Insufficient of knowledge and expertise of the foreign exchange rate exposure	0.0	0
Fluctuations in currencies are irrelevant in the long run	0.0	0
Other reasons	20.0	3
Total	**100**	**15**

Note. N = 15
119 respondents did not receive this question since it is only relevant for those who answered that only use financial instruments to manage foreign exchange rate exposure.

A majority (60.0 per cent) of the respondents who only use financial hedging techniques stated that financial instruments are better suited for managing foreign exchange rate exposure then operational techniques. 20 per cent answered that fluctuations in currencies has no significant impact on the company's cash flow and competitive position, and 20 per cent chose other reasons.

Table 3.21: The main reason why the respondents do not use financial instruments to manage their foreign exchange rate exposure.

Variable	Percentage	Frequency
The main reason why the respondents choose not to use financial instruments		
Fluctuations in currencies has no significant impact on the company's cash flow and competitive position	37.5	6
Not able to quantify the foreign exchange rate exposure good enough to be hedged with these techniques	0.0	0
Operational hedging techniques are better suited	31.3	5
It is too expensive	6.3	1
The most appropriate financial instruments is unavailable	0.0	0
Insufficient of knowledge and expertise of the foreign exchange rate exposure	6.3	1
Fluctuations in currencies are irrelevant in the long run	6.3	1
Other reasons	0.0	0
Not answered	12.5	2
Total	**100**	**16**

Note. N = 16
118 respondents did not receive this question since it is only relevant for those who answered that they only use operational hedging techniques to manage foreign exchange rate exposure.

In this question 31.3 per cent of the respondents only using operational hedging stated that operational hedging techniques are better suited for managing foreign exchange rate exposure than financial means. 37.5 per cent responded that fluctuations in currencies have no significant impact in the company's cash flows and competitive position. Two respondents chose not to answer this question.

4 Analysis

In the prior chapters we have presented the background for the thesis, earlier research performed in this field before, some theory surrounding the topic and the methodology used in the thesis. The following will test each of the hypotheses presented in chapter 1.5, in order to answer the main problem formulation. The hypotheses testing will be based on the answers from our survey, and comparison of the results with earlier research.

4.1 Hypotheses testing

Hypothesis 1:

H_2: The companies' main motivation for managing foreign exchange risk is to reduce fluctuations in income, costs or cash flow.

The respondents were asked directly about their motivation for managing foreign exchange risk in the survey, by selecting their main motivation for managing foreign exchange risk. This hypothesis is based on earlier studies by Bodnar et al. (1994, 1995 and 1998), Marshall (1999), Pramborg (2004) and Børsum and Ødegaard (2005). The results are presented in figure 4.1 below.

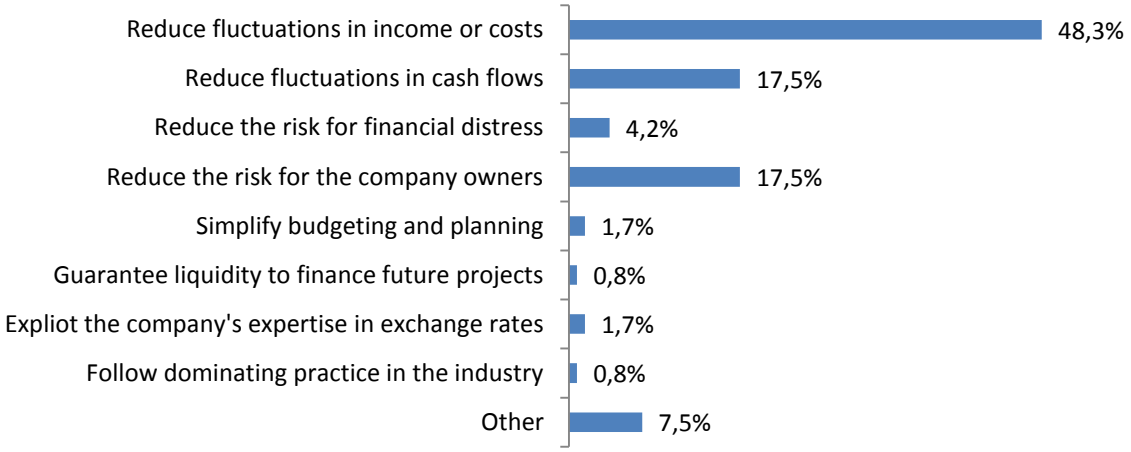

Figure 4.1: The companies' main motivation for managing foreign exchange risk.

120 companies are used as a basis for this analysis. The results from the survey show that 48.3 per cent of the companies are managing foreign exchange risk with the main purpose of reducing fluctuations in income or costs in foreign currencies. 17.5 per cent state that reducing fluctuations in cash flows is their main motivation for managing foreign exchange risk. Combined, those two alternatives make up over 65 per cent of the answers. This indicates that the largest Norwegian non-

financial companies have the same motivation for managing foreign exchange risk as companies in other countries, and is also in line with what Børsum and Ødegaard (2005) found.[36]

Hypothesis conclusion

Based on the results above and results from earlier research, the hypothesis seems probable. A large majority of the companies in the survey manage foreign exchange risk to reduce fluctuations in income, costs or cash flow in foreign currencies. The hypothesis is accepted.

Hypothesis 2:

H_3: The companies have a predefined strategy for managing foreign exchange risk which is defined by the board of directors or at corporate level in the organisation.

To find out if the companies have a predefined strategy for managing foreign exchange risk, the respondents were asked to choose the level in the corporate hierarchy that the predefined strategy is defined, if they have a predefined strategy. The levels are divided into five categories, including a category for those who do not have a predefined strategy. See figure 4.2 below for the distribution of the respondents' answers.

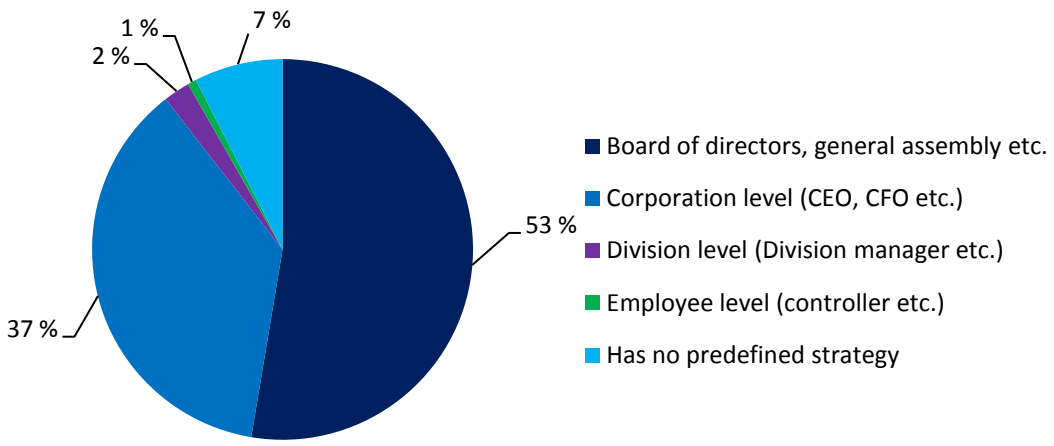

Figure 4.2: The level defining the strategy for managing foreign exchange rate exposure.

A clear majority of the firms in our sample have a predefined strategy. Out of 133 firms, only 7 per cent do not have a predefined strategy for managing foreign exchange rate exposure. This is considerably lower than what Børsum and Ødegaard (2005) found. This difference is likely to be explained by our focus on the largest companies, whereas they focused on companies in all

[36] Bodnar et al. (1994, 1995, 1998) and Pramborg (2004)

segments. It may also be explained by the financial crisis which to a large extent has increased the respondents' focus on risk management (see table 3.11, chapter 3.5). This implies that a number of companies might have allocated resources to predefine a strategy for managing exchange risk. 90 per cent of the firms have a predefined strategy defined by either the board of directors (53 per cent) or by the management at corporate level of the company (37 per cent). This is in line with Børsum and Ødegaard's (2005) results, namely that the companies have a predefined strategy towards currency risk, typically manifested by the board of directors. It is also supported by Loderer and Pichler's (2000) presumptions, saying that the risk management strategy should be set and defined at the top level of the corporate hierarchy. This should be done to ensure an optimal risk management strategy and avoid complications between managers that do not have the integral overview needed to manage the total risk exposure of the company properly.

Hypothesis conclusion

Based on the answers from the survey, a large majority of the largest Norwegian non-financial companies have a predefined strategy for managing foreign exchange risk. This strategy is (with hardly any exceptions) defined by the board of directors or by the management in the organisation. The hypothesis is accepted.

Hypothesis 3:

H_4: Short term derivatives are more commonly used than long term derivatives.

To see if short term derivatives are more frequently used than long term, the companies were asked to state what the typical maturity on their currency derivatives is. In this thesis short term is defined to be shorter than one year, while long term is one year or longer. The results are presented in figure 4.3 below.

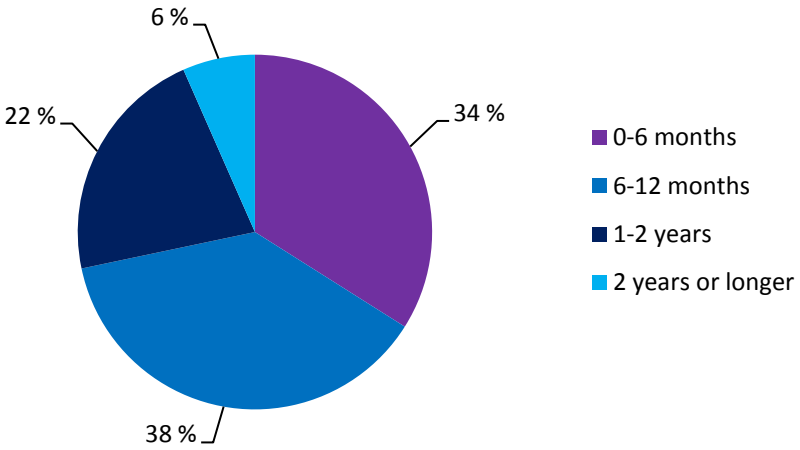

Figure 4.3: Typical maturity of currency derivatives.

More than 70 per cent of the companies typically use short term derivatives, where a total of 106 answers are used as a basis. Only six per cent use derivatives with a typical maturity of more than two years, and a total of 28 per cent typically use long term derivatives. This indicates that the majority of large Norwegian non-financial companies most commonly use derivatives to hedge short term foreign exchange risk. This is in line with previous research both from Norway, Germany and the US.[37] Hommel (2002) and Carter et al. suggest that the reasons why short term derivatives is more frequent than long term derivatives may be because firms often use operational means to hedge long term risk. Though, according to our results in hypothesis 4, this is not confirmed among the largest non-financial companies in Norway.

Hypothesis conclusion

Among the largest non-financial companies in Norway, our results clearly indicate that short term derivatives (less than one year) are more commonly used than long term derivatives. The hypothesis is accepted.

Hypothesis 4:

H_5: Operational hedging strategies are more frequently combined with short term derivatives than with long term derivatives.

Bodnar and Gebhardt (1999) suggested that companies use operational hedges to hedge long term foreign exchange risk, while the short term risk is hedged with derivatives. This is supported by

[37] Børsum & Ødegaad (2005), Loderer & Pichler (2000), Chowdhry & Howe (1999), Bodnar & Gebhardt (1999).

Hommel (2002), Carter et al. (2003) and Hansen (2009), who in their research found these to be complementary strategies. To test if this applies to the firms in our sample, the firms with only financial hedging, and the firms with both operational hedging and financial hedging are cross-tabulated against whether they use short term or long term derivatives. If the hypothesis is to be accepted, one should expect that among the firms with only financial hedging, a larger share of the firms mainly use long term derivatives, compared to the ones using both financial and operational hedging. The results are presented in table 4.1 below.

Table 4.1: Hedging approaches vs. derivative maturity. Cross-tabulation.

Variable	Short term	Long term	**Total**
Only financial hedging	19	5	**24**
Both financial and operational hedging	57	25	**82**
Total	**76**	**30**	**106**

$\chi^2 = 0.853$, DF = 1, P > 0.1

No more than five companies predominantly use derivatives with long term maturity and use only financial hedging. Out of 24 firms, this group make up 20.8 per cent. Comparing with the other group of companies that use both financial and operational hedging, there are 25 companies that mainly use long term derivatives. Out of 82 firms they make up 30.5 per cent. This result is contradictory of what one could expect and to what the previously mentioned researchers have found. At the same time the chi-square test displays no significant results on a 90 per cent confidence level.

Hypothesis conclusion

Based on the analysis above, one cannot accept the hypothesis that operational hedging strategies are more frequently combined with short term derivatives than with long term derivatives among the largest non-financial companies in Norway. The hypothesis is rejected.

Hypothesis 5:

H_6: There is a high degree of natural hedging among the companies.

The term natural hedging was defined earlier in the thesis. It describes the situation where the company has almost the same share of income and costs, or assets and debt, in the same foreign currencies. The result is that a change in one of these accounts would be cancelled by the same change in the corresponding account, leaving the total exposure to foreign exchange risk closer to

zero. Both companies in Norway and the US have in earlier research been found to rely on natural hedging.[38]

To structure our findings among the respondents the results are categorised in the following way:

- High degree of natural hedging. Approximately the same share of income and costs or assets and debt in foreign currencies.
- Medium degree of natural hedging. The respondent selected one of the alternatives closest to the first (e.g. 51 – 75 per cent of the income and 26 – 50 per cent of the costs are in a foreign currency).
- Small degree of natural hedging. The respondent selected one of the second closest alternatives to the first (e.g. 1 – 25 per cent and 51 – 75 per cent).
- Very small degree of natural hedging. The respondent still has both income and costs, or assets and debt, in foreign currencies, but the shares are hardly corresponding.

Table 4.2: Degree of natural hedging, comparing income and costs.

Variable	Percentage	Frequency
Degree of natural hedging, comparing income and costs		
High degree	39.6	53
Medium degree	17.9	24
Small degree	9.7	13
Very small degree	9.0	12
Not at all (one of the inputs is 0 %)	17.9	24
Not relevant (Both of the inputs are 0 %)	0.7	1
Incomplete answer	2.2	3
Not answered	3.0	4
Total	**100**	**134**

Note. N = 134

As can be seen from table 4.2 above, almost 40 per cent of the respondents have a high degree of natural hedging when income and costs in foreign currencies are compared. In total, more than 75 per cent of them are at some degree naturally hedged. To get a better view of the distribution of the respondents, the results are also shown in figure 4.4 below.

