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Abstract

The purpose of the dissertation has been to look at how the hikes in interest rates have affected the most traded companies on the Oslo Stock Exchange (OBX). This has been done in a purely quantitative manner through manual data collection from financial reports. The findings indicate that the companies have experienced a substantial increase in the cost of debt in 2022.There were reactive attempts to mitigate the consequences of the rate hikes in the short-term. Those were on average not very effective. At the same time most of the companies fared better than expected they compared to interest rate risk analysis. There have been some indications of attempts at reducing the long-term effects of the rate hikes. This has mostly been through risk mitigation and attempts at hedging against further rate hikes. Very few have bet on rate cuts as an attempt at long-term action against rate hikes, indicating that many expect the rates to remain high in the foreseeable future.

Acknowledgements

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Contents

Figures and Tables

Abbreviations

CAPM - Capital Asset Pricing Model

CC-ratio – Cash to Capital Ratio

D/C-ratio – Debt to Capital Ratio

EBIT – Earnings Before Interest and Taxes

ESTR – Euro Short-Term Rate

EUR – Euro

EURIBOR – Euro Interbank Offered Rate

FED – Federal Reserve

GBP – Great British Pound

IBA – Intercontinental Exchange Benchmark Administration

IBOR – Interbank Offered Rate

ICR – Interest Covering Ratio

IE – Interest expense

IFRS – International Financial Reporting Standards

INICR – Inverted Net Interest Covering Ratio

IPO – Initial Public Offering

IQR – Interquartile Range

IRS – Interest Rate Swaps

LIBOR – London Interbank Offered Rate

NIBOR – Norwegian Interbank Offered Rate

NIE – Net Interest Expense

OBX – Oslo Stock Exchange

OCI – Other Comprehensive Income

SOFR – Secured Overnight Financing Rate

STIBOR – Stockholm Interbank Offered Rate

USD – United States Dollar

YoY – Year-on-Year

WACC – Weighted Average Cost of Capital

OECD – Organization for Economic Cooperation and Development

1. Introduction

Since the pandemic shocked the financial world in early 2020 there has happened a lot in the credit markets. A galloping inflation that spread from primarily the US to the rest of the world, and the subsequent hikes in the policy rates. The astonishing speed at which rates have been hiked has not been seen since The Great Inflation when Volcker drove the US economy to the brink in order to tame inflation.

Figure 1: US Treasury yields, from: https://amers2.datastream.cp.thomsonreuters.com/dscharting/ChartPreview.aspx?previewMode=print&print=true&&cssstyle=NOVA

The hikes in policy rates have led to massive losses in the stock markets, which is expected. Higher policy rates means higher interest expenses for most companies, as well as future earnings which are worth less as the discount rate increases. This prompts the research question for this dissertation:

"How did companies act to elevated interest rates in 2022, and what was the effect on their cost of debt compared to their own risk analysis?"

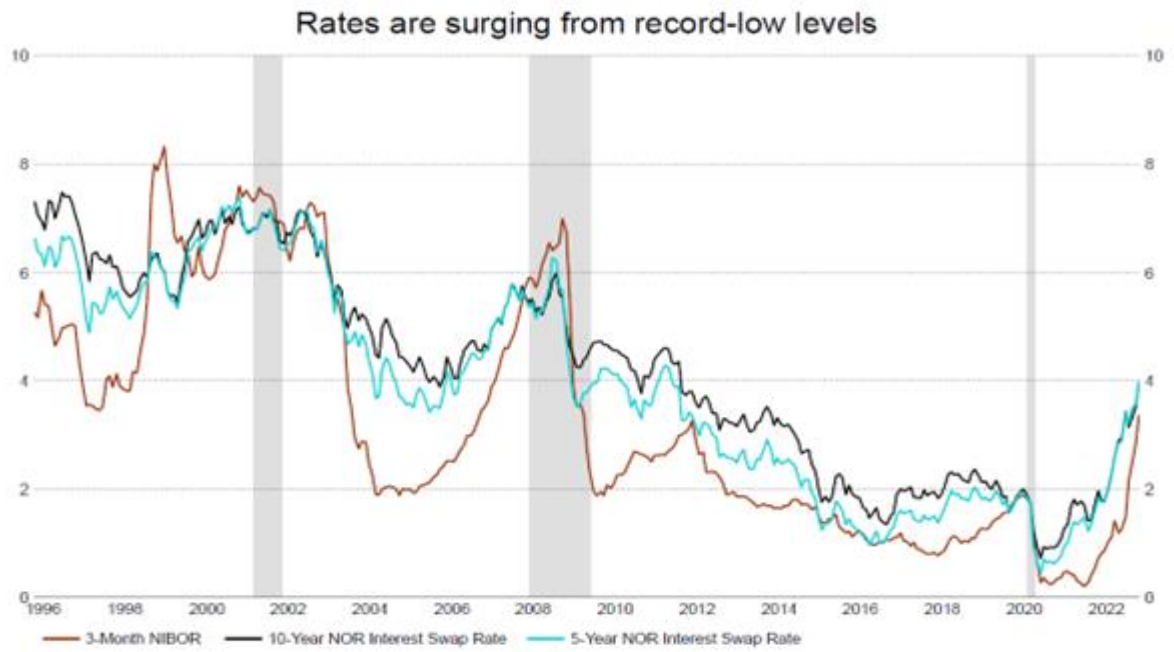

Figure 2: Short, medium and long-dated NIBOR-rates, from: https://emea1.datastream.cp.thomsonreuters.com/dscharting/ChartPreview.aspx?previewMode=print&print=true&&cssstyle=NOVA

The methodology used to answer the research question has been from a strictly quantitative research design, with data gathered from publicly traded companies on the OBX. From those data there will be extracted statistical parameters to try and explain the behavior of the companies, and how the rate hikes affect the analyzed companies.

Figure 3: EURO Swap Rates, from: *https://amers2.datastream.cp.thomsonreuters.com/dscharting/ChartPreview.aspx?previewMode=print&print=true&&cssstyle=NOVA*

The first chapter of the dissertation is meant to give a comprehensive review of relevant literature. The second chapter will explain the methodology behind how the research question has been attempted answered, along with an explanation of the limitations of the dissertation. Thereafter, the two following chapters will present the results and discuss them in detail, along with a brief proposition of relevant future research. Lastly follows a conclusion and summarization of the dissertation.

2. Theory

2.1. Capital Structure

2.1.1. Cost of Capital

Cost of capital is a financial concept that covers the cost of financing the operations and investments of a firm or a corporation. This is important both to investors and managers alike, as it helps to determine which projects and investments are worth it and which ones are not. This can be based on the expected return of said capital.

There are two main components associated with the cost of capital. Those are debt and equity. Debt is usually the least expensive of the two. Inflation helps kill the value of the debt, and the interest payments are tax-deductible. Lastly, in the event of a bankruptcy the lenders will have priority over equity holders (Brigham & Ehrhardt, 2020). Equity represents ownership in the company, and has higher risk associated with it. With the increased risk it also has a higher expected rate of return.

The cost of debt can be calculated rather straightforwardly by taking the interest rate on a company's debt and adjusting it for the tax benefit. This can be shown in the following formula (Ross et al., 2019):

$$Cost\ of\ debt\ =\ interest\ rate\ on\ debt\ *\ (1\ -\ tax\ rate)$$

The cost of equity can be found by using the capital asset pricing model (CAPM). CAPM uses three factors as input: the beta of the stock associated with the company, the expected return from the market, and the risk-free rate of return (Damodaran, 2016). The formula is as follows:

$$Cost\ of\ equity\ =\ risk-free\ rate\ +\ beta\ *\ (expected\ market\ return\ -\ risk-free\ rate)$$

Weighted average cost of capital (WACC) will consider cost associated with equity and debt. This is done in a weighted manner according to the company's capital structure (Brealey et al., 2017). The formula for WACC uses the results from the formulas of both cost of debt and equity and is as follows:

$$WACC\ =\ (cost\ of\ equity\ *\ proportion\ of\ equity)+\ (cost\ of\ debt\ *\ proportion\ of\ debt)$$

The cost of capital can and will be affected by external factors. For instance, elevated interest rates will make equity more desirable than debt (Ross et al., 2019). Therefore, one can say that the cost of capital is an important consideration when firms plan and make their decisions when it comes to investments.

2.1.2. Credit Ratings

Credit ratings are an assessment of a company's creditworthiness, and in extension its ability to handle and repay debt. Rating agencies, mainly Moody's, Standard and Poor's and Fitch Group, will analyze the financial health of a company. Said rating companies are responsible for nearly every rating issued (Bris et al., 2018). From this they will assign a rating to the associated debt securities. The rating given will be used as a measure of the risk one can expect when investing in said company. The interest rate paid on debt, in any form. will be heavily influenced by the credit rating.

According to Löffler et al. (2017), credit ratings are important for firms because they influence the cost and availability of capital for a company at any given time. A high credit rating indicates a low risk of default, and in extension this will lower the cost of borrowing capital. This can make it both easier and cheaper for a firm to raise capital and finance their operations and investments. On the other hand, a low credit rating indicates a higher risk of default. This will lead to higher costs when borrowing capital. In a worst-case scenario, a low credit rating can result in inability to both borrow and raise capital.

The three major players in the credit rating scene all use different scales, although they are all somewhat comparable. AAA is generally considered the highest rating, and the lowest risk investment. D sits at the other end of the scale and is the lowest rating that can be given. A rating of BBB- or higher is considered investment grade, while anything below is considered as speculative or in some cases "junk"-status.