[38] Børsum & Ødegaard (2005) and Loderer & Pichler (2000).

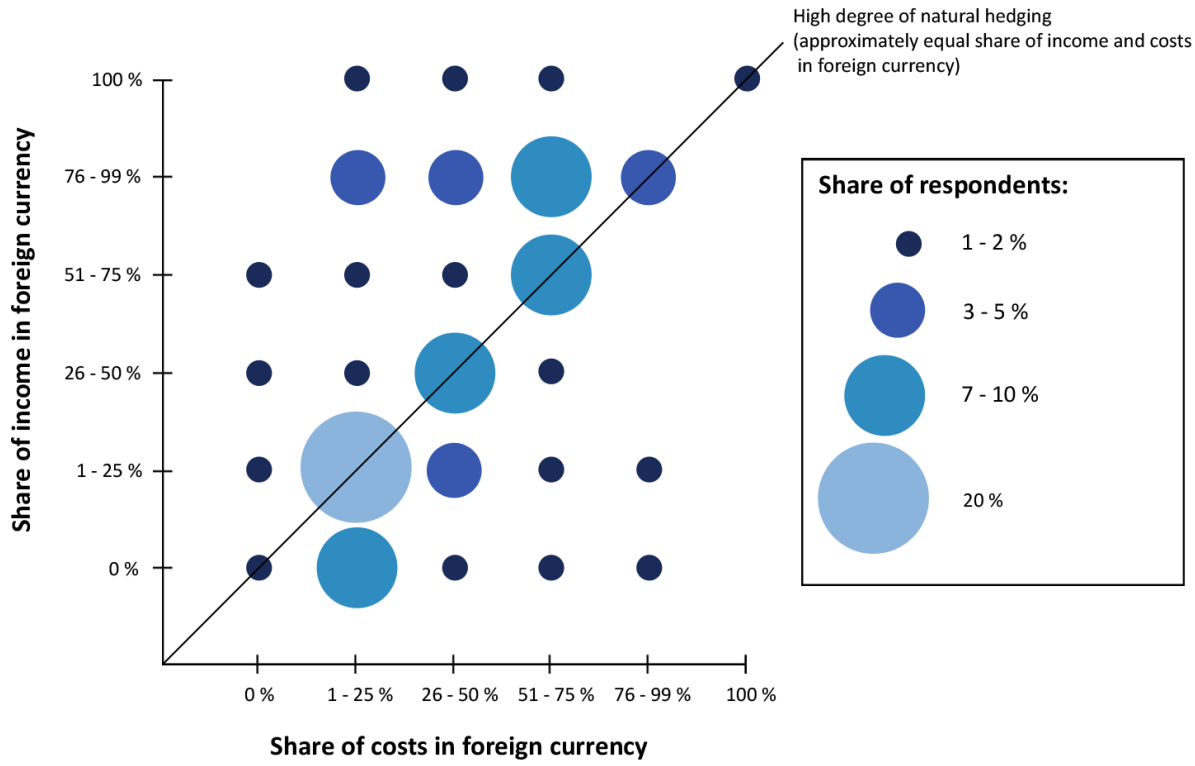

Figure 4.4: The respondents' share of income and costs in foreign currencies.

The diagram confirms that most of the respondents are naturally hedged, as they are centralised along the line in the middle. Natural hedging considering assets and debt is presented in the next table.

Table 4.3: Degree of natural hedging, comparing assets and debt.

Variable	Percentage	Frequency
Degree of natural hedging, comparing assets and debt		
High degree	44.8	59
Medium degree	6.7	9
Small degree	3.7	5
Very small degree	2.2	3
Not at all (one of the inputs is 0 %)	11.9	16
Not relevant (Both of the inputs are 0 %)	21.6	29
Incomplete answer	7.5	10
Not answered	1.5	2
Total	**100**	**134**

Note. N = 134

The degree of natural hedging is also tested with the share of assets, compared to the share of debt, in foreign currencies. Almost 45 per cent have a high degree of natural hedging, while almost 60 per cent in total are at some degree naturally hedged. It is also worth commenting that it is quite

common among the respondents to neither have assets of debt in other currencies, as this includes over 20 per cent. Also these results are shown graphically in figure 4.5 below.

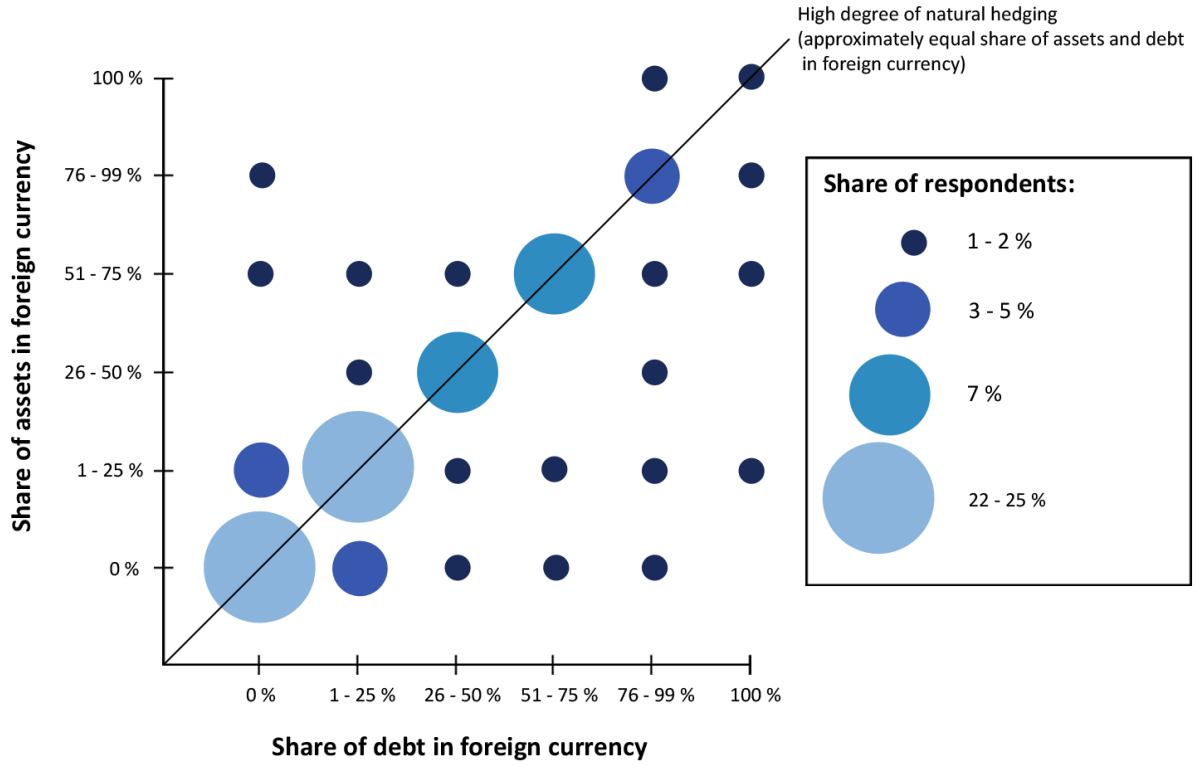

Figure 4.5: The distribution of the respondents' share of income and costs in foreign currencies.

The diagram reveals the same result, showing an even smaller spread away from the line in the middle than in the case with income compared to costs. It also reveals that it is slightly more common to have debt than to place assets in foreign currencies.

Hypothesis conclusion

Both our own results and earlier studies conducted in Norway by Børsum and Ødegaard (2005), show that Norwegian companies who are exposed to foreign currencies are to a large extend natural hedged. This is also claimed for US multinational companies by Loderer and Pichler (2000). Based on this we conclude that our sample of the largest non-financial companies in Norway have a high degree of natural hedging. The hypothesis is accepted.

Hypothesis 6:

H_7: The number of foreign subsidiaries, and the number of countries they are spread across, influences the degree of natural hedging and the use of hedging approaches.

Earlier literature has shown that multinational companies' foreign exchange rate exposure and hedging approaches differ by the number of foreign subsidiaries, and the number of countries they are spread across.[39] To see if this is the case among the largest non-financial companies in Norway, the respondents who are naturally hedged at any degree are compared with the ones who are not naturally hedged at all. At the same time the respondents who are only using financial or operational hedging techniques are compared to those who use both techniques. These effects are controlled by also including company characteristics as size (determined by revenues), company type and industry. The analysis is divided into three regressions, where the first includes the total number of foreign subsidiaries as the dependent variable (table 4.4). In the second regression the number of pure sales divisions is used as the dependent variable (table 4.5). The third and last regression has the number of countries the subsidiaries are spread across as the dependent variable (table 4.6). The number of included respondents in the three regressions is lower than in later regressions, due to the number of respondents that neither have assets of debt in foreign currencies.

As the dependent variables are describing the number of subsidiaries and countries, the results can be slightly defiant to interpret. These variables are not ratio variables, as the numbers above five are categorized in three different groups; 6 – 10, 11 – 20, and More than 20. This means that the results in the regressions should be seen as number of categories the variable is above or below the reference group, and not the exact number of subsidiaries or countries. A regression value of 2.877 would therefore mean that the variable has a number of subsidiaries or countries in 2.877 categories above the references group. The results from the first regression are presented in the table below.

[39] Pantzalis et al. (2001), Hommel (2003) and Hansen (2009).

Table 4.4: The total number of foreign subsidiaries as dependent variable. Regression.

Independent variables	Coeff.	Std. error
Income and costs naturally hedged(high, medium, small and very small degree) [a]	2.877***	(0.915)
Assets and debt naturally hedged (high, medium, small and very small degree) [a]	2.339**	(0.894)
Hedging technique [b]		
Only using financial hedging techniques	0.576	(1.068)
Only using operational hedging techniques	0.970	(0.783)
Revenues [c]	0.001**	(0.000)
Company type [d]		
Public limited company	1.925**	(0.757)
Industry [e]		
Oil and gas	-0.854	(1.255)
Energy, others	-3.771***	(1.237)
Supply	-1.713	(1.814)
Shipping	0.732	(1.323)
Manufacturing/production	0.858	(1.195)
Fish industry	-0.767	(1.715)
Other consumer goods	-0.232	(1.773)
Capital goods	-0.834	(1.523)
IT/telecom/media	0.018	(1.770)
Building/construction/real estate	-1.364	(1.771)
Transportation	-0.530	(2.429)
Constant	-0.265	(0.941)
N	86	
R^2	0.42	
Prob > F	0.000	

Note. Regression with robust standard errors.

[a] Reference group is "not naturally hedged". Unanswered, not relevant and incomplete answers are excluded.

[b] Reference group is "using both hedging techniques".

[c] Change in subsidiaries per 100 million NOK.

[d] Reference group is "Private limited companies" and "Government sector".

[e] Reference group is "other industries". "Government sector" is excluded (0 respondents only using financial hedging).

* p < 0.1 ** p < 0.05 *** p < 0.01

The results from the regression indicate that natural hedging of income and costs, and assets and debt, in foreign currencies is affected by the respondent's total number of foreign subsidiaries. The respondents that have both income and costs in foreign currencies have answered a number of subsidiaries that is 2.9 categories above those who lack natural hedging. This is also the case if the respondents have both assets and debt in foreign currencies, as the naturally hedged respondents' answer is 2.3 categories above the others. Both of these findings are significant, the first with a p-value below 0.01 and the latter below 0.05. Also the size and type of company are significantly affecting the number of subsidiaries, and even when controlling for industry in addition to these the relation between the number of foreign subsidiaries and natural hedging is significant.

Looking at how the number of foreign subsidiaries affects the choice of hedging techniques, the regression shows that those who only use financial or operational instruments do not have a significant different number of foreign subsidiaries. The reference group is the respondents using both hedging techniques. In other words, the number of foreign subsidiaries does not affect what kind of hedging approach the largest non-financial companies in Norway use.

The included independent variables explain more than 40 per cent of the total variation in total foreign subsidiaries among the respondents. The F-test shows that the model is significant, the model specification tests are satisfying, the residuals of the model are close to normally distributed and multicollinearity is not present at a disturbing level (see appendix D).

As a confirmation of our result from the regression in table 4.4, another regression is made (see table 4.5 below) using the number of pure foreign sales divisions as dependent variable.

Table 4.5: The number of pure foreign sales divisions as dependent variable. Regression.

Independent variables	Coeff.	Std. error
Income and costs naturally hedged (high, medium, small and very small degree) [a]	0.909	(0.764)
Assets and debt naturally hedged (high, medium, small and very small degree) [a]	0.488	(0.765)
Hedging technique [b]		(0.852)
Only using financial hedging techniques	0.608	(0.570)
Only using operational hedging techniques	-1.194**	
Revenues [c]	0.001***	(0.000)
Company type [d]		
Public limited company	1.665***	(0.601)
Industry [e]		
Oil and gas	-0.865*	(0.475)
Energy, others	-1.224**	(0.515)
Supply	-0.137	(0.907)
Shipping	3.168***	(0.759)
Manufacturing/production	2.538***	(0.721)
Fish industry	0.146	(1.009)
Other consumer goods	0.026	(0.879)
Capital goods	1.685	(1.686)
IT/telecom/media	-0.127	(0.860)
Building/construction/real estate	0.289	(1.516)
Transportation	1.691	(1.940)
Constant	0.085	(0.705)
N	86	
R^2	0.51	
Prob > F	0.000	

Note. Regression with robust standard errors.

[a] Reference group is "not naturally hedged". Unanswered, not relevant and incomplete answers are excluded.

[b] Reference group is “using both hedging techniques”.
[c] Change in subsidiaries per 100 million NOK.
[d] Reference group is “Private limited companies” and “Government sector”.
[e] Reference group is “other industries”. “Government sector” is excluded (0 respondents only using financial hedging).
* p < 0.1 ** p < 0.05 *** p < 0.01

As pure sales divisions most likely generate only a small share of the total amount of costs, they should not influence the companies’ degree of natural hedging. This is confirmed as those who are naturally hedged with income and costs, and assets and debt, do not have a significant higher number of pure sales divisions in foreign countries. What is worth noticing is that the respondents only using operational hedging techniques has a significant lower number of pure sales divisions in foreign countries than those using both. Also the size and type of company are significantly affecting the number of foreign sales divisions, together with some of the industries.

These independent variables explain more than 50 per cent of the total variation in foreign sales divisions among the respondents. The F-test confirms that the model is significant, and even though the residuals of the regression are close to normally distributed and the level of multicollinearity is satisfying, the model specification tests show signs of trouble (see appendix D). Based on this, the results should be carefully handled.

The last regression in the analysis of this hypothesis uses the total number of countries the foreign subsidiaries are spread across as dependent variable. The results from this regression are presented in the table below.

Table 4.6: The total number of countries the foreign subsidiaries is spread across as dependent variable. Regression.

Independent variables	Coeff.	Std. error
Income and costs naturally hedged(high, medium, small and very small degree) [a]	2.632***	(0.724)
Assets and debt naturally hedged (high, medium, small and very small degree) [a]	1.978**	(0.792)
Hedging technique [b]		
Only using financial hedging techniques	1.158	(0.975)
Only using operational hedging techniques	1.014*	(0.580)
Revenues [c]	0.001***	(0.000)
Company type [d]		
Public limited company	1.758**	(0.710)
Industry [e]		
Oil and gas	-1.002	(1.157)
Energy, others	-3.813***	(0.996)
Supply	-1.519	(1.966)
Shipping	0.207	(1.094)
Manufacturing/production	0.476	(1.104)
Fish industry	-1.829	(1.338)
Other consumer goods	-1.670	(1.420)
Capital goods	-1.739	(0.865)
IT/telecom/media	0.379	(1.321)
Building/construction/real estate	-1.479	(1.429)
Transportation	-0.929	(2.368)
Constant	-0.060	(0.799)
N	86	
R^2	0.39	
Prob > F	0.000	

Note. Regression with robust standard errors.

[a] Reference group is "not naturally hedged". Unanswered, not relevant and incomplete answers are excluded.

[b] Reference group is "using both hedging techniques".

[c] Change in subsidiaries per 100 million NOK.

[d] Reference group is "Private limited companies" and "Government sector".

[e] Reference group is "other industries". "Government sector" is excluded (0 respondents only using financial hedging).

* p < 0.1 ** p < 0.05 *** p < 0.01

The result from this regression is not very different from the first, as also the number of countries affects the respondents natural hedging of income and costs, and assets and debt. The ones with both income and costs in foreign currencies have answered a number of countries that is 2.632 categories above those who lack natural hedging. This is significant with a p-value below 0.01. The answer of the respondents who have both assets and debt in foreign currencies is 1.978 categories above those who are not naturally hedged, significant with a p-value below 0.05.

Those who only use operational hedging techniques have subsidiaries in a significant higher number of countries than those using both (with a p-value below 0.1), while this is not the case with those

only using financial hedging. Lastly, also in this regression the size and type of company are significantly affecting the number of subsidiaries

The included independent variables explain almost 40 per cent of the total variation in the number of countries among the respondents. Also the F-test of this regression is significant, the model specification tests are satisfying, the residuals of the model are close to normally distributed and multicollinearity is not present at a disturbing level (see appendix D).

Hypothesis conclusion

The result from the three regressions on the previous pages show that the number of foreign subsidiaries and the number of countries they are spread across influence if the respondents are naturally hedged or not. These differences are all significant at a satisfactory level, and are also confirmed by Pantzalis et al. (2001) for US multinational companies. When examining the type of hedging approaches, our results show that the companies who only use operational hedging techniques have foreign subsidiaries in more countries than the companies who only use financial derivatives, or the ones using both (at a significant level). In the regression with the number of foreign subsidiaries as the dependent variable, the type of hedging technique had no significant effect. Based on this, the hypothesis is partly accepted.

Hypothesis 7:

H_8: There is a positive and significant relationship between company size and the use of derivatives.

According to Bodnar and Gebhardt (1999), the size of the multinational companies in Germany and the US affects their use of derivatives. Also Børsum and Ødegaard (2005) claim that larger companies are more competent and have more resources and time to spare when considering derivatives. To see if this also is the case for the largest non-financial companies in Norway, a regression placing the respondents' revenues as the dependent variable, and the type of hedging approach as the independent variable, is performed. The results are also controlled for company type and industry. The results can be viewed in table 4.7 below.

Table 4.7: The companies' revenues in thousands as dependent variable. Regression.

Independent variables	Coeff.	Std. error
Hedging technique [a]		
Only using financial hedging techniques	9 904 688	(12 500 000)
Only using both financial and operational hedging techniques	9 527 472	(11 600 000)
Company type [b]		
Public limited company	33 400 000	(21 400 000)
Industry [c]		
Oil and gas	37 200 000	(41 000 000)
Energy, others	-2 712 282	(5 007 947)
Supply	-17 500 000	(17 200 000)
Shipping	-13 000 000	(15 100 000)
Manufacturing/production	-1 199 492	(8 027 688)
Fish industry	-15 800 000	(13 100 000)
Other consumer goods	6 912 780	(8 430 360)
Capital goods	8 615 953	(5 765 526)
IT/telecom/media	1 148 303	(6 166 945)
Building/construction/real estate	-7 671 905	(8 687 815)
Transportation	4 047 776	(3 689 461)
Constant	-6 917 065	(10 800 000)
N	123	
R^2	0.11	
Prob > F	0.826	

Note. Regression with robust standard errors.

[a] Reference group is "using operational hedging techniques".

[b] Reference group is "Private limited companies" and "Government sector".

[c] Reference group is "other industries". "Government sector" is excluded (0 respondents only using financial hedging).

* p < 0.1 ** p < 0.05 *** p < 0.01

None of the independent variables are significant, and at the same time they only explain 11 per cent of the total variation in the respondents' revenues. The type of hedging approach used is therefore not significantly related to the companies' revenues. This is a contrast to the findings of Bodnar and Gebhardt (1999) in German and US multinational companies, and what Børsum and Ødegaard (2005) found among Norwegian companies. Their results make it even more interesting that it had no significant influence on the companies in our selection. This is likely to be explained by our sample, consisting of the largest non-financial companies, which makes all the corporations able to exploit the opportunities from economies of scale.

The F-test also discards that the model is significant, and also the rest of the regression diagnostic tests show that this model is non-reliable (see appendix D). This implies that the model lacks relevant independent variables and that the variation in size among the largest non-financial companies in Norway is explained by something else.

Hypothesis conclusion

Using the applied regression as foundation for the analysis of this hypothesis, the results clearly indicate that there is no significant relation between the revenues of the largest non-financial companies in Norway and the use of derivatives. Based on this, the hypothesis is rejected.

Hypothesis 8:

H_9: Companies in energy, commodity and shipping industries are more sophisticated in their use of derivatives than companies in other industries.

The term "sophisticated" is measured by a larger share of respondents using financial hedging techniques, and at the same time using more types of derivatives. First we will perform a cross-tabulation, comparing if the companies are using financial or operational hedging techniques solely, or both of them combined, against if they are a part of energy, commodity and shipping industries or not. Second, the regression analysis tests if the companies in energy, commodities and shipping industries use more types of derivatives than the other industries.

Based on previous research from both Norway and other countries, the hypothesis implies that companies in energy, commodities and shipping industries more commonly use financial derivatives, and a combination of more types of these, than the other industries.[40] This is tested through the use of a cross-tabulation and reveals if there is any difference in hedging approaches. In the cross-tabulation, the industries are categorised into two categories; energy, commodities and shipping, and other industries.

[40] Børsum & Ødegaard (2005), Bodnar et al. (1995) and Chowdhry & Howe (1999).

Table 4.8: Hedging approaches vs. industry. Cross-tabulation.

Variable	Other industries	Energy, commodities and shipping	Total
Only financial hedging	14	11	**25**
Only operational hedging	14	4	**18**
Both financial and operational hedging	58	25	**83**
Total	**86**	**40**	**126**

$\chi^2 = 2.587$, DF = 2, P > 0.1

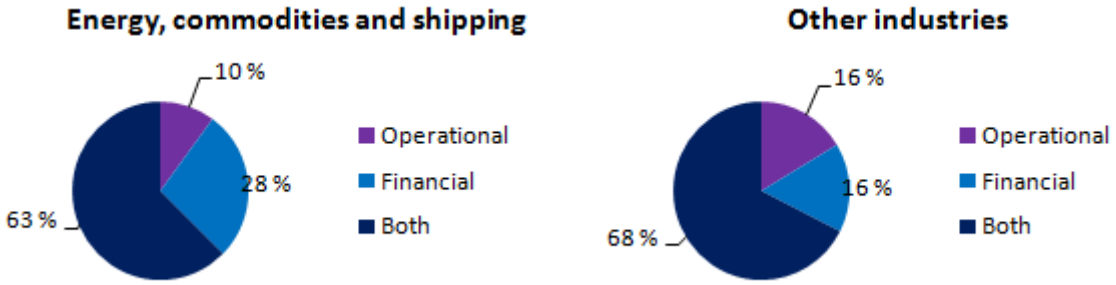

Figure 4.6: Comparing derivative usage in energy, commodities and shipping with other industries.

Even though the cross-tabulation does not serve a very clear result, figure 4.7 shows that the largest share in both categories are using both financial and operational hedging. In the reference category including all other industries than energy, commodities and shipping, the number of respondents that use either financial or operational hedging alone is exactly the same. They both consist of 16 per cent of the total respondents in the category. Among the companies in energy, commodities and shipping industries, the results are slightly different. Here only 10 per cent state that they only use operational hedging techniques, while 28 per cent answered that they only use financial instruments. Even so, the Chi-square test performed on the cross-tabulation discards the results as they are not significant within a 90 per cent confidence level.

Moving on, the regression below tests if the companies in energy, commodities and shipping industries use more types of derivatives than the other industries. The dependent variable is the number of types of derivatives used, while industry is the independent variable, controlled for company type and size. The results in this regression are also controlled for what currency the respondents are most exposed to, due to their possible relation to the type of derivatives. The reference group of the industry dummy variables are the industries excluded from the regression. The reason for excluding all other industries is to show the effect of the energy, commodity and shipping industries relative to all of them, and not only one.

Table 4.9: The number of types of derivatives used as dependent variable. Regression.

Independent variables	Coeff.	Std. error
Industry [a]		
Oil and gas	-0.361*	(0.196)
Energy, others	0.046	(0.311)
Shipping	1.426***	(0.296)
Fish industry	0.272	(0.331)
Company type [b]		
Public limited company	0.029	(0.186)
Revenues [c]	-0.00013	(0.000)
Hedging technique [d]		
Only using financial hedging techniques	1.214***	(0.231)
Only using operational hedging techniques	1.455***	(0.187)
Currency the respondents are the most exposed to [e]		
Euro	-0.097	(0.255)
Dollar	0.106	(0.277)
Pound sterling	-0.255	(0.279)
Nordic currencies	-0.056	(0.315)
Constant	0.287	(0.276)
N	123	
R^2	0.45	
Prob > F	0.000	

Note. Regression with robust standard errors.

[a] Reference group is all other industries than the ones included in the regression.

[b] Reference group is "Private limited companies" and "Government sector".

[c] Change in subsidiaries per 100 million NOK.

[d] Reference group is "only using operational hedging techniques".

[e] Reference group is "other currencies".

* p < 0.1 ** p < 0.05 *** p < 0.01

The results from the regression show that companies in the shipping industry use almost 1.5 more types of derivatives than the industries that are excluded from the regression (significant with a p-value below 0.01). Another interesting finding is that companies in the oil industry use fewer types of derivatives than the reference group. The companies in other energy and fish industries do not use a significantly different number of types of derivatives than the industries excluded from the regression. The industry in the reference group that mainly affects these results is manufacturing/production, due to the high number of respondents. These results are partly confirming the results of energy and shipping companies found by Børsum and Ødegaard (2005), but not the findings of Bodnar et al. (1995) and Chowdhry and Howe (1999) regarding US multinational companies in the commodity industry.

The independent variables included in the regression explain 45 per cent of the total variation in the dependent variable and the F-test of the model is significant. All of the regression diagnostic tests are showing a satisfying result, though the test of normal distribution among the residuals shows a small deviation from what is optimal (see appendix D).

Hypothesis conclusion

The result from the cross-tabulation do not show that there is a significant difference in the derivatives usage among companies in energy, commodities and shipping industries (clustered together), and the other industries in our selection. On the other hand, in the regression the respondents in the shipping industry alone are using significantly more types of derivatives than the reference group, while companies in the oil and gas industry use fewer. Based on this, the hypothesis is partly accepted.

5 Conclusion

The purpose of this thesis was to investigate how the largest non-financial companies in Norway manage their foreign exchange rate exposure. This was done through the use of a survey distributed to the largest non-financial firms in Norway.

The results from the analysis clearly indicate that the largest non-financial companies in Norway have a predefined strategy for managing foreign exchange risk, and that this strategy is defined at corporate level or by the board of directors. This confirms what Loderer and Pichler (2000) recommends, implying that only the CEOs and top level management have the integral view and the information needed to optimise the risk management. Our results also show that the main motivation for managing foreign exchange risk is to reduce fluctuations in income, costs or cash flow. This is in line with previous international studies, and Børsum and Ødegaard (2005) who found that 86 per cent of the Norwegian companies in their survey had reducing fluctuations in income and costs as their main goal.[41]

Short term derivatives (shorter than one year) are more commonly used than long term derivatives among the respondents in our survey. This is in line with previous research both from Norway, Germany and the US, which indicates that this applies for the largest non-financial companies in Norway.[42] The hypothesis regarding operational hedging strategies being more frequently combined with short term derivatives than with long term derivatives was on the other hand rejected. This is a contradiction to the results from Bodnar and Gebhardt's (1999) research among US and German non-financial firms. Our analysis leaves us unable to confirm that this is the case among the largest non-financial companies in Norway.