Not only is the credit rating important when it comes to the cost of raising capital, but also when it comes to a company's reputation. A high credit rating can signal financial stability and an ability to meet obligations to everyone from investors to customers (De Jong, Driessen, and Verbeek, 2017). Therefore, a high credit rating can be helpful to build trust and confidence in a company, which in turn could lead to better opportunities and increased growth.

2.1.3. Credit Spread

Credit spread, commonly known as yield- or bond spread, is a key concept in finance. Particularly so when talking about fixed-income markets. The yield refers to the divergence between yields in two debt securities. They also need to have similar maturities and different credit quality (Hull, 2018). Generally, the credit spread reflects the additional risk premium an investor demands for holding a bond with a lower credit rating compared to a safer, higher-rated bond (Fabozzi, 2017).

Fabozzi (2017) posits that credit spread is determined by factors such as the creditworthiness of the issuer, economic conditions, and supply and demand for the underlying securities. During times of economic uncertainty credit spreads usually widen. This likely happens as a result of investors becoming more risk-averse and seeking safer, lower return, and higher rated bonds (Gupta et al., 2019). Conversely, credit spreads may narrow when market sentiment improves, and investors regain confidence in riskier assets.

One common way to measure credit spread is by comparing the yield of a corporate bond to a government bond with a similar maturity (Chen et al., 2010). As an example, in the United States, the yield on a 10-year corporate bond might be compared to the yield on a 10-year Treasury note. The difference between the two yields represents the additional return that investors require for bearing the credit risk associated with the corporate bond (Hull, 2018).

Empirical studies have shown that credit spreads are important indicators of credit risk and are closely related to macroeconomic variables and financial market conditions (Gupta et al., 2019). Longstaff et al. (2005) found that credit spreads are highly sensitive to changes in

interest rates, inflation, and the overall state of the economy. As a result, they argued that credit spreads can serve as early warning signals for potential financial crises.

2.1.4. Equity Rates

Equity rates, or commonly known as equity returns, are a metric used to evaluate the performance of equity investments, such as a share a company or a variable rate bond. According to Bodie et al. (2020), the equity rate of return is the percentage increase in the value of an investment over a given period. This is most often expressed as an annualized percentage.

Both internal and external factors can influence the equity rate associated with a company. The performance of the company itself is of course a major factor. This is confirmed by Malkiel and Ellis (2020), as they state that the performance of a company is a key driver of equity rates. This is justified by stating that a company performing well is likely to experience an increase in its' stock price and consequently giving a higher rate of return on equity. At the same time other, external factors, such as investor sentiment or even the state of the economy as a whole.

According to Shiller (2015), investor sentiment can be influenced by a number of factors. Most notably among them are news events, economic indicators, and market trends. When investors are optimistic about the prospects of a company or the stock market, equity rates usually increase. Conversely when investors are pessimistic, equity rates may decrease.

Equity rates are inherently riskier than fixed-income investments, such as fixed rate bonds, because there is no guarantee of returns. However, from a historical point of view equity investments have outperformed the lower risk fixed rate investments.

2.1.5. Debt

2.1.5.1. Bank Loan

Bank loans are one of three major ways for firms and corporations to raise capital. Brigham and Erhardt (2020) states that a bank loan is a contract between the creditor, in the case of a bank loan this is the bank, and a debtor, the firm or corporations that is raising capital. This contract will have a principal amount, an interest rate, and a repayment schedule. This way of raising capital is a reliable way to secure financing and is also helpful in that it helps to establish a good credit history. In turn this can make it easier to obtain financing, both in the form of a bank loan and other, in the future.

There are, however, potential drawbacks to using bank loans to raise the needed capital. The interest rate payments can be high, as noted by Dey and Banerjee (2015), and companies can be forced to provide collateral or some form of guarantee to secure the loan. This is not necessarily the case in other ways of raising capital. Furthermore, there are limitations to the amount of financing a firm or corporation can receive from a bank. This can make it hard to finance larger investments in bank loans alone.

Bank loans come in two main forms: either a secured or an unsecured loan. As mentioned above, a secured loan is a loan where the debtor has to provide some kind of guarantee, or collateral, which in a case of default the creditor can claim. In contrast, an unsecured loan is a loan issued based on the credit history and creditworthiness of the debtor (Federal Reserve Bank of San Francisco, n.d.). Another type can be a term loan which has fixed repayment schedules and interest rates. Lastly one could also use a revolving line of credit, which allows the debtor to draw funds from the bank up until a predetermined limit (Berk & DeMarzo, 2017).

The typical process of acquiring a bank loan includes an application, a credit assessment, and the decision. The credit assessment is usually based on the debtor's credit history, as mentioned earlier. Furthermore, financial statements and other relevant information might influence the decision of the application. Whether a loan is granted or not is a result of quite a few factors. These might include, but are not limited to, the debtor's ability to repay, the purpose of the loan, and the creditors’ tolerance for risk (Crouhy et al., 2006).

Bank loans play a vital role in the financial system by facilitating the allocation of funds from savers to borrowers. The reason why this is important is that it can enable economic growth and development (Mishkin, 2016). There are potential risks and drawbacks associated with this as well, and in worst case systemic risk. The prime example would be the subprime mortgage crisis of 2007-2008 (Kroszner & Strahan, 2011).

2.1.5.2. Bonds

Bonds are another way of raising capital. They are debt securities that represent a loan issued by an investor to a borrower. In contrast to the case of bank loans, governments are often the debtor of this kind of security. Furthermore, this is also a major way of funding for corporations. The debtor promises to pay the creditor an interest rate at a regular, predetermined, rate. This can be anything from daily to annually. The contract will also include a maturity date — which is a predetermined date for when the entirety of the loan will be repaid to the creditor (Fabozzi, 2017). Bonds are considered an investment with less associated risk than, for instance stocks. This is especially true for fixed-rate bonds, partly because they are more senior. Thus, putting a holder of fixed bond ahead in the queue to get the money back in the event of a default. (Bodie et al, 2020).

Coupon rate is the name of the interest rate paid on the bond. This is set at the time of issuance. In the case of a fixed-rate bond the coupon rate will remain the same until it matures (Hull, 2018). In contrast, a floating bond will pay a variable interest rate plus a fixed element. The most common way is that the debtor agrees to pay a benchmark rate, often in the form of an interbank offered rate, plus a premium to compensate the creditor. This premium will vary depending on a lot of factors, of which the credit rating is the most important one.

There are several different types of bonds. These include government bonds, corporate bonds, and municipal bonds. Government bonds are issued by national governments and are generally considered the safest type of bond. There are some exceptions. This is primarily the case when a company has a higher credit rating than a country. Although this is rare it does happen. According to Wikipedia the state of Belarus has a credit rating of CCC, whereas Johnson & Johnson has AAA. One can generally say that government bonds are the safest, as they are backed by the full faith and credit of the government (Fabozzi, 2017). This is because

most companies have a lower credit rating and creditworthiness than a country. Furthermore, the creditworthiness of companies can vary greatly (Bodie et al., 2020). Municipal bonds are issued by local governments. They are often used to fund public projects such as schools and highways (Hull, 2018).

2.1.5.3. Share Issuance

Share issuance is considered as the third major way of raising capital. When a company issues new shares it sells ownership of the company to investors. This is the only way to raise capital without acquiring more debt. This way of raising capital dilutes the ownership of existing investors. Often this will create an abundance of shares and in extension have a negative effect on the stock. It could also be a sign of a company struggling to get funding through other means. Because of this large-scale share issuance will often scare away investors.

According to Ross et al. (2019), there are two main types of share issuance: primary offerings and secondary offerings. Primary offerings, or an initial public offering (IPO), are used by start-ups to acquire seed funding through venture capital or angel investors. Although angel investors can be acquired through an IPO, they are in many cases a prerequisite for a company to attempt to be publicly listed. Secondary offerings, however, occur when a company issues additional shares to the public after its IPO. According to Brealey et al. (2017), more established firms may issue shares to the public or engage in private placements to raise capital. The choice of financing method will depend on factors such as the company's size, growth prospects, and the availability of capital in the market.

2.1.6. Debt-to-capital Ratio

The debt-to-capital ratio is an important financial metric that gauges a company's financial leverage by comparing its total debt to total capital (Equity plus Debt) (Ross et al., 2019). This ratio is utilized by investors, analysts, and financial institutions to evaluate a company's financial stability, risk profile, and its capacity to fulfill its debt obligations (Brigham & Erhardt, 2020).

The debt-to-capital ratio can be calculated using the following formula:

$$Debt - to - Capital\ Ratio\ = Total\ Debt\ /\ (Total\ Debt\ +\ Total\ Equity)$$

Total Debt includes both short- and long-term debt obligations. Total Equity refers to shareholders' equity. This includes common and preferred stock, retained earnings, and additional paid-in capital. The debt-to-capital ratio serves as an indicator of a company's capital structure and its reliance on debt. A high ratio signifies a high degree of financial leverage. This might increase the risk of insolvency and bankruptcy, particularly during economic downturns (Frank & Goyal, 2009). Although the optimal debt-to-capital ratio varies across sectors of industries, investors and analysts often compare the ratio of a specific company with industry benchmarks or peer companies to determine its relative risk profile (Modigliani & Miller, 1958).