The analysis confirms that natural hedging is common among the largest non-financial companies in Norway. This tells us that the companies have almost the same share of income and costs, and/or assets and debt, in the same foreign currencies. The result is expected, as this also was the case in Børsum and Ødegaard (2005), and Loderer and Pichler's (2000) studies of companies in Norway and the US respectively. Our analysis also shows that the number of foreign subsidiaries, and the number of countries they are spread across, influences natural hedging. This is also confirmed by Pantzalis et al. (2001) for US multinational companies. When examining the type of hedging approaches, our

[41] According to Bodnar et al. (1994, 1995, 1998) and Pramborg (2004), the companies in USA and Korea focuses on reducing volatility in cash flows, while companies in Sweden reduce fluctuations in income and costs.
[42] Børsum & Ødegaad (2005), Loderer & Pichler (2000), Chowdhry & Howe (1999), Bodnar & Gebhardt (1999).

results show that the companies who only use operational hedging techniques have foreign subsidiaries in more countries than the companies who only use financial derivatives, or the ones using both.

There is no significant relation between the size of the company, measured by revenues, and the use of derivatives among the largest non-financial companies in Norway. This is not in line with what Bodnar and Gebhardt (1999) found among German and US multinational companies, and Børsum and Ødegaard (2005) found among Norwegian companies. This is likely to be explained by our sample, consisting of the largest non-financial companies, which probably makes all the corporations able to exploit the opportunities from economies of scale. When looking at the variation in derivative usage among the industries, our results show that shipping companies use more types of derivatives than other industries. The companies in the oil and gas industry use significantly fewer types of derivatives than the other industries (all though the difference is small). This was unexpected, as Børsum and Ødegaard (2005) found that both oil and gas, and shipping industries were using more derivatives with a longer horizon than other industries. Bodnar et al. (1994, 1995, 1998) and Chowdhry and Howe (1999) also found that companies in the commodity industry use more derivatives than other industries, but this is not significant in our analysis.

Answering the thesis' main problem formulation, the largest non-financial companies in Norway have a predefined strategy for managing foreign exchange risk, which is defined by the board of directors or by the management in the organisation. The companies' main motivation for managing foreign exchange risk is to reduce fluctuations in income, costs or cash flow, and short term derivatives are more commonly used than derivatives with a long horizon. They also have a high degree of natural hedging, which is influenced by the number of foreign subsidiaries and the number of countries they are spread across. Those who only use operational hedging techniques have subsidiaries in more countries than those only using financial derivatives and those using both. The companies in the shipping industry use more types of derivatives than the other industries, while companies in the oil and gas industry use less.

5.1 Other interesting results from the survey

In this subchapter we will list other interesting results from the survey, which is not tested with hypotheses due to lack of previous empirical support. Even though these results are excluded from the conclusion of the main problem formulation, they are still providing a broader understanding on foreign exchange risk management among the largest non-financial companies in Norway.

Almost 25 per cent of the respondents in the survey stated that they are not exposed to foreign currencies, even though they are among the largest non-financial companies in Norway.

The currency that most of the respondents are primarily exposed to is Euro, followed by US Dollars in second and Nordic currencies (SEK, DKK and ISK) in third.

The most frequently used method to measure foreign exchange rate exposure among the respondents is Cash Flow and/or Value at Risk analysis.

30 per cent of the respondents have increased their focus on foreign exchange rate management, as a consequence of the financial crisis. The remaining companies have not changed their focus.

Borrowing or placing funds in other currencies is the most frequently used operational hedging technique, followed by buying factor inputs in the same currency as the exposed income, and pricing policies.

Forward/Futures contracts are the most frequently used financial hedging technique, followed by swaps as the second and options as the third.

A majority of the respondents who use both operational and financial hedging techniques consider the financial approach as the most important.

Short term derivatives are more frequently used among the respondents mainly because future transactions are hedged individually.

5.2 Limitations

In this study of foreign exchange risk management among the largest non-financial companies in Norway, some delimitations have been set while some limitations have occurred.

First of all, the target sample was restricted to the 500 largest companies in Norway ranked by their revenues in 2008.[43] This was done deliberately, due to the fact that larger companies are more likely to be exposed to foreign exchange risk, thus providing us with data about foreign exchange risk management. Still, it can be questioned if the 500 largest companies in fact are representative of the largest companies in Norway. Perhaps should even more (fewer) companies been included (excluded) in the sample.

Contact information was attainable for the majority of the companies in the sample, but for some firms the contact information was unavailable. It would also be optimal to get the e-mail addresses to the person best suited to answer the survey. In regards to this, the answers of the survey may have been influenced by the person answering the survey (CEO, CFO, Controller or information director).

One drawback when sending out the survey to the large companies may be the danger that some of them are not managing foreign exchange risk on a parent company level, but rather in the individual subsidiaries. At the same time, the individual subsidiaries may not be large enough on their own to be included in the sample. As a result of this, there is a risk that some companies have answered that they are not exposed to foreign exchange risk, even though they are indirectly exposed via the subsidiaries.

It should be mentioned that there is a small possibility that several questionnaires was sent out to the same company. We did discover some duplicates (e.g. same company, but different names) in the sample list, but a lot of time was used in order to eliminate this problem.

The questionnaire was written in Norwegian, and not English. This was a deliberate choice from our side, to minimise the risk of any misunderstandings which could potentially lead to distorted answers and lower the validity of the study. Even though we have tried to the largest extent possible to eliminate any translation errors, it should be mentioned that some words and expressions might

[43] http://www.norgesstorstebedrifter.no

have been slightly warped or lost in translation. Also, there is always a risk that some of the respondents may have misunderstood or had problems understanding some of the questions.

Based on some of the answers, a few respondents seemed to have problems with understanding the difference between operational and financial hedging. If we were to send out the survey again, we would have defined the difference between operational and financial hedging more clearly in the beginning of the questionnaire. This would have clarified any misunderstandings regarding those expressions.

Another limitation is the choice of having interval variables in the question about number of foreign subsidiaries and number of countries. This was done to ease the effort and time needed by the respondents. In retrospect, the most favourable would have been ratio variables. This would made interpretation of the results from the regression analysis more uncomplicated and intuitive.

When analysing the degree of natural hedging among the companies, we have looked at the share of income vs. the share of costs, and the share of assets vs. the share of debt in foreign currency. Theoretically, when e.g. the costs and income are denominated in the same currency, one of these accounts would be cancelled by the same change in the corresponding account, leaving the total exposure to foreign exchange risk closer to zero. One limitation regarding the question on this subject is the possibility that the firms do not necessarily have the income and costs in the same foreign currency. This may lead to slightly misleading results, because a firm may e.g. have income in USD and costs in EUR.

5.3 Further research

Further research beyond what is presented in this thesis is desirable, and may well provide additional insight to the foreign exchange risk management of the largest non-financial companies in Norway.

A comparative study where a sample of small and/or medium sized companies is compared to the sample of the largest firms may yield interesting results. It would be interesting to see if there are any systematic differences in how large and smaller companies manage their foreign exchange rate exposure.

A country comparison may also be interesting, distributing the survey to the largest non-financial companies in other countries. This may provide country specific differences, and contribute to a better understanding and interpretation of the results achieved in this thesis.

Another alternative is to repeat the survey sometime in the future, and test if there have been any changes in methods or motivation. This will provide additional insight in the development of how the companies are managing their foreign exchange rate exposure. Perhaps the continuing development of financial derivative markets results in the companies shifting from operational hedges to more financial hedges.

One possible study could be a more qualitative approach, using a sample of the firms and perform in-depth interviews with the respondents. This opens the possibility for more qualitative questions, and may provide additional insight about the thoughts and motivations behind the companies risk management strategy and policy. This also allows for the possibility to clarify any misunderstandings that may occur with the use of standardised questionnaires.

Another possible study could be based on the use of derivatives among Norwegian companies, e.g. to compare derivative usage for hedging foreign exchange exposure, interest rate risk and commodity risk up against each other, or to look more closely on currency hedging solely. Information about this may be found in annual reports (at least for the public traded companies), which could be used as a basis for a quantitative study, but in general, detailed data about this may be hard to get.

If one could get data on the specific quantity of currency derivatives being used by each company, this could be useful. This would provide the possibility to test derivative usage against firm size in another fashion then what is done in this thesis and previous studies.

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Appendices

Appendix A: E-mail distributed to the respondents

First e-mail distributed to the respondents:

Hei,

Vi er to masterstudenter ved Norges Handelshøyskole (NHH), hvor vi for tiden skriver en avsluttende masterutredning innenfor profilen finansiell økonomi. I den forbindelse håper vi at du finner tid til å hjelpe oss med å svare på en kort, nettbasert undersøkelse om valutaeksponering og valutasikring.

Målet med oppgaven er å kartlegge valutaeksponering, samt sikring av valutarisiko blant de største bedriftene i Norge. Dette emne er lite forsket på i norsk kontekst og derfor interessant å studere grundigere. Dersom det er ønskelig vil et kort og informativt sammendrag hvor undersøkelsens viktigste resultater inngår, være tilgjengelig gjennom å ta kontakt med en av undertegnede.

Undersøkelsen er beregnet til å ta maksimalt ca 5 minutter, og alle svar blir behandlet anonymt.

Vi setter stor pris på at du tar deg tid til å besvare undersøkelsen. Har du spørsmål, ikke nøl med å ta kontakt.

På forhånd takk!

Med vennlig hilsen
Krister Eriksen – krister.eriksen@stud.nhh.no – 415 12 959
Ola Wedøe – ola.wedoe@stud.nhh.no – 977 97 564

Reminder distributed to the respondents:

Hei igjen,

Vi har registrert at din bedrift ikke har besvart vår undersøkelse om valutaeksponering sendt ut for en måned siden. Vi har full forståelse for at din hverdag er hektisk, men håper likevel du vil hjelpe oss med å få en bedre forståelse for valutasikring i et norsk perspektiv.

OBS! Dersom din bedrift ikke er eksponert mot valuta vil vi sette stor pris på om du svarer dette i spørsmål tre. Spørreundersøkelsen vil deretter bli avsluttet.

Som tidligere beskrevet er målet vårt med masterutredningen å kartlegge valutaeksponering, samt sikring av valutarisiko blant de største bedriftene i Norge. Det har tidligere vært lite forskning på dette blant norske bedrifter, som etter vår mening vil tilsi at ditt bidrag også vil være interessant utenfor rammene av en masterutredning. Dersom det er ønskelig vil et kort og informativt sammendrag hvor undersøkelsens viktigste resultater inngår, være tilgjengelig gjennom å ta kontakt med en av undertegnede.

Undersøkelsen er nettbasert, beregnet til å ta maksimalt ca 5 minutter, og alle svar blir behandlet anonymt.

Vi setter stor pris på at du tar deg tid til å besvare undersøkelsen. Har du spørsmål, ikke nøl med å ta kontakt.

På forhånd takk!

Med vennlig hilsen
Krister Eriksen – krister.eriksen@stud.nhh.no – 415 12 959
Ola Wedøe – ola.wedoe@stud.nhh.no – 977 97 564

Appendix B: The survey

In the following the complete survey is presented.

Undersøkelse om valutaeksponering og sikring

Denne undersøkelsen inngår som en del av hovedgrunnlaget i vår masterutredning ved Norges Handelshøyskole (NHH) våren 2010. Målet med oppgaven er å kartlegge valutaeksponering, samt sikring av valutarisiko blant de største bedriftene i Norge.

Undersøkelsen er dynamisk, og avhengig av svar vil den inneholde mellom 3 og 17 spørsmål. Maksimal beregnet tidsbruk er ca 5 minutter.

Svarene fra undersøkelsen behandles anonymt i utredningen.

Vi gjør oppmerksom på at undersøkelsen ikke inneholder en tilbake-knapp, så vi ber deg tenke gjennom svarene dine før du trykker videre.

Vi setter stor pris på at du tar deg tid til å besvare undersøkelsen.

På forhånd takk!

Med vennlig hilen
Krister Eriksen og Ola Wedøe
Masterstudenter, Norges Handelshøyskole

Hva slags bransje tilhører din bedrift?

- ○ Olje/gass
- ○ Annen energi
- ○ Forsyningsbedrifter
- ○ Shipping
- ○ Industri/produksjon
- ○ Fiskeindustri
- ○ Andre forbruksvarer
- ○ Kapitalvarer
- ○ IT/telekom/media
- ○ Offentlig sektor
- ○ Annet, spesifiser her

Hva kjennetegner din bedrift best?

- ○ Notert ved Oslo Børs
- ○ Ikke børsnotert aksjeselskap
- ○ Offentlig sektor

Neste >>

5 % fullført

Undersøkelse om valutaeksponering og sikring

Har din bedrift inntekter, kostnader, eiendeler og/eller gjeld i en annen valuta enn norske kroner (NOK)?

- ○ Ja
- ○ Nei

Neste >>

11 % fullført

Undersøkelse om valutaeksponering og sikring

Hvilken av de følgende valutaene er din bedrift -mest- eksponert mot?

- ○ Euro (EUR)
- ○ Dollar (USD)
- ○ Britisk pund (GBP)
- ○ Nordiske valutaer (SEK, DKK, ISK)
- ○ Annet, spesifiser her

Neste >>

16 % fullført

Undersøkelse om valutaeksponering og sikring

Hvor mange datterselskaper har din bedrift i utlandet?

Velg alternativ

Hvor mange av disse datterselskapene er rene salgsavdelinger?

Velg alternativ

Hvor mange land har din bedrift datterselskaper i?

Velg alternativ

Neste >>

21 % fullført

Undersøkelse om valutaeksponering og sikring

Hvor stor andel av inntekter, kostnader, eiendeler og gjeld er i en annen valuta enn norske kroner (NOK)?

	0%	1-25%	26-50%	51-75%	76-99%	100%
Inntekter	○	○	○	○	○	○
Kostnader	○	○	○	○	○	○
Eiendeler	○	○	○	○	○	○
Gjeld	○	○	○	○	○	○

Neste >>

26 % fullført

Undersøkelse om valutaeksponering og sikring

Hvilke metoder bruker selskapet for å vurdere valutarisiko?

- [ ] Grovvurdering
- [ ] Cash Flow og/eller Value at Risk
- [ ] Scenarioanalyse
- [ ] Stressanalyse
- [ ] Ingen metode
- [ ] Andre metoder, spesifiser her

Neste >>

32 % fullført

Undersøkelse om valutaeksponering og sikring

Dersom din bedrift har en formell forhåndsdefinert strategi for håndtering av valutarisiko, på hvilket nivå er denne bestemt?