2.1.7. Interest Coverage Ratio

The interest coverage ratio (ICR) is a financial metric that quantifies a company's ability to fulfill its interest payments on outstanding debt. It is commonly used by investors, creditors, and analysts to evaluate a firm's creditworthiness and financial stability (Ross et al., 2019). The ICR is calculated by dividing a company's EBIT by its interest expenses (IE) incurred within a specified period (typically one year) (Wahlen, Baginski, & Bradshaw, 2020).

$$Interest\ Coverage\ Ratio\ = EBIT\ /\ IE$$

A higher ICR suggests a greater capacity to meet interest obligations, implying lower credit risk and stronger financial health (Brigham & Ehrhardt, 2020). Conversely, a lower ICR may indicate a company's struggle to cover its IE, which could lead to potential solvency issues (Parrino et al., 2020). As an example, an ICR below 3 is considered a red flag.

It is essential to consider the ICR in the context of the specific industry, as certain sectors may have inherently higher or lower ratios due to their unique financial dynamics (Palepu et al., 2021). In addition, the ICR should be used alongside other financial metrics such as debt-to-

equity ratio, current ratio, and quick ratio to obtain a comprehensive assessment of a company's financial health (Groppelli & Nikbakht, 2021).

2.1.8. Interest Rate Swaps

Interest rate swaps (IRS) are financial derivative instruments that allow two parties to exchange interest rate payments on a principal amount. This is known as the notional principle, and happens over a predetermined period (Hull, 2018). IRS are widely used by financial institutions, corporations, and investors to manage their risk regarding interest rates. The primary use is as a hedge against fluctuations in interest rates and speculate on the movement of future interest rate movements (Kolb & Overdahl, 2003).

After an IRS agreement has been made, the two parties exchange cash flows based on different interest rates. One party pays the fixed interest rate. The other pays the floating interest rate side. These rates are usually tied to a reference rate in the form of either one of the IBORs or the SOFR (Choudhry, 2004).

IRS can be classified into various types, such as plain vanilla swaps, basis swaps, and cross-currency interest rate swaps, depending on the structure and underlying reference rates. A plain vanilla swap is the most common type, involving the exchange of a fixed interest rate for a floating interest rate (Hull, 2018). Basis swaps entail the exchange of two floating interest rates, typically based on different reference rates or maturities (Choudhry, 2004). Cross-currency interest rate swaps involve the exchange of interest payments in two different currencies, allowing parties to manage both interest rate and currency risk simultaneously (Pilbeam, 2018).

The valuation of interest rate swaps relies on the concept of discounting future cash flows. The present value of the swap is determined by discounting expected future cash flows at an appropriate discount rate. This is often derived from zero-coupon yield curves (Hull, 2018).

2.1.9. Modigliani-Miller Theorem

The Modigliani-Miller (Modigliani & Miller, 1958) theorem is a theory within finance that states that if taxes and transaction costs are removed from the equation then the value of a firm is independent of its capital structure. The proposition suggests that the determination of the value of the firm is solely based on its ability to create earnings. Consequently, the theory implies that the way the earnings are financed is irrelevant. Furthermore, the theorem states that the current value of a firm is determined by its expected earnings. The way in which those earnings are divided between equity and debt is more or less irrelevant when it comes to valuation. It is important to note that there are several major assumptions set for the theorem. The two more prevalent ones at the absence of taxes, and the availability of a perfect capital market.

The theorem does take into account the existence of financial risk. It states that increased debt financing will come with an increased financial risk, but with the advantage of a lower associated cost of capital than if equity were to be used. Although the theorem argues that this does not change the overall valuation of the firm as the increased financial risk is offset by the lower cost of the capital. This trade-off is also known as the “debt-equity trade-off”.

As the theorem is over 60 years old it has been subject to both empirical testing and debate. There have been studies conducted since that both support and conflicts the findings of the study. Even though the theorem is a source of debate it is to this day still an important financial theorem.

2.2. Interest Rates

2.2.1. Interbank Offered Rate

Interbank offered rates (IBORs) are benchmark interest rates used as a reference for a variety of financial transactions, including loans, bonds, and derivatives. They are calculated based on the average interest rates that banks are willing to lend to one another on the interbank market. The rates are published daily by a designated administrator, such as the ICE Benchmark Administration (IBA), and are widely recognized and accepted as a standardized reference rate.

The most used IBOR is the London Interbank Offered Rate, which is calculated by the IBA based on the submissions of a panel of 16 banks representing five currencies and seven maturities. The IBA calculates the rate by taking the trimmed arithmetic mean of the submissions, which removes the highest and lowest submissions to prevent manipulation (Clare et al., 2019).

Concerns were raised about the reliability of IBORs in the wake of the LIBOR scandal. In 2012, several banks were found to have manipulated the LIBOR rate for their own gain. This led to investigations and fines (Choudhry, 2019). The result of the investigation were efforts to transition to alternative benchmark rates, such as the Secured Overnight Financing Rate (SOFR) in the United States and the Euro Short-Term Rate (ESTR) in Europe.

SOFR is calculated based on transactions in the overnight Treasury repurchase agreement (repo) market, which provides a robust source of data (Federal Reserve Bank of New York, 2021). ESTR is calculated based on the transactions in the unsecured overnight market in the euro area, with the rate being published by the European Central Bank.

The transition away from LIBOR to alternative benchmark rates is a complex and challenging process, particularly given the widespread use of LIBOR in financial contracts and products. However, the Financial Stability Oversight Council in the US has identified the transition as a top priority, and the Alternative Reference Rates Committee has been established to facilitate the transition.

2.2.2. Policy Rate

Policy rates refer to the rates at which central banks lend money to commercial banks. The policy rate is arguably the most important tool that central banks have in their arsenal to attempt to influence the economy. When a central bank changes its policy rate it will likely affect the cost of borrowing and lending for commercial banks. Ultimately this change will reach customers and therefore impact economic growth and inflation.

The basic idea behind the use of policy rates is according to Gali (2015) to implicitly influence the interest rate which people and corporations must pay to borrow money. The extension of this will also be the gain associated with lending money. Therefore, by changing the policy rates the central banks can attempt to affect the short interest rate and by its extension also somewhat control the economic activity and inflation.

There was a study by Kishor, K. R., and Ramakumar, R. (2020) that found a link between policy rates and a country's exchange rate. The conclusion of the study was that there exists a positive correlation between the policy rate and the strength of the domestic currency. Whereas an increase in the policy rate would strengthen the domestic currency and vice versa. This can be seen in combination with a study conducted by Forbes and Chinn (2010). This study found that currencies tied to fixed exchange rate regimes were more volatile towards changes in exchange rates. The effect of policy rates on economies with floating rate regimes was in extension less affected by changes in policy rates.

2.2.3. Long Rates

Long rates, or long-term interest rates, are the interest rates on financial instruments that have a maturity of more than one year. These instruments are often either loans or bonds. The valuation and price of these rates are determined from the expectations of the market. The expectations are usually influenced by the economic outlook regarding inflation, growth and the demand for credit. One could argue that long rates reflect the market's expectation of what the economy will look like in the future.

According to the expectations hypothesis, the relation between the long and short interest rates is somewhat predictable. The hypothesis postulates that if there is a consensus that the policy rates will be hiked, then then long-term rate should be higher than the short term. If the situation is reversed, however, then the opposite is expected to happen. Explicitly, if there is an expectation of a lowering of the policy rates, then the short-term rate should be higher than the long-term equivalent (Mishkin, 2018).

Research has shown that long rates are an important indicator of economic activity. A study by Durland and McCurdy (1994) found that long rates are an important determinant of business cycles in the United States. Another study by Ang and Piazzesi (2003) showed that the slope of the yield curve, which reflects the difference between short and long rates, can predict future economic growth.

2.2.4. Short Rates

Short rates refer to the interest rate on short-term financial instruments. These are instruments that have up to one year until maturity. If maturity is further than one year away, it is a long-term financial instrument. Examples of short-term financial instruments are treasury bills, commercial paper and certificates of deposits. Short rates have a significant impact on the economy, and have a strong influence on monetary policy, and in extension on the economy in general.

According to Liu and Shiller (2004), short rates are a key indicator used by central banks to implement monetary policy. By adjusting short rates, central banks can influence borrowing costs and stimulate or slow down economic activity. For example, during an economic downturn, central banks may lower short rates to encourage borrowing and investment, which can stimulate economic growth.

As mentioned above under the section of long rates the expectation hypothesis, short rates are closely watched by investors and traders as they provide insights into market expectations for future interest rates and economic conditions. For instance, a sudden increase in short rates

may indicate that investors expect inflation to rise, prompting them to sell bonds and causing bond prices to fall.

Moreover, short rates are being used when pricing options and futures contracts. The pricing of these instruments is heavily influenced by expectations of future short rates, which can be highly volatile and unpredictable (Duffie & Singleton, 1993).

2.2.5. Yield Curve

Yield curves are a crucial component of financial markets and provide valuable insights into economic conditions and future expectations. Understanding and analyzing yield curves is essential for grasping the dynamics of interest rates, economic growth, and inflation expectations.

A yield curve is a graphical representation of interest rates across different maturities for a specific class of debt securities. The security in question is usually government bonds (Mishkin, 2019). The curve plots time to maturity on the x-axis and yield on the y-axis. The analyzed yield curve is that of U.S. Treasury securities (Gürkaynak & Wright, 2012).

Yield curves can take three shapes. It can be either flat, upward- or downward sloping. According to Estrella and Mishkin (1997), a normal yield curve is observed when longer-term interest rates are higher than shorter-term rates, reflecting a positive term premium. This premium compensates investors for the uncertainty and risks associated with holding bonds over a longer period. The economy is expected to grow, and inflation is anticipated to remain stable while this scenario remains true.

An inverted yield curve occurs when shorter-term interest rates are higher than longer-term rates, which is considered a harbinger of an economic downturn (Bauer & Mertens, 2018). This inversion is attributed to expectation of lower future interest rates from slowing economic growth or deflationary pressures. Therefore, investors may prefer to lock longer-term rates, driving up prices and lowering yields.

A flat yield curve, on the other hand, indicates that interest rates are relatively uniform across maturities, reflecting a period of economic uncertainty or transition (Chinn & Kucko, 2010). This shape may occur when the market is anticipating a shift in monetary policy or when investors are uncertain about future economic conditions.

Research conducted by Estrella and Hardouvelis (1991) and Estrella and Mishkin (1997) has demonstrated that an inverted yield curve has historically been a reliable predictor of economic recessions in the United States. However, recent studies have questioned the yield curve's predictive accuracy in the context of unconventional monetary policy and global economic factors (Engstrom & Sharpe, 2018).

3. Method

The dissertation has considered two different, but not independent, studies regarding the research question. One which covers the main study and the other which is a set of smaller studies. The reason for this is that the latter proved to provide valuable insight into the results from the main study. The main study analyzed the predicted and actual IE for 2022 through the use of statistical parameters. The method analyzed the effect from relevant determinants for any divergence between the forecast and reported IE, as well as any change in the latter when compared to 2021.
The second branch of studies conducts multiple analysis on the determinants that are expected to be significant to the results in the main study. This is a two-step process: Firstly, analyzing the historical data on the determinants and then assessing any significance in the yearly changes from the data both company and sector-wise. Thereafter, comparing the determinants to the results from the main analysis, looking for any correlation between them.

3.1. Data Acquisition

The data used in the dissertation has its origin from multiple sources categorized after the necessary information needed. Refinitiv has been the primary source of the data used in the dissertation. Information on the most traded companies stems from Refinitiv's database, as well as IBOR-rates, historical data from the financial reports, issuance of loans and bonds, raise of capital, dividends, and other company data of relevance. Currency-rates were fetched from both Refinitiv and OECD. Credit spreads were extracted from FED's database giving historic yield spreads for different credit scores Federal Reserve Bank of St. Louis. (2023).

Quarterly reports from Refinitiv's database were extracted through a self-made script in Python, for which the source code can be found in the appendix. The script scraped the necessary data from the reports company by company. Information on issuance of loans, bonds and equity were gathered through Refinitiv's screener. IBOR- and currency-rates were either gathered by data acquisition through Refinitiv, or manually from the same source.

Sensitivity analysis on interest rate risk, a floating to fixed ratio on interest rate, currency composition and relevant IBORs were all collected manually from the annual reports of the selected companies into a spreadsheet. The sensitivity analysis contains the normalized predicted change in IE per 100 basis points. The annual reports were all gathered from the webpage: newsweb.oslobors.no, and the mentioned datapoints manually collected into a spreadsheet.

3.2. Data Processing

The scraping of historical data from each company's financial reports is stored in separate Excel files. The first step of the data cleaning was to gather all relevant data into one single file. The process required additional self-made Python scripts, accessing every company file, pulling data and placing it in a common file. As a result, the data is fetched and organized in a swift and timely manner. However, the presented data in the common file are "dead", meaning that it lacks the link to its original source file. The data deemed relevant includes topics like debt, interest income/expense, hedging, profit/loss and assets. From the common file, further Excel-spreadsheets originate which in turn access the different topics separately. These files assess changes, relevant ratios and any outliers in the data, including preparation for the sub analysis. All these processed files link back to the common file, consisting of the mentioned "dead data". Consequently, the datasets are vulnerable to sorting arrangements and sudden changes.

Data collected from the annual reports is already structured according to the other files, and no further processing is necessary. Other data from the Refinitiv database and FED are either time series, which requires no further processing, or prepared in separate sheets in the same file. Some sheets are processed for use in the main analysis. This data transfers from historical data aggregated to each company for the time range 2021-2022. Additional processing includes estimates using other data from FED/Refinitiv as input. For sheets that are meant for the sub analysis, all historical data are aggregated to each year for time series analysis. This includes the entire time range.

Using the processed files as inputs, forecasts and analysis are conducted in separate Excel-files. This is done either directly or through the VLOOKUP-method. The prediction model inputs data from the sensitivity analysis—both rate of change and reference rate(s), and the manually gathered IBOR-rates mentioned. From this, predictions are made based on the value of IBORs at the end of the quarter and the rate of change reported. The predicted data are analyzed together with actual reported data and determinants gathered in the processed files. This also includes data in the range 2021-2022 from the Refinitiv screeners, regarding issuance of bonds, loans and equity. Determinants regarding change in debt required some estimations, requiring inputs from the annual reports, Refinitiv's screener and the manually entered currency-rates. Summarizing, data from multiple sources were processed into excel-files, which again works as input to the main analysis.

For comparison and scalability, all forecast and actual IE are presented using the ICR where companies with negative EBIT are set to zero. The reason is that companies without income cannot pay down their interest payment, implying an ICR of zero. As some companies have large cash deposits that reduce the negative exposure to interest rates, it is relevant to include net IE as part of the analysis for direct comparison to IE. However, Net ICR lacks linearity. As an example: Three companies with the same EBIT are plotted below. A has a higher net interest expense (NIE) than B, while Cs are negative.

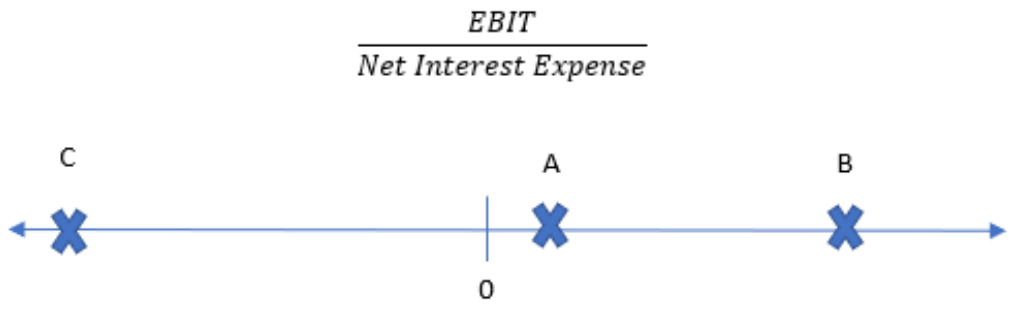

Figure 4: Example of ICR

B has a better ratio than A, but worse than C. Comparing these three companies is difficult. Consequently, the Inverse of Net ICR(INICR) has been used, creating linearity, and providing comparability—where smaller values are better. In addition, it enables analysis of companies with negative EBIT.

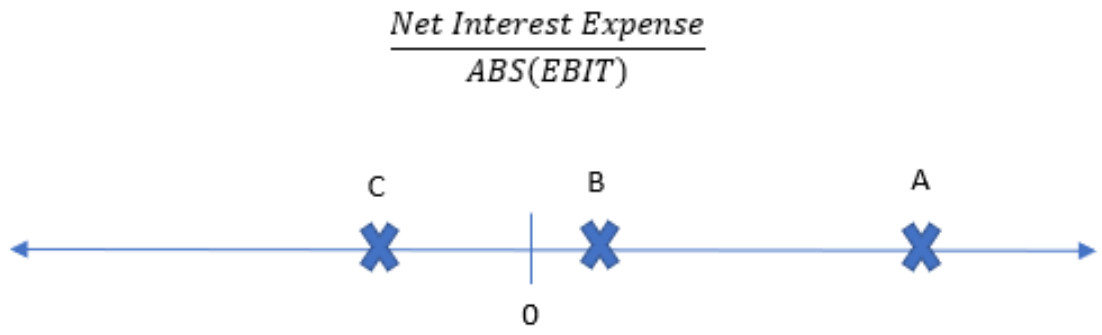

Figure 5: Example of INICR

The analysis of ICR/INICR focuses on the change relative to the last quarter of 2021(Q421). As it is the change in IE, which is relevant, EBIT is set equal to Q421 for all four quarters. Further analysis will not consider changes in EBIT unless explicitly stated, as the ratios are meant for comparability. Thus, it can be stated that the INICR is a very good indicator of how much of the EBIT goes into paying the net interest expenses.

3.3. Analysis

The analysis of ICR/INICR uses descriptive statistics, including the comparison to the determinants. Changes compared to Q421 are summarized by relevant statistical parameters as well as boxplots for visualization. Divergence between the forecast and actual ICR/INICR are measured in the same way. As for the determinants, correlation to ICR/INICR are measured, as well as the aggregated average per business sector using Pivot-tables.

As for the sub analysis, a mix of descriptive statistics and time series analysis are utilized. Data from the processed files are gathered using Pivot-tables, and categorized after year, business sector or characteristics—depending on the relevance. Pivot-tables are either located in common Excel file for sub analysis, or in the respective topic's file. The data is measured by average, sum or percentiles. Some of it is visualized using boxplots or other graphs. Data regarding the issuance of bonds and loans are compared to yearly NIBOR-rates by correlation, as well as the average year-to-maturity.

3.4. Limitations

The main analysis target was to analyze the one hundred most traded the OBX during 2021 and 2022, with some exceptions. The first exception is companies that went through a restructuring or filed for bankruptcy. These kinds of actions tend to erase a lot of the debt by converting it to equity. Furthermore, companies within the following sectors are exempt: Investment, Insurance and Banking. All of these have their core operations within financials, bonds, or stock investments. As these sectors tend to operate either solely using equity or only with debt, they would simply have been generating outliers for the statistical analysis. The extension of this would have skewed the results from the analysis in one way or another. Investment firms are financed almost exclusively through their clients' funds, while banks through regulation operate with a very low level of equity.