- ( ) Styret, Generalforsamling eller tilsvarende
- ( ) Konsernnivå (Adm. Dir., økonomisjef, regnskapssjef eller tilsvarende)
- ( ) Divisjonsnivå (divisjonsdirektør, regionsdirektør eller tilsvarende)
- ( ) Avdelingsnivå (formann, mellomleder eller tilsvarende)
- ( ) Medarbeidernivå (økonomimedarbeider, controller eller tilsvarende)
- ( ) Har ingen formell forhåndsdefinert strategi

Neste >>

37 % fullført

Undersøkelse om valutaeksponering og sikring

Har din bedrift endret sitt fokus på valutasikring som følger av finanskrisen?

- ○ Økt fokus
- ○ Redusert fokus
- ○ Uendret fokus

Neste >>

42 % fullført

Undersøkelse om valutaeksponering og sikring

For å begrense konsekvensene av valutasvingninger, hvilke av de følgende operasjonelle valutasikringsteknikker bruker din bedrift?

- ☐ Endrer prisingsstrategi
- ☐ Endrer produktmiks
- ☐ Tilpasser seg markeder og markedssegmenter
- ☐ Kjøper innsatsfaktorer i samme valuta som produktet faktureres i
- ☐ Valg av leverandørers lokalisering
- ☐ Fakturerer utenlandske kunder helt eller delvis i norske kroner
- ☐ Har flyttet eller planlegger å flytte deler av virksomheten til utlandet
- ☐ Låner eller plasserer midler i valuta
- ☐ Ingen
- ☐ Annet, spesifiser her

Neste >>

47 % fullført

Undersøkelse om valutaeksponering og sikring

For å begrense konsekvensene av valutasvingninger, hvilke av de følgende finansielle instrumenter/derivater bruker din bedrift?

- [ ] Terminkontrakter (Forwards/Futures)
- [ ] Byttekontrakter (Swaps)
- [ ] Opsjoner (Options)
- [ ] Ingen
- [ ] Annet, spesifiser her

Neste >>

53 % fullført

Undersøkelse om valutaeksponering og sikring

Hva er typisk løpetid på valutaderivatene din bedrift benytter?

- ( ) 0-6 mnd
- ( ) 6-12 mnd
- ( ) 1-2 år
- ( ) Over 2 år

Neste >>

58 % fullført

Undersøkelse om valutaeksponering og sikring

Hva er den -viktigste- årsaken til at din bedrift i mindre grad benytter seg av derivater med lengre løpetid?

- Fremtidige kontantstrømmer kan ikke estimeres med god nok sikkerhet
- Avtalte transaksjoner i fremtiden sikres individuelt ved inngåelse
- Langsiktig horisont sikres med operasjonelle teknikker
- Valutasvingninger nuller hverandre ut i det lange løp
- Det krever for store posisjoner i finansielle derivater
- Det er for dyrt
- Annet, spesifiser her

Neste >>

63 % fullført

Undersøkelse om valutaeksponering og sikring

Hvilken valutasikringsteknikk er -viktigst- for din bedrift?

- Operasjonelle valutasikringsteknikker
- Finansielle instrumenter/derivater
- Like viktige

Neste >>

68 % fullført

Undersøkelse om valutaeksponering og sikring

Hva er den -viktigste- årsaken til at din bedrift bruker valutasikringsteknikker?

- Redusere svingninger i inntekter eller kostnader i valuta
- Redusere svingninger i kontantstrømmer i valuta
- Redusere risikoen for finansielle problemer
- Redusere risikoen for eierne
- Forenkle budsjettering og planlegging
- Garantere nok likviditet til å finansiere fremtidige prosjekter/investeringer
- Utnytte bedriftens spesialkompetanse i valuta
- Utnytte renteforskjeller mellom ulike valutaer
- Følge dominerende praksis i bransjen
- Annet, spesifiser her

Neste >>

74 % fullført

Undersøkelse om valutaeksponering og sikring

Hva er den -viktigste- årsaken til at din bedrift bruker operasjonelle valutasikringsteknikker?

- Redusere svingninger i inntekter eller kostnader i valuta
- Redusere svingninger i kontantstrømmer i valuta
- Redusere risikoen for finansielle problemer
- Redusere risikoen for eierne
- Forenkle budsjettering og planlegging
- Garantere nok likviditet til å finansiere fremtidige prosjekter/investeringer
- Utnytte bedriftens spesialkompetanse i valuta
- Utnytte renteforskjeller mellom ulike valutaer
- Følge dominerende praksis i bransjen
- Annet, spesifiser her

Neste >>

79 % fullført

Undersøkelse om valutaeksponering og sikring

Hva er den -viktigste- årsaken til at din bedrift bruker finansielle valutasikringsteknikker?

- Redusere svingninger i inntekter eller kostnader i valuta
- Redusere svingninger i kontantstrømmer i valuta
- Redusere risikoen for finansielle problemer
- Redusere risikoen for eierne
- Forenkle budsjettering og planlegging
- Garantere nok likviditet til å finansiere fremtidige prosjekter/investeringer
- Utnytte bedriftens spesialkompetanse i valuta
- Utnytte renteforskjeller mellom ulike valutaer
- Følge dominerende praksis i bransjen
- Annet, spesifiser her

Neste >>

84 % fullført

Undersøkelse om valutaeksponering og sikring

Hva er -hovedårsaken- til at valutasikringsteknikker ikke benyttes i din bedrift?

- Valutasvingninger har ingen signifikant innvirkning på selskapets kontantstrømmer og konkurranseposisjon
- Eksponeringen kan ikke kvantifiseres godt nok til å bli sikret med valutasikringsteknikker
- Kostnadene ved hedging/sikring er for høye
- De mest passende finansielle instrumentene er ikke tilgjengelige i markedet
- Manglende forståelse og ekspertise av valutaeksponeringen
- På sikt vil valutasvingninger nulle ut hverandre
- Har etter vurdering av risikoen valgt å være eksponert
- Annet, spesifiser her

Neste >>

89 % fullført

Undersøkelse om valutaeksponering og sikring

Hva er -hovedårsaken- til at operasjonelle valutasikringsteknikker ikke benyttes i din bedrift?

- Valutasvingninger har ingen signifikant innvirkning på selskapets kontantstrømmer og konkurranseposisjon
- Eksponeringen kan ikke kvantifiseres godt nok til å bli sikret med operasjonelle virkemidler
- Eksponeringen er bedre styrt med finansielle instrumenter
- Kostnadene ved hedging/sikring er for høye
- Manglende forståelse og ekspertise av valutaeksponeringen
- På sikt vil valutasvingninger nulle ut hverandre
- Annet, spesifiser her

Neste >>

95 % fullført

Undersøkelse om valutaeksponering og sikring

Hva er -hovedårsaken- til at finansielle valutasikringsteknikker ikke benyttes i din bedrift?

- Valutasvingninger har ingen signifikant innvirkning på selskapets kontantstrømmer og konkurranseposisjon
- Eksponeringen kan ikke kvantifiseres godt nok til å bli sikret med finansielle virkemidler
- Eksponeringen er bedre styrt med operasjonelle virkemidler
- Kostnadene ved hedging/sikring er for høye
- De mest passende finansielle instrumentene er ikke tilgjengelige i markedet
- Manglende forståelse og ekspertise av valutaeksponeringen
- På sikt vil valutasvingninger nulle ut hverandre
- Annet, spesifiser her

Send

100 % fullført

Appendix C: The complete sample

#	*Company*
1	Statoil ASA Hovedkontor
2	Telenor ASA Hovedkontor
3	Yara International ASA
4	Norsk Hydro ASA Konsern
5	ExxonMobil Exploration and Production Norway AS
6	Orkla ASA Hovedkontor
7	Aker Solutions ASA Konsern
8	Total E&P Norge AS Contracts
9	Helse Sør-Øst Rhf
10	Norgesgruppen ASA Hovedkontor
11	A/S Norske Shell Hovedkontor
12	Reitangruppen AS
13	ConocoPhillips Norge Konsern
14	DnB NOR ASA
15	Stx Europe AS
16	Nordea Bank Norge ASA Konsern
17	Storebrand ASA Hovedkontor
18	Coop Norge SA
19	Norske Skogindustrier ASA Hovedkontor
20	Coop Norge Handel AS Hovedkontor
21	Statkraft SF Konsern
22	Eni Norge AS
23	Vital Forsikring ASA
24	TINE BA Hovedkontor
25	Veidekke ASA Hovedkontor
26	Wilh. Wilhelmsen ASA
27	Helse Vest RHF
28	Ica Norge AS Hovedkontor
29	Nortura Sa
30	National Oilwell Norway AS
31	Gjensidige Forsikring BA Hovedkontor
32	Atea ASA Hovedkontor
33	MøllerGruppen AS
34	Schibsted ASA Konsern
35	Helse Midt-Norge RHF
36	Marine Harvest ASA
37	Petroleum Geo-Services ASA
38	Posten Norge AS
39	Eksportfinans ASA
40	SAS Scandinavian Airlines Norge AS
41	If Skadeforsikring Hovedkontor
42	Seadrill Norge AS
43	Scandinavian Bunkering AS
44	Helse Nord RHF
45	Kongsberg Gruppen ASA Hovedkontor
46	Hafslund ASA Hovedkontor
47	Rolls-Royce Marine AS Head Office
48	Norsk Tipping AS
49	Expert AS
50	Felleskjøpet Agri BA
51	Jotun AS Hovedkontor
52	Norges Statsbaner AS
53	Aktieselskapet Vinmonopolet
54	Cermaq ASA
55	Høegh Autoliners Shipping AS
56	Skanska Norge AS Hovedkontor
57	Det Norske Veritas Stiftelsen Hovedkontor
58	O. N. Sunde AS
59	Camillo Eitzen & Co ASA
60	Kommunalbanken AS
61	Elkem AS
62	Kongsberg Automotive Holding ASA
63	Laco AS
64	Odfjell Se
65	ABB AS Hovedkontor
66	Bonheur ASA
67	Torvald Klaveness Rederiaksjeselskapet
68	BP Norge AS
69	Renewable Energy Corporation ASA
70	ExxonMobil Production Norway Inc
71	Bama Gruppen AS
72	Varner-Gruppen AS Hovedkontor
73	Norsk Medisinaldepot AS Hovedkontor
74	Moelven Industrier ASA Hovedkontor
75	Aibel AS
76	NetCom AS
77	Ullevål universitetssykehus Hf
78	Kongsberg Automotive AS
79	Avinor AS
80	Agder Energi AS Konsern
81	Rikshospitalet Hf
82	Helse Bergen HF
83	Umoe Gruppen AS
84	Aker ASA
85	St Olavs Hospital Hf
86	Idemitsu Petroleum Norge AS
87	Uno-X Energi AS
88	Grieg Star Shipping AS
89	ISS Facility Services AS

90 Norwegian Air Shuttle ASA
91 Norges Råfisklag Hovedkontor
92 Lerøy Seafood Group ASA
93 Sparebanken Vest Hovedkontor
94 Sykehuset Innlandet Hf
95 NCC Construction AS Konsern
96 Eltek ASA Hovedkontor
97 AF Gruppen ASA Konsern
98 Optimera AS Hovedkontor
99 Fred Olsen Energy ASA
100 ErgoGroup AS Hovedkontor
101 Nexans Norway AS Hovedkontor
102 Brødrene Dahl AS Hovedkontor
103 Livsforsikringsselskapet Nordea Liv Norge AS Hovedkontor
104 SpareBank 1 Livsforsikring AS Hovedkontor
105 Siemens AS
106 Eramet Norway AS
107 Alcoa Norway ANS
108 Apotek 1 Norge AS
109 Dong E&P Norge AS
110 Den Norske Stats Husbank Hovedkontor
111 Rieber & Søn ASA Hovedkontor
112 Universitetssykehuset Nord-Norge HF
113 Ahlsell Norge AS Hovedkontor
114 A-pressen AS
115 Kverneland ASA
116 Choice Hotels Scandinavia AS
117 SpareBank 1 Nord-Norge Hovedkontor
118 Apokjeden Distribusjon AS
119 Tandberg ASA
120 Elkjøp Norge AS
121 Byggmakker Norge AS
122 Lyse Energi AS
123 Norsk Rikskringkasting AS Hovedkontor
124 Komplett ASA Hovedkontor
125 Statens Lånekasse for Utdanning Hovedkontor
126 Statnett SF
127 Enterprise Oil Norge AS
128 Toyota Norge AS
129 Tts Group ASA
130 GDF SUEZ E&P NORGE AS
131 Ineos Bamble AS
132 Bergenshalvøens Kommunale Kraftselskap AS Hovedkontor
133 Austevoll Seafood ASA
134 EDB Business Partner Norge AS
135 YIT AS
136 Helse Stavanger HF
137 KLP Kreditt AS
138 Scancem International ANS
139 Sørlandet sykehus HF
140 Halliburton AS
141 Schenker AS
142 Akershus Universitetssykehus Hf
143 Skretting AS
144 H & M Hennes & Mauritz AS Hovedkontor
145 Stiftelsen Norsk Rikstoto
146 Norsk Scania AS Hovedkontor
147 E- Co Energi AS
148 BN Bank ASA
149 GE Healthcare AS
150 Eidsiva Energi AS
151 Tomra Systems ASA
152 Sykehuset Østfold HF
153 Løvenskiold-Vækerø AS Hovedkontor
154 Baker Hughes Norge AS
155 Hess Norge AS
156 Fjordkraft AS
157 Siba Norge, Filial Av Siba Ab Sverige
158 Nord-Trøndelag Elektrisitetsverk (NTE) Hovedkontor
159 Store Norske Spitsbergen Kulkompani AS
160 WesternGeco AS
161 Alliance Unichem Norge AS
162 Acergy Norway AS
163 Veolia Miljø AS
164 Fokus Bank Hovedkontor
165 Ewos AS Hovedkontor
166 E A Smith AS Hovedkontor
167 TGS Nopec Geophysical Company ASA
168 Adecco Norge AS Hovedkontor
169 Jernia AS
170 Ulsmo AS
171 Tide ASA
172 Ferd Holding AS
173 Plantasjen ASA
174 Hafslund Nett AS
175 Nammo AS
176 Harald Sætre AS Rederiet
177 Fugro-Geoteam AS
178 Coop Trondheim og Omegn BA Hovedkontor
179 Sparebanken Hedmark Hovedkontor
180 Sør-Norge Aluminium AS