The final tally of the number of companies analyzed is 92. The reason for 8 companies lacking were due to the discovery that those companies had data in their quarterly reports, or from Refinitiv's database, which was either missing or distorted. As a result, those companies ended up being exempt from the study.

The dataset comprises data going back to 1970. This is primarily the historical issuance of loans and bonds for all companies on the OBX. This data is used for the smaller studies on the determinants. The main analysis uses quarterly data from the start of 2021 until the end of 2022. Even though the time span is rather short, it is an eventful one. The period is characterized by going from a rate standstill to massive rate hikes. This highlights the differences between companies and how they are structured. As for the side analysis, data from all periods are relevant.

Given that not all companies receive issued credit ratings from the relevant agencies, Refinitiv's Credit Risk Model (CRM) is utilized. The model estimates each company's credit

risk based on different relevant sources of data. Therefore, there is a potential mismatch between implied and actual credit ratings. This is only applicable to companies without an official rating Refinitiv (2023).

It has been necessary with some assumptions regarding the issuance and repayments of loans and bonds. Especially loans at fixed rate, as the information on interest rate is missing from Refinitiv's database, and this information is otherwise very hard to come by. Therefore, it is assumed that at the issuance of new debt with fixed rates, the company must pay a rate equal to the relevant credit spread at that time. This is regardless of the term, sector, operating area, history, and any other factor that determines the interest rate for the specific company. When measuring down payment on debt, reduction in IE is estimated based on the weighted-average interest rate calculated from forecast IE divided by the current debt level.

Furthermore, when calculating expected change in IE based on a company's floating rated debt, the relevant reference rates are measured on the final day of the quarter. There is also a similar simplification in terms of currencies, as some companies hold a mix of loans and bonds issued in different currencies. Refinitiv's Screener converts these loans back to the reporting currency for each company. Any fluctuation in relevant currencies in relation to the reporting one is measured using exchange rates on the last day of each quarter. Any effect of a change in this relation is calculated using the current reported value of each company's debt.

4. Results

The dissertation seeks to explore how the most traded companies on OBX have acted to elevated interest rates, and if they were successful in doing so. The research question: *"How did companies act to elevated interest rates in 2022, and what was the effect on their cost of debt compared to their own risk analysis?* Is what will be attempted answered in this section. The data were all collected either by hand from annual reports, or by scripts off Refinitiv's database and exported into an Excel-sheet. Interest rate risk, currency composition, floating to fixed ratio on interest rate, and relevant IBORs were the main data collected. The main study covers all of 2021 and 2022, whilst the secondary study has data ranging all the way back to 1970.

4.1. Change in ICR and INICR

The first thing to note when looking at Table 1 is that there has been a broad hike in the expenses that companies from Q421 to Q422. A negative change in the mean ICR compared to Q4 2021 by 2.62 while keeping EBIT the same indicates a rise in the actual IE by the same factor.

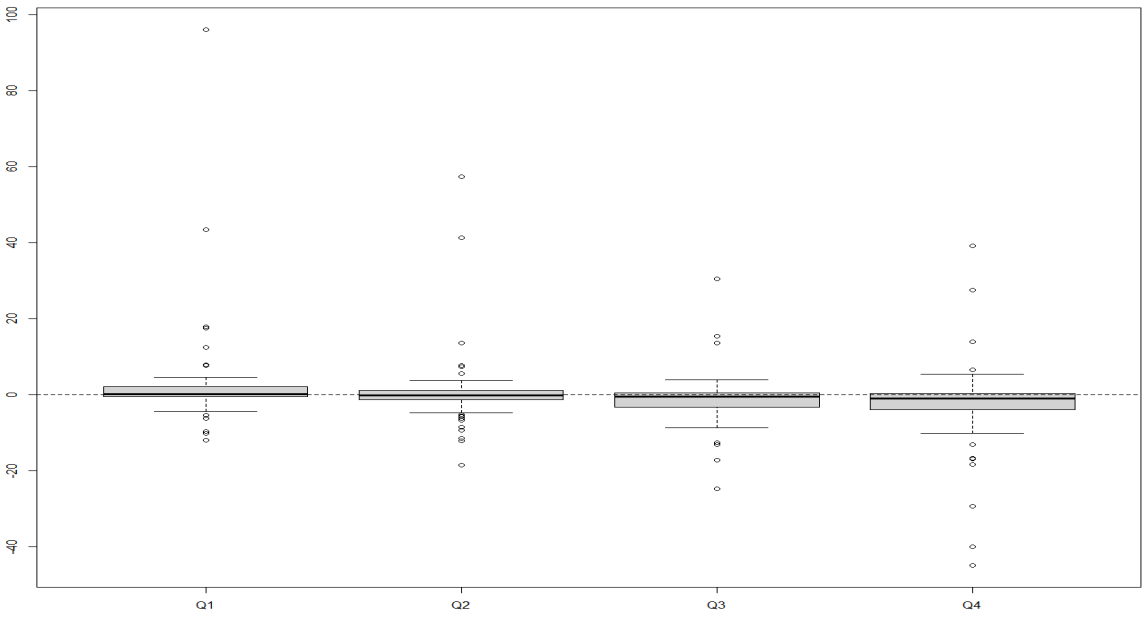

Figure 6: Changes in ICR relative to Q421, including outliers.

Looking at the entire set, one can see that from Q4 2021 to Q1 there was a lowering of the IE caused by a few companies. The median increase in the ICR value compared to Q4 2021 was only 0.16 whilst the mean change was 2.58. This is reflected in a positive skew of 5.56. Therefore, even though the average company had a significant upswing, it's caused by some extreme outliers. As seen in Figure 1, the change was caused by a few companies with the largest change in ICR compared to Q4 2021 being almost 100. Therefore, one can say that the change for most companies was very small, and the median is a better metric to use rather than mean.

When looking at Q2 2022 one can see a sudden negative and drastic change in the compared ICR. The Q2 2022 mean is 0.47 but has a rate of change of 2.17. This is almost the same change as Q4 2021 and Q1 2022 just in the opposite direction. The thing to note here is that even though the change is almost the same, the skewness and standard deviation are both considerably lower. Hence, more companies saw negative change in Q2 compared to the number with a positive one in Q1. This is also well represented in Figure 1, as one can see that there are quite a few dots just below the lower $1.5 * IQR$. The change in median from Q1 to Q2 2022 was only -0.41, whilst the mean change was -2.17.

Table 1: Changes in ICR relative to Q421

Change compared to Q421	**Q4**	**Q3**	**Q2**	**Q1**
Mean	-2,62	-1,28	0,47	2,58
Median	-0,96	-0,54	-0,17	0,16
Std.Deviation	11,15	6,80	9,75	13,41
75 percentile	0,22	0,41	1,05	2,00
25 percentile	-3,83	-3,24	-1,44	-0,54
Skewness	-0,57	0,93	3,93	5,56

Rate of Change	Q4	Q3	Q2	Q1
Mean	-1,33	-1,79	-2,17	2,58
Median	-0,38	-0,48	-0,41	0,16
Std.Deviation	12,73	5,86	6,21	13,41
75 percentile	0,35	0,04	0,01	2,00
25 percentile	-2,50	-1,88	-1,89	-0,54
Skewness	-1,69	-2,66	-3,82	5,56

Q3 2022 represents the first quarter with a negative mean of -1.28, and a median of -0.54. Between Q2 and Q3 there was a considerably broader increase in IE. The skewness, while still positive, shrunk to 0.93. As seen in Figure 6, this is caused by positive outliers dropping while the negative ones continue downward. Figure 7 excludes the outliers, presenting a better picture of the changes—showing a decline in ICR.

In the fourth quarter the mean sits at almost -2.62, while the median is -0.96. The skew is -0.57, meaning that for the first time in the 4 quarters the median increase in IE is larger than the average one. The upper and lower bounds in Q3 2022, 0.44 and -3.24, and Q4 2022, 0.22 and -3.83, are very close. This could mean that the decline is stabilizing. Due to the fact that Q4 has more outliers, the standard deviation skyrocketed compared to Q3, from 6.8 to 11.15. This is the largest rate of change in the data set. This can be seen on Figure 7, as the number of data points outside the $4 * IQR$ is larger. Not only that, but they are also further from the mean.

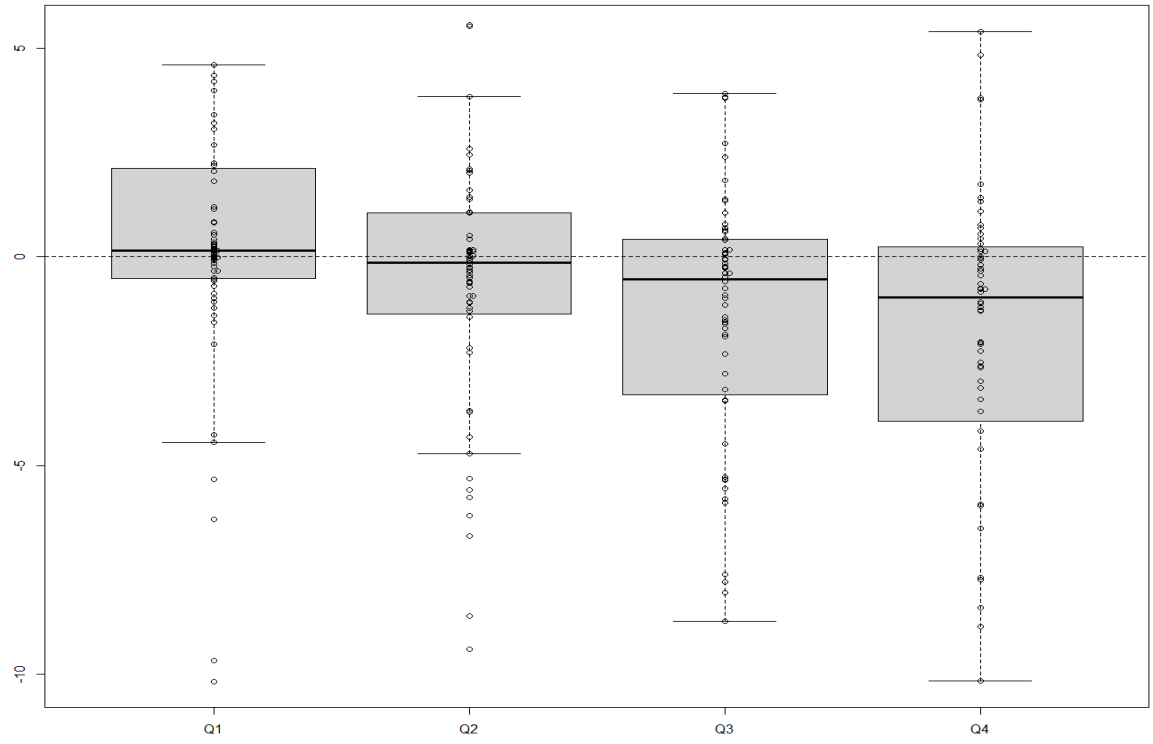

Figure 7: Changes in ICR relative to Q421, excluding outliers.

The INICR for companies is presented below in Table 2. As with ICR, this table adopt a fixed EBIT for comparability between companies of different sizes. Additionally, Figure 8 and Figure 9 are scaled by a factor of 100 to get readable numbers.

Table 2: Changes in INICR relative to Q421

Change compared to Q421(x100)	**Q4**	**Q3**	**Q2**	**Q1**
Mean	4,9302	14,4296	5,9644	3,9856
Median	1,4757	-0,4088	0,1931	0,2494
Std. Deviation	123,5552	89,3865	55,4291	59,9090
75 percentile	20,0559	8,2951	8,2633	5,5309
25 percentile	-9,9563	-5,6528	-2,5459	-1,9219
Skewness (not scaled)	-0,5381	4,3929	2,2172	2,0161

Rate of Change compared to Q421(x100)	Q4	Q3	Q2	Q1
Mean	-9,4995	8,4653	1,9787	3,9856
Median	0,7788	0,1395	0,2925	0,2494
Std. Deviation	150,4481	62,3052	30,1199	59,9090
75 percentile	12,7715	3,1836	4,0064	5,5309
25 percentile	-5,6636	-3,5396	-2,1435	-1,9219
Skewness (not scaled)	-6,4428	7,5508	1,4807	2,0161

The first thing to note is that in all, but especially the first three quarters, the mean and median are very far from each other. This is also well represented in the skew. Q1 and Q2 have a skew of around 2, and this jumps to 4.4 in Q3. Then it turns negative in Q4 at -0.53, although closer to zero than the other 3 quarters. This indicates that the increased NIE in Q4 is experienced by the majority of the analyzed companies.

When comparing Table 1 to Table 2, ICR and INICR diverge. In Q1, the median and mean ICR increased compared to Q421, by 0.16 and 2.58 respectively. This indicates a decrease in IE. For INICR the median and mean increased with 0.25 and 3.98 respectively—implying an increased NIE. The only way this can happen is if the amount of interest-bearing cash is declining. In other words, the cash balance was drained during this period. As for Q2, the mean and median diverge for both ICR and INICR. However, for ICR its due to outliers with

reduced IE, while INICR is due to higher NIE. In Q3, ICR turns negative for the mean as well, while INICR continues its divergence in the positive direction. Finally, INICR's rate of change drops for the mean in the final quarter, aligning more with the median value. Hence, the median company drained its cash balance in Q1 and Q4, while increasing it in between those quarters.

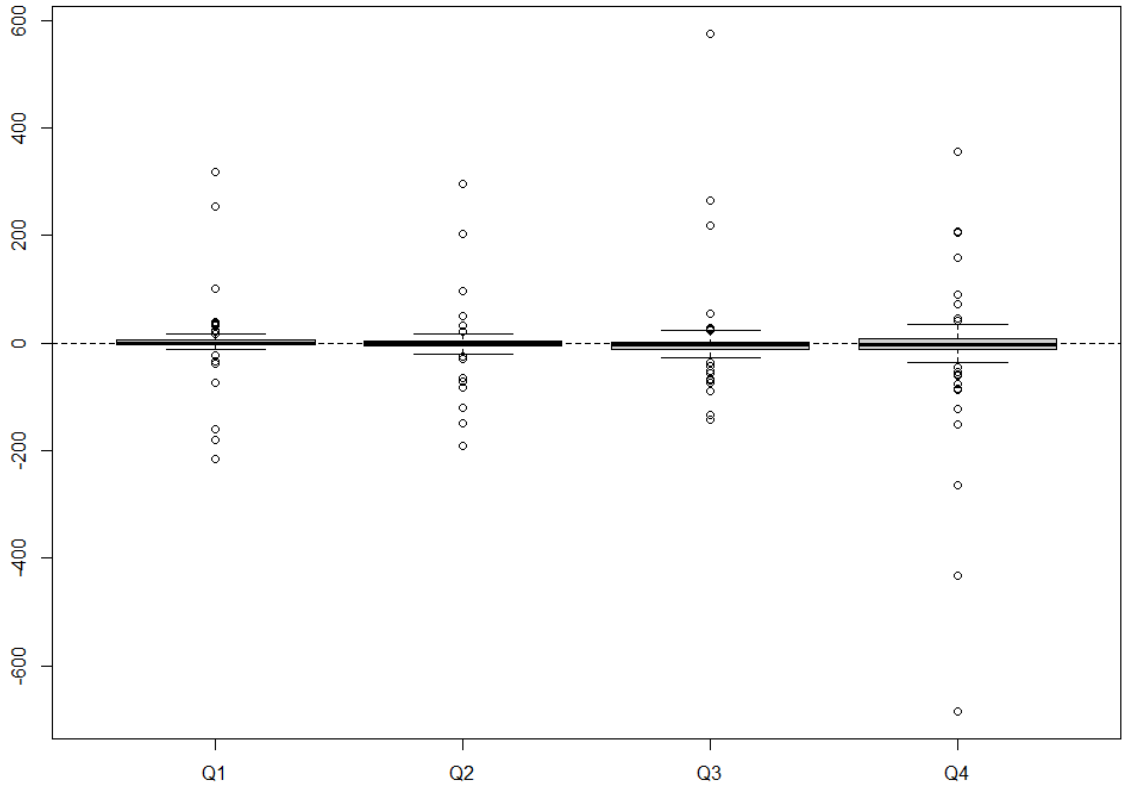

Figure 8: Changes in INICR relative to Q421, including outliers. Scaled x100.

The first and second quarters for INICR are rather similar. Both have a median hovering around 0.2, and a mean of 3.98 and 5.96 respectively. This means that the majority of the companies analyzed experienced moderate increase in INICR in those quarters, while a few experienced very large hikes in INICR. This is well reflected in Figure 8, which shows the boxplot of Table 2 with the same scaling. Even though the majority of data is seemingly centered on zero, there are a few large outliers. The largest one at almost 400. To get a better perspective of how the distribution looks like, Figure 9 contains a scaled version. Here one can see that most of the data is inside the range of $4 * IQR$.

The third quarter offers some interesting results. The median INICR is for the first time negative, indicating that the median company had a decrease in NIE when compared to Q4 2021. However, the mean suddenly jumped to 14.42, caused by one extreme outlier which can be seen in Figure 8. The peak one at almost 600. This alone caused the skew to jump to 4.4. Compared to the previous two quarters, Q3 did not have that great a change in the 25th and 75th percentiles. The most important change is that the lower end sank from -2.54 to -5.56. This is indicated in the median value, which was as earlier stated, negative.