181 Sparebanken Møre Hovedkontor
182 Kleven Maritime AS
183 Bergen Bunkers AS
184 Visma AS
185 Hurtigruten ASA
186 Farstad Shipping ASA
187 Hafslund Strøm AS
188 Tele2 Norge AS
189 Bilia Personbil AS
190 Reinertsen AS
191 Kruse Smith Gruppen AS
192 E.ON Ruhrgas Norge AS
193 Aker Universitetssykehus Hf
194 E-CO Vannkraft AS
195 Scana Industrier ASA Hovedkontor
196 Wartsila Norway AS Hovedkontor
197 Sandnes Sparebank Hovedkontor
198 Norsk Stål AS Hovedkontor
199 Transocean Offshore (North Sea) Ltd
200 Widerøe's Flyveselskap AS
201 Hewlett-Packard Norge AS Hovedkontor
202 Fjord1 Nordvestlandske AS
203 Nordlandssykehuset HF
204 Statsbygg
205 TV 2 Gruppen AS
206 Aker Seafoods ASA Konsern
207 Tollpost Globe AS
208 Technip Norge AS
209 KB Gruppen Kongsvinger AS
210 Alliance Healthcare Norge AS
211 Subsea 7 Norway
212 SG Finans AS Hovedkontor
213 AS Agra Industrier
214 Ekornes ASA Hovedkontor
215 J E Ekornes AS
216 Sykehuset Buskerud Hf
217 Wenaasgruppen AS
218 Kruse Smith Entreprenør AS
219 SINTEF
220 Oslo Bolig og Sparelag Hovedkontor
221 AGR Group ASA
222 Saferoad AS
223 Gk Konsern AS
224 Onninen AS Hovedkontor
225 Kollektivtransportproduksjon AS
226 Elektroskandia Norge AS
227 Kleven Verft AS
228 SpareBank 1 SR-Bank Hovedkontor
229 Troms Kraft AS
230 Sparebanken Sør Hovedkontor
231 Bladcentralen ANS
232 Skjeggerød AS
233 Coca-Cola Drikker AS
234 Heidenreich Holding AS
235 Aegis Media Norge AS Hovedkontor
236 Carat Norge AS
237 Chr. Hansen AS Norsk avd. av utenlandsk foret
238 NordlandsBanken ASA Hovedkontor
239 M-I Swaco Norge AS
240 Sykehuset Telemark HF
241 I. K. Lykke AS Konsern
242 Coop Orkla Møre Sa
243 BKK Produksjon AS
244 Steen & Strøm AS
245 Mestergruppen AS Konsern
246 Vetco Gray Scandinavia AS
247 Relacom AS
248 Ving Norge AS
249 Peab Norge AS
250 Europris Holding AS
251 Rica Hotels AS
252 Kitron ASA
253 Olav Thon Eiendomsselskap ASA
254 Ikm Gruppen AS
255 Norway Pelagic ASA
256 Bauda AS Konsern
257 Helse Fonna HF
258 Solstad Offshore ASA
259 Sykehuset i Vestfold Hf
260 Johan G Olsen AS
261 Grieg Maturitas AS
262 Ford Motor Norge AS Konsern
263 Helse Sunnmøre HF
264 Laerdal Medical AS
265 Wallenius Wilhelmsen Logistics AS
266 Wilson ASA
267 Ulstein Verft AS Hovedkontor
268 Odim ASA
269 Torghatten ASA
270 Kraft Foods Norge AS Hovedkontor
271 Selvaag Gruppen AS
272 Nordic Paper AS
273 Felleskjøpet Rogaland Agder
274 GNT Norway AS

275 Helse Nord Trøndelag HF
276 Coop Hordaland BA
277 Nte Energi AS
278 Manpower AS Hovedkontor
279 Ventelo Bedrift AS
280 Cubus AS Hovedkontor
281 Sparebanken Pluss Hovedkontor
282 Fatland AS
283 Verdens Gang AS Hovedkontor
284 Solar Norge AS
285 Sykehuset Asker og Bærum Hf
286 Volvo Maskin AS Hovedkontor
287 Nordek AS
288 Norconsult Holding AS
289 Kuoni Scandinavia AB NUF
290 Helse Nordmøre og Romsdal HF
291 Sykehusapotekene Hf
292 Heimdal Gruppen AS
293 Handicare AS
294 Norwegian Property ASA
295 Kasu AS
296 Brødr. Sunde AS Hovedkontor
297 Framo Engineering AS
298 Denofa AS
299 Leonhard Nilsen & Sønner As
300 Byggma ASA
301 Havyard Leirvik AS Konsern
302 Salmar Processing AS
303 Heli-One Norway AS
304 Rezidor Hotels Norway AS
305 Sparebanken Sogn og Fjordane Hovedkontor
306 Gyldendal ASA
307 Grenland Group ASA
308 InfoCare AS
309 Pareto AS
310 Jackon Holding AS
311 Coop Nord BA Hovedkontor
312 Nergård AS
313 Seawell AS
314 Bjørge ASA Hovedkontor
315 Forbrukersamvirket Sør BA Hovedkontor
316 Salmar ASA
317 CargoNet AS Hovedkontor
318 Kavli Holding AS Hovedkontor
319 Volvo Personbiler Norge AS
320 Bankenes Betalingssentral AS
321 Star Tour AS Hovedkontor
322 BMW Norge AS
323 SAS Ground Services Norway AS
324 Glamox ASA Konsern
325 PriceWaterhouseCoopers AS
326 Nordea Eiendomskreditt AS Hovedkontor
327 Nycomed Pharma AS Hovedkontor
328 GC Rieber AS
329 Hent AS
330 Gard Marine & Energy Limited
331 Accenture AS
332 Esso Energi AS Konsern
333 Ernst & Young AS Hovedkontor
334 Fesil AS
335 Beerenberg Corp AS
336 T S Eiendom AS Konsern
337 T. Stangeland Maskin AS
338 Cappelen Damm AS
339 Norgesenergi AS
340 Bolig- og Næringskreditt AS Hovedkontor
341 Odfjell Drilling Management AS
342 Telefast AS
343 Umoe Ikt AS
344 Coop Økonom BA Hovedkontor
345 Johs. Rasmussen AS Hovedkontor
346 Grieg Seafood ASA
347 Knutsen Bøyelaster Vi KS
348 Electrolux Home Products Norway AS Hovedkontor
349 Alstom Norway AS
350 Södra Cell Tofte AS
351 Clas Ohlson AS
352 Eniro Norge AS Hovedkontor
353 DHL Express (Norway) AS
354 British American Tobacco Norway AS
355 Nordic Intertrade AS
356 Coop Vestfold og Telemark BA Hovedkontor
357 Bis Industrier AS
358 Peterson Linerboard AS Moss
359 Green Reefers ASA
360 AL Gartnerhallen Hovedkontor
361 Eidsiva Vannkraft AS
362 Brødrene Risa AS
363 Det Norske Diakonhjem
364 Skanem AS Hovedkontor
365 Aller Media AS Konsern
366 Lefdal Elektromarked AS
367 Energiselskapet Buskerud AS

368 Coop Vest BA
369 Euro Sko Norge AS
370 Wintershall Norge ASA
371 Dno International ASA
372 Rasmussengruppen AS
373 LeasePlan Norge AS
374 Jakob Hatteland Holding AS
375 Asko Nord AS
376 Roxar ASA
377 Helse Finnmark HF
378 Coop Haugaland BA Hovedkontor
379 Securitas AS
380 Kitron AS
381 Itegra AS
382 CHC Norway AS
383 Entra Eiendom AS
384 Norway Royal Salmon AS
385 Glava AS Hovedkontor
386 Agder Ops Vegselskap AS
387 Bkk Nett AS
388 Voice Norge AS
389 Arcus-gruppen AS
390 Spenncon AS Hovedkontor
391 Istad AS Hovedkontor
392 Pronova BioPharma Norge AS
393 Legula AS
394 West Contractors AS
395 GET AS
396 Coop Innlandet BA
397 Oceaneering AS
398 Scandinavian Business Seating Group AS
399 Jysk AS Hovedkontor
400 Abg Sundal Collier Holding ASA
401 Abg Sundal Collier Norge ASA
402 Nordfjord Kjøtt AS
403 HelgelandsKraft AS Hovedkontor
404 Hjemmet Mortensen AS Hovedkontor
405 Bonnier Publications International AS
406 ESS Support Services AS
407 Contiga AS Hovedkontor
408 Seaborn AS
409 Terina AS
410 Jm Byggholt AS Konsern
411 Bring Frigoscandia AS Hovedkontor
412 Neumann Bygg AS
413 Mccann Worldgroup AS
414 Pon Equipment AS Hovedkontor
415 Hansa Borg Bryggerier AS
416 Kuehne + Nagel AS
417 Solstad Rederi AS
418 Helgeland Sparebank Region Nord Hovedkontor
419 DSV Road AS Konsern
420 Viken Skog BA Konsern
421 General Motors Norge AS
422 Bergen Group Fosen Yard AS
423 Helgelandssykehuset HF
424 Øie AS
425 Ruukki Profiler AS
426 Norgros Handel AS
427 Protan AS Hovedkontor
428 Bautas AS
429 Fatland Ølen AS
430 Bw Offshore AS
431 Terra Gruppen AS
432 Lovisenberg Diakonale Sykehus AS
433 Heidenreich AS Hovedkontor
434 Diakonhjemmet Sykehus AS
435 Møller Bil Vest AS
436 Dresser-Rand AS
437 Mediaedge Cia Norway AS
438 Rutebileiernes Standardiseringsaksjeselskap Konsern
439 SCA Hygiene Products AS Hovedkontor
440 Capgemini Norge AS Hovedkontor
441 Oslo Børs Vps Holding ASA
442 Tieto Norway AS
443 Hamworthy Gas Systems AS
444 Tafjord Kraft AS
445 Saint-Gobain Byggevarer AS
446 Aker Reinertsen AS
447 Knutsen Shuttle Tankers Pool AS
448 Havila Shipping ASA
449 Kappahl AS
450 Norsildmel Innovation AS
451 AGA AS Hovedkontor
452 Apply Leirvik AS
453 Multiconsult AS Konsern
454 Eidsiva Marked AS
455 Macgregor Hydramarine AS
456 Xstrata Nikkelverk AS
457 Lindex AS Hovedkontor
458 Handelshøyskolen BI
459 A-K maskiner AS
460 Fjord1 Fylkesbaatane AS

461 Jordan AS Hovedkontor
462 Linstow AS
463 Pon Power AS Hovedkontor
464 North Cape Minerals AS
465 Vizada AS
466 Coop Sambo BA Hovedkontor
467 Bristow Norway AS
468 J. Martens AS
469 Shell International Pipelines Inc
470 Vakt Service AS
471 Chess Communication AS Hovedkontor
472 Reservoir Exploration Technology ASA
473 Stens Invest AS
474 Volvo Aero Norge AS
475 EuroPark AS
476 Boliden Odda AS Hovedkontor
477 Draka Norsk Kabel AS Hovedkontor
478 Bergene Holm AS
479 Ømf Holding AS
480 Eastern Bulk Carriers AS
481 Malermestrenes Andelslag Hovedkontor
482 MAN Last og Buss AS Hovedkontor
483 Würth Norge AS
484 Fujitsu Technology Solutions AS
485 Deepocean AS
486 Ge Vingmed Ultrasound AS
487 Network Norway AS
488 SpareBank 1 Buskerud-Vestfold Hovedkontor
489 Unicon AS Hovedkontor
490 Tdc AS
491 Nte Marked AS
492 Aspelin-Ramm Gruppen AS Konsern
493 Reitan Servicehandel Norge AS
494 Schneider Electric Norge AS
495 Diplom-Is AS Hovedkontor
496 Aktiv Kapital ASA
497 Lemminkäinen Norge AS Hovedkontor
498 Malthus AS Hovedkontor
499 Strøm Gundersen AS
500 DVB Bank SE Nordic Branch

Appendix D: Regression diagnostic tests

Hypothesis 6:

Regression

Ref. table 4.4

Linear regression

Number of obs	86
F(17, 68)	9.83
Prob > F	0.0000
R-squared	0.4159
Root MSE	2.839

Q5	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
hyp7_innt	2.876517	.9150859	3.14	0.002	1.050491	4.702542
hyp7_eiegjld	2.338959	.8940048	2.62	0.011	.5550002	4.122918
ant_kunfin	.5758984	1.067774	0.54	0.591	-1.554812	2.706609
ant_kunop	.9702084	.783321	1.24	0.220	-.5928844	2.533301
omsetn_100m	.0006054	.0002369	2.56	0.013	.0001327	.0010781
kjen_bors	1.924724	.7569873	2.54	0.013	.4141791	3.435269
B_olje	-.8544011	1.254982	-0.68	0.498	-3.358678	1.649876
B_aneregy	-3.770811	1.237266	-3.05	0.003	-6.239736	-1.301886
B_forsyn	-1.712882	1.813736	-0.94	0.348	-5.332136	1.906372
B_ship	.7319137	1.323139	0.55	0.582	-1.908369	3.372196
B_indust	.8583389	1.194603	0.72	0.475	-1.525455	3.242133
B_fisk	-.7670941	1.714609	-0.45	0.656	-4.188544	2.654356
B_forbruk	-.2319135	1.77345	-0.13	0.896	-3.770779	3.306952
B_kap	-.834233	1.523415	-0.55	0.586	-3.87416	2.205694
B_ITkommed	.0176132	1.770196	0.01	0.992	-3.514758	3.549984
B_bygganei	-1.364075	1.771158	-0.77	0.444	-4.898366	2.170217
B_trans	-.5295195	2.429449	-0.22	0.828	-5.37741	4.318371
_cons	-.2649277	.9408828	-0.28	0.779	-2.14243	1.612575