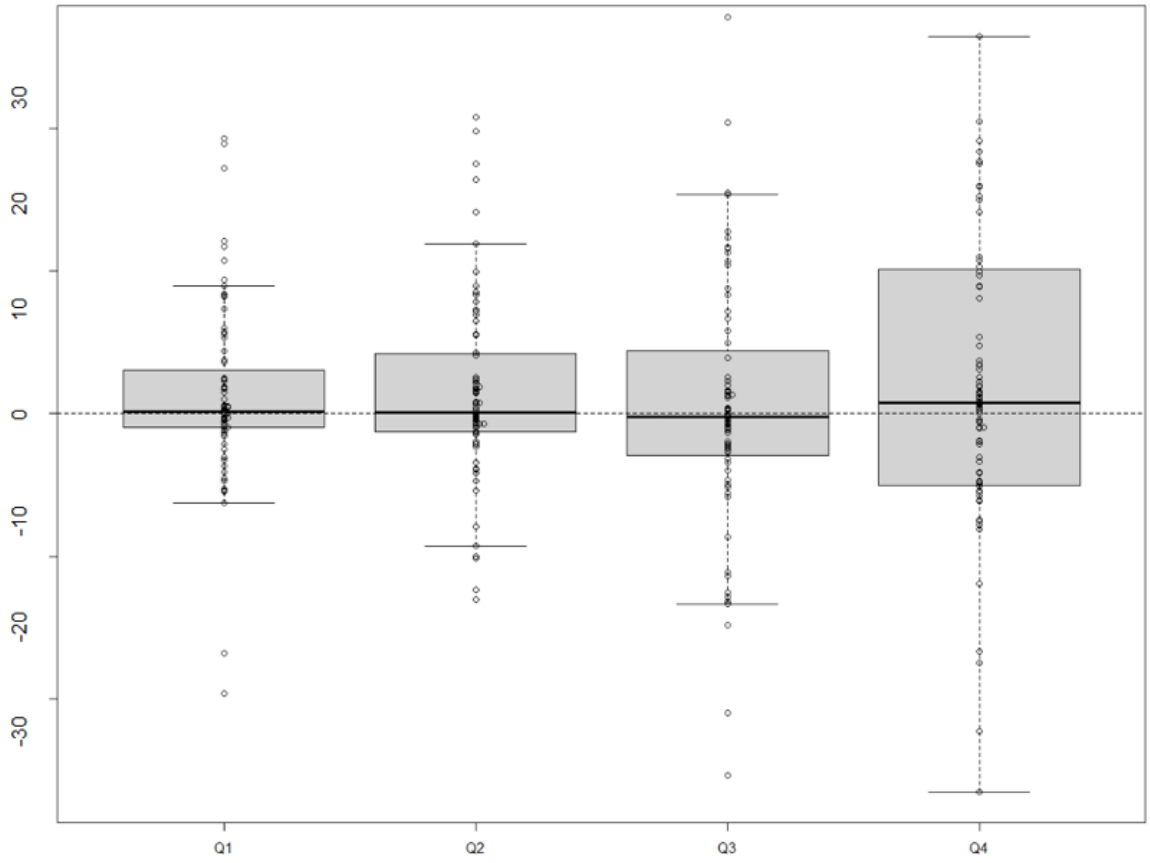

Figure 9: Changes in INICR relative to Q421, excluding outliers. Scaled x100.

In Q4, the skew turns negative signaling more extreme outliers in the negative territory—that can be seen in Figure 8. The median jumps to 1.47 in Q4 from -0.41 in Q3. At the same time, the mean plummets from 14.43 to 4.93 in accordance with the negative outliers. Viewing Figure 9, the 50th percentile widens significantly, ranging over twice the size of Q3. Conversely, the standard deviation increases from 90 in Q3 to 123 in Q4. Hence, the magnitude of both positive and negative changes increased quite a lot in Q4—widening the

gap between companies. With a positive mean and median, more companies saw increased NIE in Q4.

The standard deviation rose over the four quarters. It remained between 50 and 60 in the first two quarters, before surging to 90 in Q3 and 123.55 in Q4. At the same time, the skew narrowed. This indicates that even though the amplitude of the changes in NIE got somewhat normalized, the bounds for what is considered normal widened. This solidifies the fact that when comparing Q4 2021 to Q4 2022 the majority of companies for the first time really felt the effects of the increase in policy rates through NIE.

4.2. Forecast vs Actual ICR and INICR

The difference between the actual and forecasted changes compared to Q421, as represented in Figure 10, is the residual ICR hereafter called the $eICR$. Correspondingly, the residual for INICR is called the $eINICR$. A positive $eICR$ indicates that the actual ICR beat the forecast value. In contrast, negative values of $eINICR$ indicates better INICR than forecast. The forecast stems from the prediction model explained in chapter 3. The median value of $eICR$ throughout all four quarters is relatively stable. The median for $eINICR$, however, is not as stable, and trends negatively with time.

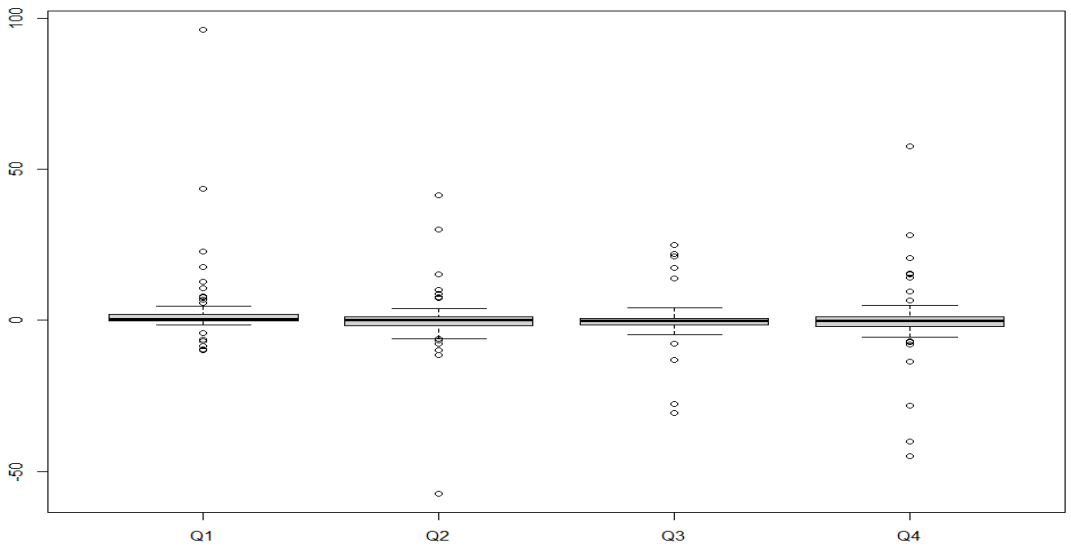

Figure 10: Residual ICR, including outliers.

As seen in Table 3, the $eICR$ throughout all four quarters indicate a steady decline towards zero, both in terms of mean and median. Having an $eICR$ near zero implies that companies increased IE in line with forecast. In Q1, there mean and median value was 3.26 and 0.27 respectively—indicating most companies outperformed compared to forecast. This fits well with the positive ICR in Q1 combined with elevated policy rates, creating a mismatch. Continuing in Q2 and Q3 both the mean and median stay positive, although by smaller magnitude than previously. In Q4, most companies seem to experience increased ICR in line with forecast. However, the standard deviation increased to 12.45 from 7.86 in Q3.

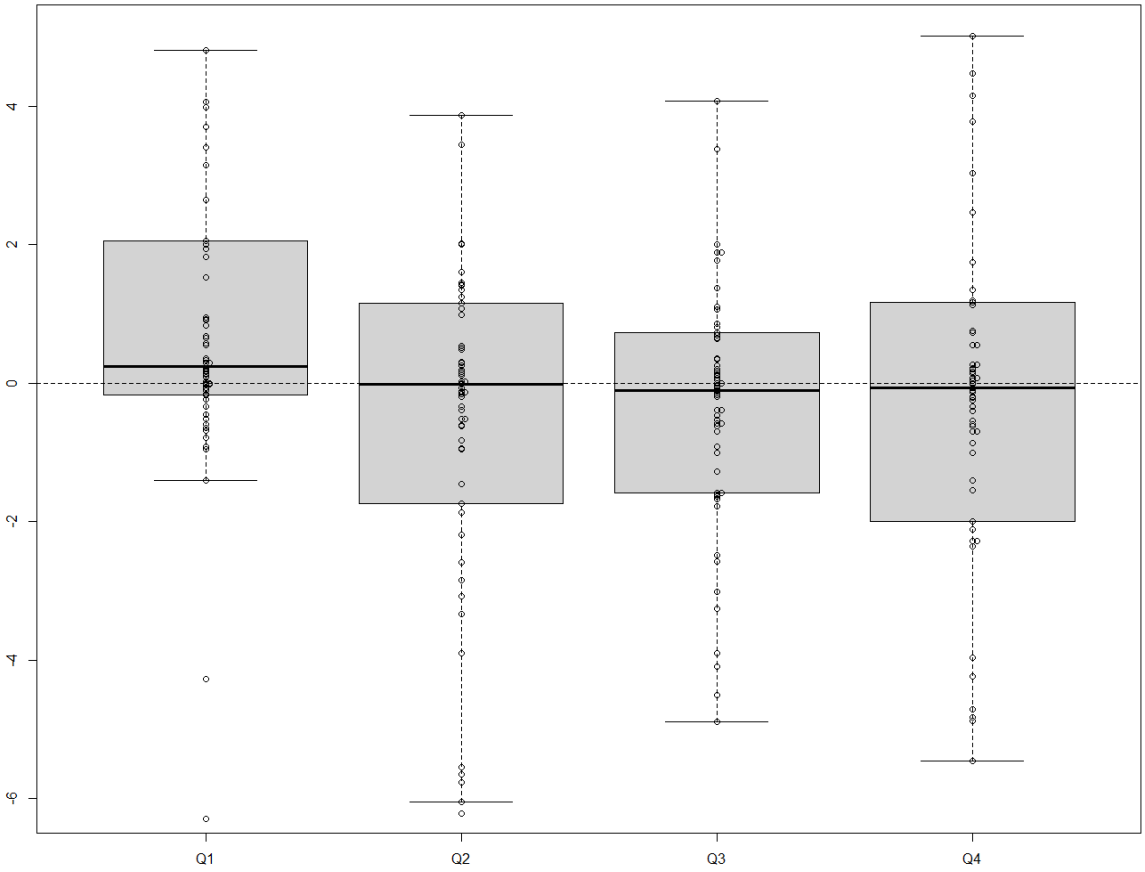

Figure 11:Residual ICR, excluding outliers.