Ref. table 4.5

Linear regression

Number of obs	86
F(17, 68)	6.60
Prob > F	0.0000
R-squared	0.5072
Root MSE	2.3313

Q6	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
hyp7_innt	.9089315	.7642162	1.19	0.238	-.6160382	2.433901
hyp7_eiegjld	.4882381	.7645673	0.64	0.525	-1.037432	2.013908
ant_kunfin	.6078201	.8515688	0.71	0.478	-1.091459	2.307099
ant_kunop	-1.19437	.5696175	-2.10	0.040	-2.331024	-.0577158
omsetn_100m	.0009375	.0002654	3.53	0.001	.0004078	.0014671
kjen_bors	1.665406	.6011429	2.77	0.007	.4658442	2.864968
B_olje	-.86494	.47475	-1.82	0.073	-1.812289	.0824088
B_aneregy	-1.224174	.515121	-2.38	0.020	-2.252082	-.1962658
B_forsyn	-.136938	.9074944	-0.15	0.881	-1.947815	1.673939
B_ship	3.167801	.7594649	4.17	0.000	1.652313	4.68329
B_indust	2.538333	.7211875	3.52	0.001	1.099225	3.97744
B_fisk	.1462042	1.009119	0.14	0.885	-1.867461	2.15987
B_forbruk	.025827	.8788779	0.03	0.977	-1.727947	1.7796
B_kap	1.685205	1.686058	1.00	0.321	-1.679271	5.049681
B_ITkommed	-.1273483	.8598454	-0.15	0.883	-1.843143	1.588447
B_bygganei	.2891091	1.516062	0.19	0.849	-2.736146	3.314364
B_trans	1.691287	1.939835	0.87	0.386	-2.179594	5.562168
_cons	.0845366	.7054449	0.12	0.905	-1.323157	1.49223

Ref. table 4.6

Linear regression

Number of obs	86
F(17, 68)	8.29
Prob > F	0.0000
R-squared	0.3846
Root MSE	2.7532

Q7	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
hyp7_innt	2.631819	.7241449	3.63	0.001	1.18681	4.076828
hyp7_eiegjld	1.978128	.7924371	2.50	0.015	.3968442	3.559412
ant_kunfin	1.158284	.9754156	1.19	0.239	-.788127	3.104696
ant_kunop	1.013934	.5801386	1.75	0.085	-.1437146	2.171582
omsetn_100m	.0005756	.0001849	3.11	0.003	.0002067	.0009445
kjen_bors	1.757879	.709749	2.48	0.016	.341597	3.174161
B_olje	-1.002182	1.157145	-0.87	0.389	-3.311229	1.306864
B_aneregy	-3.81285	.9958132	-3.83	0.000	-5.799965	-1.825736
B_forsyn	-1.519477	1.965903	-0.77	0.442	-5.442375	2.403421
B_ship	.2069162	1.093746	0.19	0.851	-1.97562	2.389453
B_indust	.4759133	1.103944	0.43	0.668	-1.726973	2.6788
B_fisk	-1.828683	1.337941	-1.37	0.176	-4.498503	.8411378
B_forbruk	-1.670224	1.420063	-1.18	0.244	-4.503916	1.163468
B_kap	-1.739046	.8649151	-2.01	0.048	-3.464957	-.0131351
B_ITkommed	.3785792	1.321216	0.29	0.775	-2.257866	3.015024
B_bygganei	-1.479072	1.42947	-1.03	0.304	-4.331536	1.373391
B_trans	-.9287198	2.36792	-0.39	0.696	-5.65383	3.796391
_cons	-.059983	.7994731	-0.08	0.940	-1.655307	1.535341

Model specification

Ref. table 4.4

. linktest

Source	SS	df	MS
Model	390.465833	2	195.232916
Residual	547.917888	83	6.60142034
Total	938.383721	85	11.0398085

Number of obs	86
F(2, 83)	29.57
Prob > F	0.0000
R-squared	0.4161
Adj R-squared	0.4020
Root MSE	2.5693

Q5	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	.9340159	.433983	2.15	0.034	.0708413	1.797191
_hatsq	.007238	.0454171	0.16	0.874	-.0830949	.0975709
_cons	.1147859	1.023912	0.11	0.911	-1.921734	2.151306

Ref. table 4.5

. linktest

Source	SS	df	MS
Model	398.76715	2	199.383575
Residual	351.186338	83	4.2311607
Total	749.953488	85	8.82298222

Number of obs	86
F(2, 83)	47.12
Prob > F	0.0000
R-squared	0.5317
Adj R-squared	0.5204
Root MSE	2.057

Q6	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	.3257511	.3400982	0.96	0.341	-.3506904	1.002193
_hatsq	.1002251	.0480622	2.09	0.040	.0046313	.1958189
_cons	.6790776	.506871	1.34	0.184	-.3290684	1.687224

Ref. table 4.6

```
. linktest
```

Source	SS	df	MS	Number of obs =	86
				F(2, 83) =	25.93
Model	322.067647	2	161.033824	Prob > F =	0.0000
Residual	515.420725	83	6.20988825	R-squared =	0.3846
				Adj R-squared =	0.3697
Total	837.488372	85	9.85280438	Root MSE =	2.492

Q7	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	1.016846	.487992	2.08	0.040	.0462491	1.987442
_hatsq	-.0020409	.056678	-0.04	0.971	-.1147711	.1106893
_cons	-.0268159	1.009589	-0.03	0.979	-2.034848	1.981216

Ref. table 4.4

```
. ovtest

Ramsey RESET test using powers of the fitted values of Q5
       Ho:  model has no omitted variables
                  F(3, 65) =      0.89
                  Prob > F =      0.4516
```

Ref. table 4.5

```
. ovtest

Ramsey RESET test using powers of the fitted values of Q6
       Ho:  model has no omitted variables
                  F(3, 65) =      3.67
                  Prob > F =      0.0165
```

Ref. table 4.6

```
. ovtest

Ramsey RESET test using powers of the fitted values of Q7
       Ho:  model has no omitted variables
                  F(3, 65) =      0.41
                  Prob > F =      0.7484
```

Heteroskedasticity

Ref. table 4.4

```
White's test for Ho: homoskedasticity
         against Ha: unrestricted heteroskedasticity

         chi2(61)     =     46.04
         Prob > chi2  =    0.9225

Cameron & Trivedi's decomposition of IM-test
```

Source	chi2	df	p
Heteroskedasticity	46.04	61	0.9225
Skewness	18.09	17	0.3834
Kurtosis	2.36	1	0.1245
Total	66.49	79	0.8412

Ref. table 4.5

```
White's test for Ho: homoskedasticity
         against Ha: unrestricted heteroskedasticity

         chi2(61)     =     65.77
         Prob > chi2  =    0.3153

Cameron & Trivedi's decomposition of IM-test
```

Source	chi2	df	p
Heteroskedasticity	65.77	61	0.3153
Skewness	19.42	17	0.3051
Kurtosis	0.47	1	0.4949
Total	85.65	79	0.2851

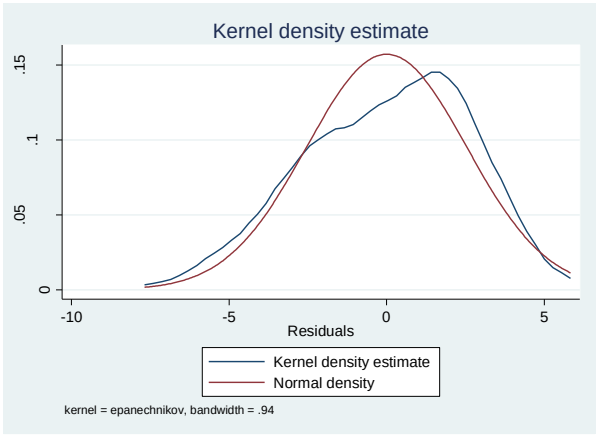
Ref. table 4.6

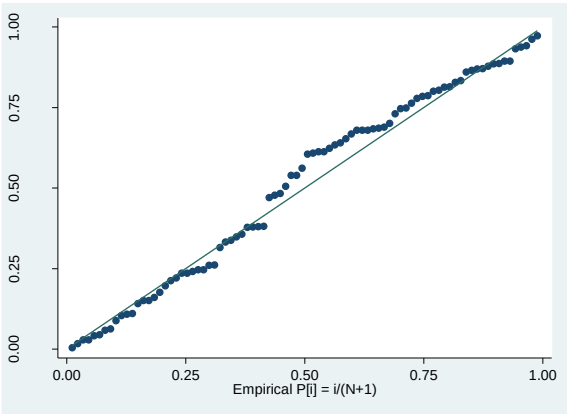
```
White's test for Ho: homoskedasticity
         against Ha: unrestricted heteroskedasticity

         chi2(61)     =     42.67
         Prob > chi2  =    0.9641

Cameron & Trivedi's decomposition of IM-test
```

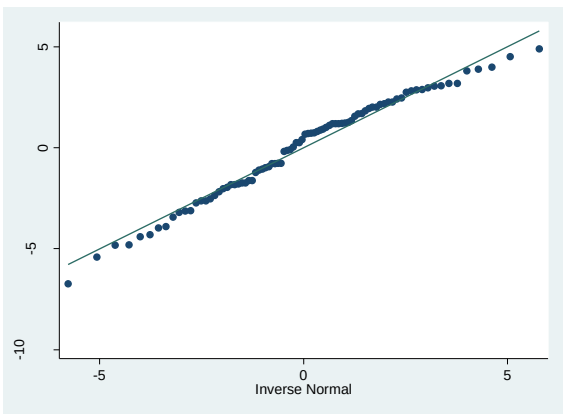
Source	chi2	df	p
Heteroskedasticity	42.67	61	0.9641
Skewness	21.98	17	0.1856
Kurtosis	0.01	1	0.9235
Total	64.66	79	0.8778

Normality of the residuals

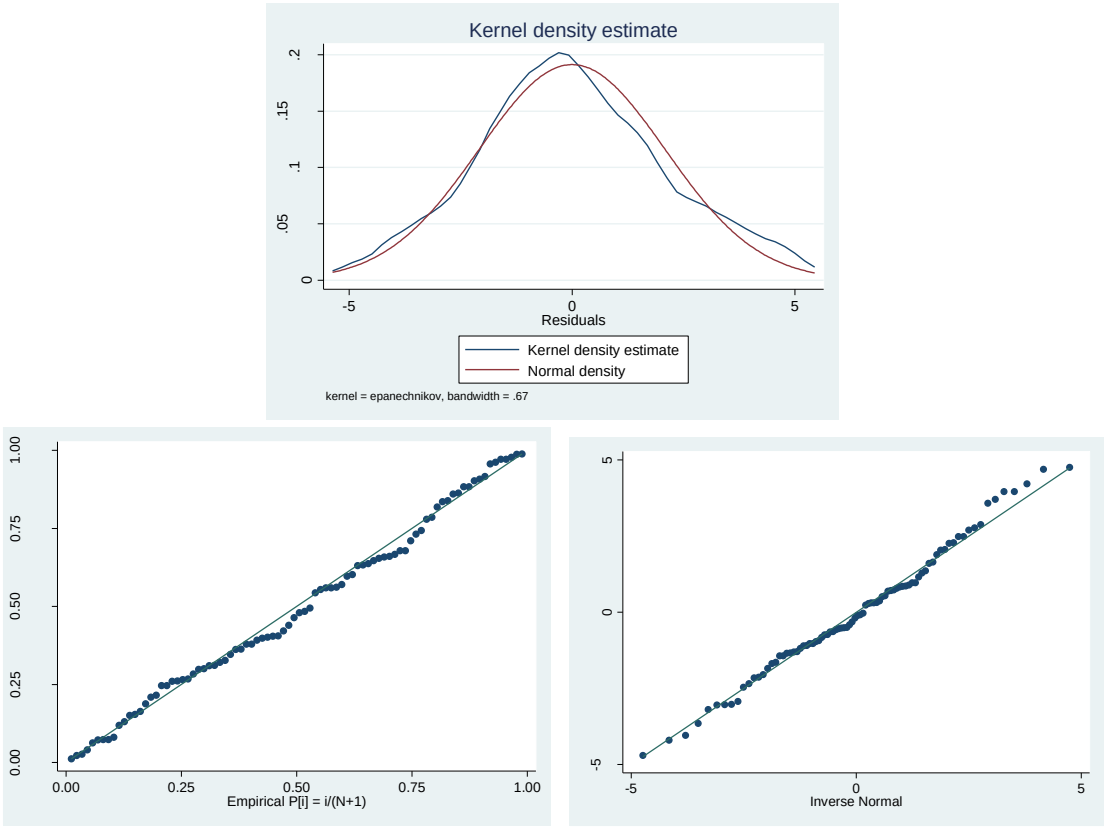
Ref. table 4.4



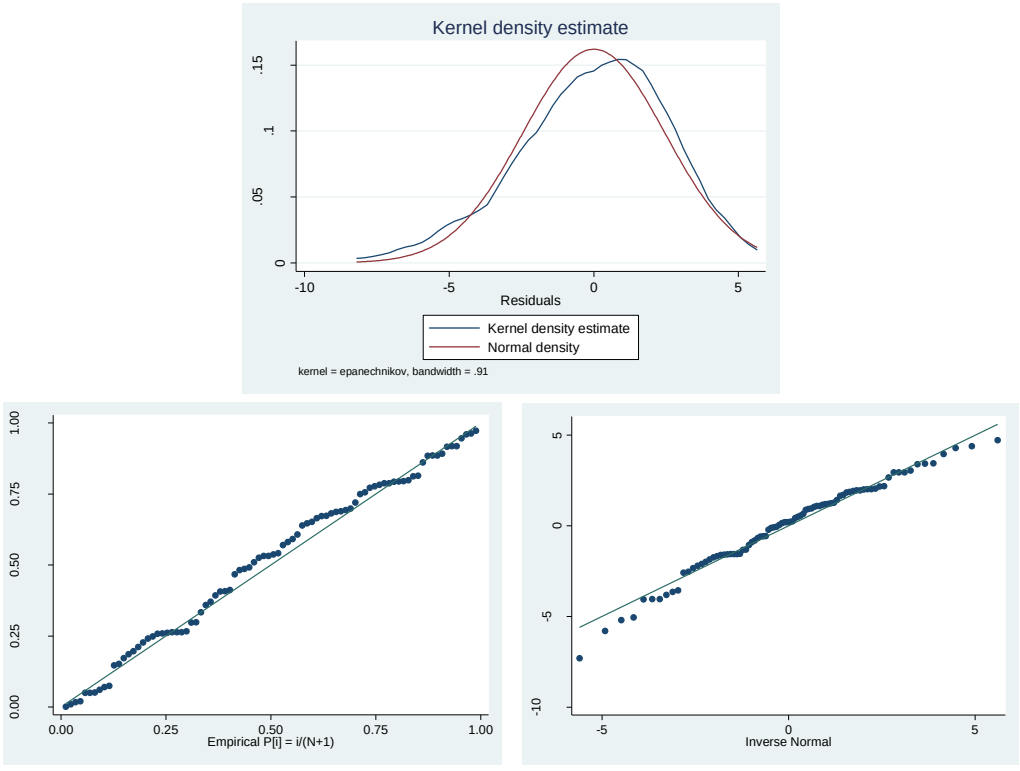




Ref. table 4.5



Ref. table 4.6



Multicollinearity

Ref. table 4.4

```
. vif
```

Variable	VIF	1/VIF
B_indust	3.00	0.332942
B_olje	2.35	0.426311
B_ship	1.84	0.544260
B_fisk	1.66	0.603149
B_forbruk	1.60	0.624591
B_ITkommed	1.51	0.662220
B_bygganei	1.47	0.678167
B_aneregy	1.43	0.698100
B_kap	1.40	0.715516
B_trans	1.36	0.733659
hyp7_eiegjld	1.35	0.741728
kjen_bors	1.35	0.742053
ant_kunfin	1.32	0.757845
hyp7_innt	1.30	0.769092
B_forsyn	1.28	0.783911
ant_kunop	1.21	0.828039
omsetn_100m	1.13	0.887318
Mean VIF	1.56	

Ref. table 4.5

```
. vif
```

Variable	VIF	1/VIF
B_indust	3.00	0.332942
B_olje	2.35	0.426311
B_ship	1.84	0.544260
B_fisk	1.66	0.603149
B_forbruk	1.60	0.624591
B_ITkommed	1.51	0.662220
B_bygganei	1.47	0.678167
B_aneregy	1.43	0.698100
B_kap	1.40	0.715516
B_trans	1.36	0.733659
hyp7_eiegjld	1.35	0.741728
kjen_bors	1.35	0.742053
ant_kunfin	1.32	0.757845
hyp7_innt	1.30	0.769092
B_forsyn	1.28	0.783911
ant_kunop	1.21	0.828039
omsetn_100m	1.13	0.887318
Mean VIF	1.56	

Ref. table 4.6

```
. vif
```

Variable	VIF	1/VIF
B_indust	3.00	0.332942
B_olje	2.35	0.426311
B_ship	1.84	0.544260
B_fisk	1.66	0.603149
B_forbruk	1.60	0.624591
B_ITkommed	1.51	0.662220
B_bygganei	1.47	0.678167
B_aneregy	1.43	0.698100
B_kap	1.40	0.715516
B_trans	1.36	0.733659
hyp7_eiegjld	1.35	0.741728
kjen_bors	1.35	0.742053
ant_kunfin	1.32	0.757845
hyp7_innt	1.30	0.769092
B_forsyn	1.28	0.783911
ant_kunop	1.21	0.828039
omsetn_100m	1.13	0.887318
Mean VIF	1.56	

Hypothesis 7

Regression

Linear regression

Number of obs	123
F(14, 108)	0.64
Prob > F	0.8256
R-squared	0.1071
Root MSE	6.0e+07

Omsetning	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
ant_kunfin	9904688	1.25e+07	0.79	0.429	-1.48e+07	3.46e+07
Ant_begge	9527472	1.16e+07	0.82	0.414	-1.35e+07	3.26e+07
kjen_bors	3.34e+07	2.14e+07	1.56	0.121	-8986328	7.59e+07
B_olje	3.72e+07	4.10e+07	0.91	0.367	-4.41e+07	1.18e+08
B_aneregy	-2712282	5007947	-0.54	0.589	-1.26e+07	7214337
B_forsyn	-1.75e+07	1.72e+07	-1.02	0.310	-5.16e+07	1.66e+07
B_ship	-1.30e+07	1.51e+07	-0.87	0.389	-4.29e+07	1.68e+07
B_indust	-1199492	8027688	-0.15	0.882	-1.71e+07	1.47e+07
B_fisk	-1.58e+07	1.31e+07	-1.21	0.229	-4.17e+07	1.01e+07
B_forbruk	6912780	8430360	0.82	0.414	-9797656	2.36e+07
B_kap	8615953	5765526	1.49	0.138	-2812320	2.00e+07
B_ITkommed	1148303	6166945	0.19	0.853	-1.11e+07	1.34e+07
B_bygganei	-7671905	8687815	-0.88	0.379	-2.49e+07	9548852
B_trans	4047776	3689461	1.10	0.275	-3265375	1.14e+07
_cons	-6917065	1.08e+07	-0.64	0.523	-2.83e+07	1.45e+07

Model specification

. linktest

Source	SS	df	MS
Model	8.3727e+16	2	4.1864e+16
Residual	3.5809e+17	120	2.9841e+15
Total	4.4182e+17	122	3.6215e+15

Number of obs	123
F(2, 120)	14.03
Prob > F	0.0000
R-squared	0.1895
Adj R-squared	0.1760
Root MSE	5.5e+07

Omsetning	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	-.70505	.5490462	-1.28	0.202	-1.792123	.3820234
_hatsq	3.50e-08	1.00e-08	3.49	0.001	1.52e-08	5.49e-08
_cons	2037823	5818015	0.35	0.727	-9481442	1.36e+07

. ovtest

Ramsey RESET test using powers of the fitted values of Omsetning
Ho: model has no omitted variables
F(3, 105) = 5.52
Prob > F = 0.0015

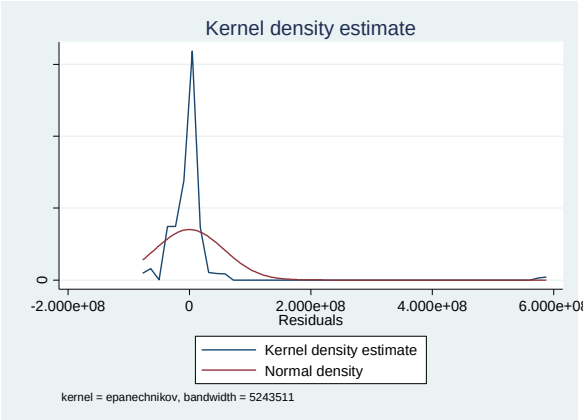
. estat imtest, white

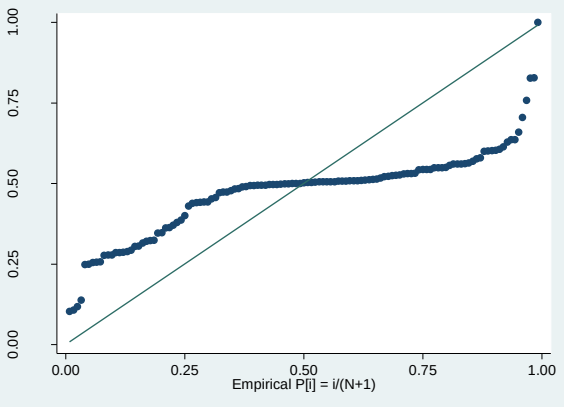
Heteroskedasticity

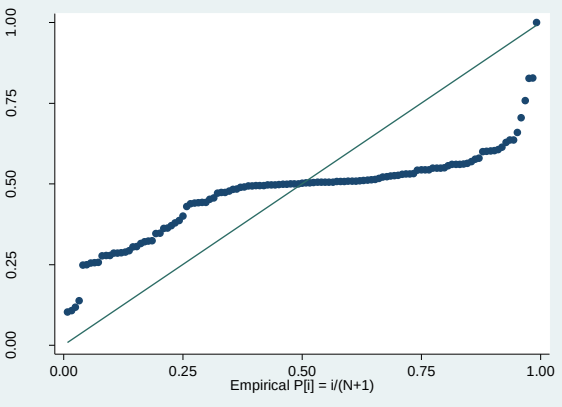
```
White's test for Ho: homoskedasticity
         against Ha: unrestricted heteroskedasticity

         chi2(40)     =     32.49
         Prob > chi2  =    0.7946

Cameron & Trivedi's decomposition of IM-test
```

Source	chi2	df	p
Heteroskedasticity	32.49	40	0.7946
Skewness	.	14	.
Kurtosis	.	1	.
Total	.	55	.

Normality of the residuals







Multicollinearity

```
. vif
```

Variable	VIF	1/VIF
B_indust	2.68	0.373061
ant_kunfin	2.33	0.429515
Ant_begge	2.16	0.463066
B_olje	1.85	0.539457
B_aneregy	1.76	0.566625
B_bygganei	1.56	0.639745
B_ship	1.52	0.656898
B_fisk	1.50	0.666412
B_ITkommed	1.41	0.710451
B_kap	1.40	0.716358
B_forbruk	1.37	0.732232
B_trans	1.30	0.767180
kjen_bors	1.21	0.827314
B_forsyn	1.16	0.861916
Mean VIF	1.66	

Hypothesis 8

Regression

Linear regression

Number of obs	123
F(12, 110)	15.63
Prob > F	0.0000
R-squared	0.4509
Root MSE	.7954

fin	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
B_olje	-.3606391	.1956182	-1.84	0.068	-.7483083	.0270302
B_aneregy	.0459614	.3111331	0.15	0.883	-.5706314	.6625542
B_ship	1.42619	.2961284	4.82	0.000	.8393333	2.013047
B_fisk	.2718907	.3306005	0.82	0.413	-.3832819	.9270633
kjen_bors	.0288714	.1857093	0.16	0.877	-.3391608	.3969036
omsetn_100m	-.00013	.0001131	-1.15	0.253	-.0003542	.0000941
ant_kunfin	1.214344	.230813	5.26	0.000	.7569269	1.671761
Ant_begge	1.45458	.187098	7.77	0.000	1.083796	1.825365
euro	-.096531	.2553011	-0.38	0.706	-.6024779	.4094159
dollar	.1056769	.2770899	0.38	0.704	-.4434503	.6548041
pund	-.2553733	.2788027	-0.92	0.362	-.8078948	.2971482
nordisk	-.0560436	.3148815	-0.18	0.859	-.6800649	.5679776
_cons	.2870547	.2759458	1.04	0.301	-.2598051	.8339144

Model specification

```
. linktest
```

Source	SS	df	MS
Model	57.1717924	2	28.5858962
Residual	69.5761751	120	.579801459
Total	126.747967	122	1.03891777

Number of obs	123
F(2, 120)	49.30
Prob > F	0.0000
R-squared	0.4511
Adj R-squared	0.4419
Root MSE	.76145

fin	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	.963091	.2438844	3.95	0.000	.480217	1.445965
_hatsq	.0134148	.0807293	0.17	0.868	-.1464236	.1732532
_cons	.0189328	.2016028	0.09	0.925	-.3802267	.4180922

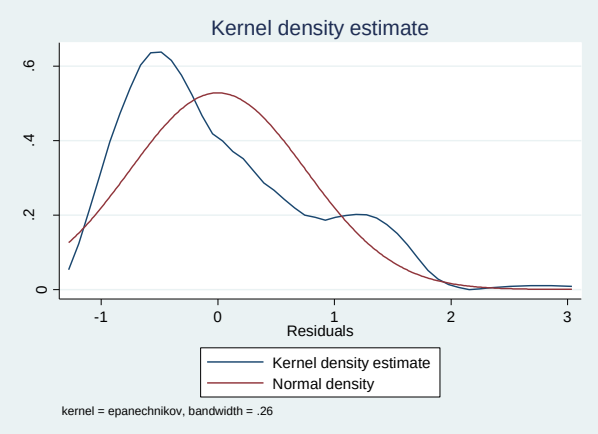
```
. ovtest

Ramsey RESET test using powers of the fitted values of fin
       Ho:  model has no omitted variables
                 F(3, 107) =      0.23
                  Prob > F =      0.8720
```

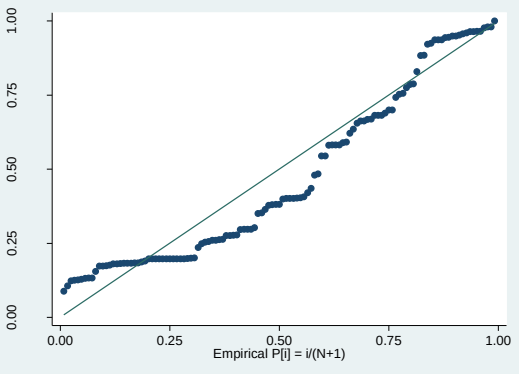
Heteroskedasticity

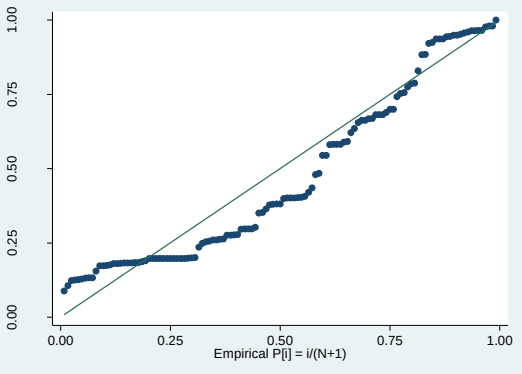
```
. estat imtest, white

White's test for Ho: homoskedasticity
        against Ha: unrestricted heteroskedasticity

        chi2(50)     =    31.78
        Prob > chi2  =    0.9792

Cameron & Trivedi's decomposition of IM-test
```

Source	chi2	df	p
Heteroskedasticity	31.78	50	0.9792
Skewness	18.35	12	0.1055
Kurtosis	0.12	1	0.7341
Total	50.25	63	0.8776

Normality of the residuals







Multicollinearity

```
. vif
```

Variable	VIF	1/VIF
euro	3.59	0.278673
dollar	3.28	0.304497
nordisk	2.49	0.401991
ant_kunfin	2.38	0.421006
Ant_begge	2.06	0.485026
pund	1.62	0.615501
B_olje	1.39	0.720276
B_aneregy	1.27	0.790497
kjen_bors	1.24	0.803358
omsetn_100m	1.15	0.870083
B_fisk	1.13	0.881280
B_ship	1.10	0.906588
Mean VIF	1.89	