Looking at Figure 11, Q1 distance itself from the other three quarters with the majority of companies beating forecast. From that point, the trend is towards zero while the spread widens.

As seen in Table 3, the median $eINICR$ was rather stable in Q1 and Q2, and the jumped quite significantly in Q3. However, the mean was relatively stable in the first three quarters, until it had a sudden and extreme jump in Q4. In contrast to $eICR$, the average company experienced higher INICR than forecast in Q1—before converging to zero in Q2. As for Q3, the mean and median diverge by posting 0.95 and -2.10 respectively. While the median company beat forecast in all four quarters, the mean moves back and forth. In Q4, both metrics go negative. With the mean steady at -1.9, the mean plunges to -12.85. Hence, most companies beat forecast in Q4, while some did so quite significantly.

Table 3: Descriptive statistics of the difference between actual and forecast.

eICR compared to Q421	**Q4**	**Q3**	**Q2**	**Q1**	**Avg**
Mean	0,05	1,24	2,03	3,26	1,59
Median	-0,09	0,18	0,15	0,27	0,10
Std.Deviation	12,45	7,86	10,05	13,50	7,95
75 percentile	1,19	1,28	1,44	2,50	1,44
25 percentile	-2,09	-0,70	-0,91	-0,22	-0,86
Skewness	0,40	1,06	3,74	5,43	1,94

eINICR compared to Q421(x100)	Q4	Q3	Q2	Q1	Avg
Mean	-12,85	0,95	-0,04	2,29	-2,41
Median	-1,91	-2,10	-0,36	-0,06	-1,31
Std.Deviation	110,80	77,72	51,38	57,19	52,30
75 percentile	8,22	2,39	4,81	5,22	4,34
25 percentile	-11,67	-12,03	-6,28	-2,34	-8,91
Skewness (not scaled)	-2,76	4,97	1,81	1,63	2,09

Looking at Table 4, 51.7% of companies were expected to see declining ICR in Q1. That value remained steady until Q3 were the forecast elevated to 57.3%, due to EURIBOR turning positive. Nevertheless, only 33.7% actually reported declining ICR in Q1. In spite of this, the number increased every quarter to 51.7% in Q4. Hence, just over half the companies saw lower ICR compared to Q421 at the end of the year. Of the ones forecasted with a negative change, 54.3% increased their ICR in Q1. Not only beating expectations but posting a gain as well. However, the number dropped every quarter, stopping at 27.5% in Q4. Out of those

companies which saw an actual decline in Q1, 16.7% fared better than forecast. This value increased steady up to 34.9% in Q3 before easing to 23.9% in Q4.

As for INICR, the results are almost in line with ICR. The reason why there is a difference between the percentages in ICR and INICR in Table 4 is explained in the method chapter. In short, companies with negative EBIT are set with ICR equal to zero. The result is that both parts of the table trend in the same way, but with slightly different numbers.

Table 4: Divergence between forecast and actual ICR/INICR

ICR compared to Q421	**Q4**	**Q3**	**Q2**	**Q1**
% $\Delta Forecast < 0$	57,3 %	57,3 %	51,7 %	51,7 %
% $\Delta Actual < 0$	51,7 %	48,3 %	42,7 %	33,7 %
% $\Delta Actual > 0 \mid \Delta Forecast < 0$	27,5 %	33,3 %	43,5 %	54,3 %
% $\Delta Actual > \Delta Forecast \mid \Delta Actual < 0$	23,9 %	34,9 %	23,7 %	16,7 %

INICR compared to Q421	Q4	Q3	Q2	Q1
% $\Delta Forecast > 0$	67,4 %	67,4 %	62,0 %	62,0 %
% $\Delta Actual > 0$	42,4 %	52,2 %	47,8 %	45,7 %
% $\Delta Actual < 0 \mid \Delta Forecast > 0$	35,5 %	38,7 %	43,9 %	42,1 %
% $\Delta Actual < \Delta Forecast \mid \Delta Actual > 0$	20,8 %	27,3 %	10,6 %	14,0 %

Table 5 shows the actual ICR, using the correct annual EBIT. The change in actual ICR from 2021 to 2022 with and without the energy sector are two different stories. Included, the median increased by 33.8% and the mean by 22.4%. Excluded, the ICR decreases for both mean and median by 2.8% and 3.8% respectively. As for the standard deviation, it gains 12.9% with the energy sector, and drops -12.6% without it. The skewness, however, remains almost the same in both scenarios.

Table 5: Actual ICR. Accumulated interest expense and EBIT for all four quarters, excluding negative EBITs.

Change in Actual ICR	**2022**	**2021**	Δ	**Δ(%)**
Mean	9,36	7,65	1,71	22,4 %
Median	4,32	3,23	1,09	33,8 %
Std.Deviation	13,95	12,36	1,59	12,9 %
75 percentile	10,79	8,74	2,04	23,4 %
25 percentile	0,38	0,42	-0,04	-9,3 %
Skewness	2,41	3,40	-0,99	

Change in Actual ICR ex Energy & Fossil Fuels	2022	2021	Δ	Δ(%)
Mean	8,34	8,59	-0,24	-2,8 %
Median	3,60	3,74	-0,14	-3,8 %
Std.Deviation	12,01	13,75	-1,74	-12,6 %
75 percentile	10,32	10,67	-0,35	-3,3 %
25 percentile	0,18	0,30	-0,12	-40,8 %
Skewness	2,33	3,18	-0,85	-

Table 6 tracks the annual change in EBIT for the same scenarios as above. The mean change in EBIT year on year for all companies has been 219.5%. Excluding energy, the mean values rose to 82.4%. The same trend can also be seen in the median value, standard deviation, and skewness. The energy sector has been a positive force, and the OBX looks bleaker without these companies included.

Table 6: Change in EBIT YoY for all sectors and excluding energy.

EBIT ΔYoY (%)	**All**	**Ex Energy**
Mean	219,5 %	82,4 %
Median	25,3 %	16,0 %
Std.Deviation	11,36	1,90
75 percentile	142,4 %	97,0 %
25 percentile	0,1 %	-4,4 %
Skewness	8,26	3,55

4.3. Loans and Bonds

Between 2021 and 2022 there have been some very notable changes in the terms in the issuance of both bonds and loans. The average term of bonds in 2022 suddenly spiked to 11.80 and 13.82 years, for floating and fixed rates respectively. The rate of change for the average term has only been comparable twice since the start of 1983, which can be seen in Figure 12. Those were in the 90's during the dot-com crash, and during the subprime crisis of 2008. For floating-rated debt, there was also a similar spike during the European debt crisis in-and-around 2015.

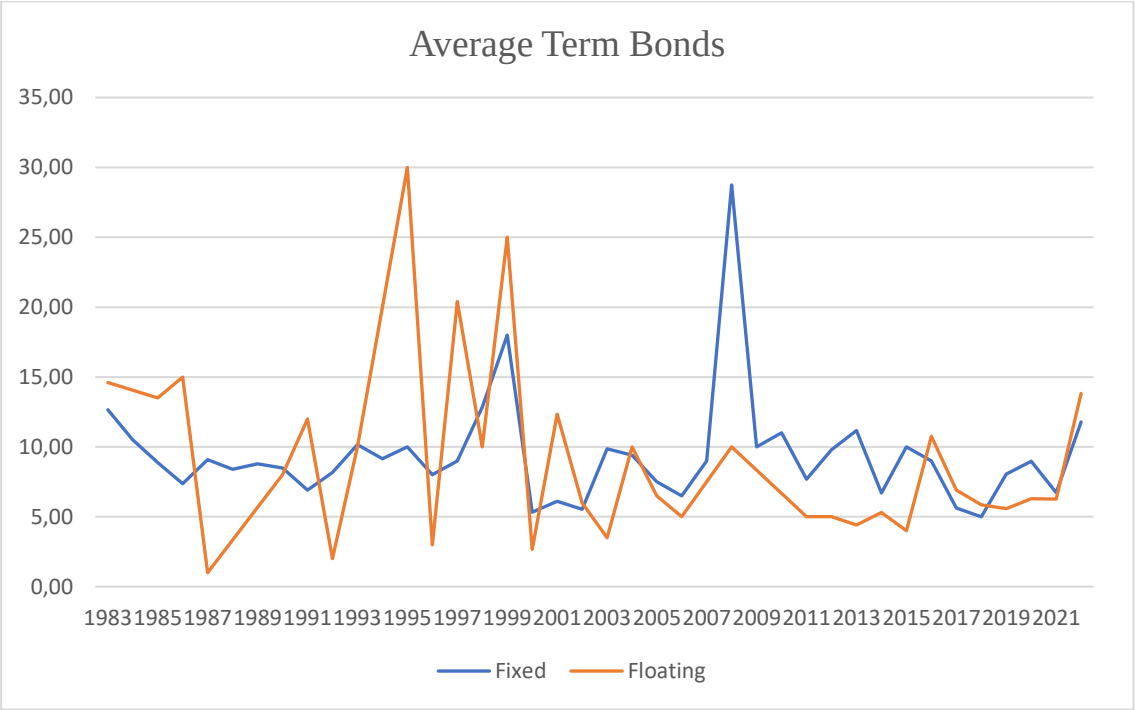

Figure 12: Average Term loans. Data based on Table 8

The historical mean states that 38.4% of all issuances have been bonds, while the rest have been loans. The number for 2022 was 7.3%, as seen in Table 7. The 5-year average between 2017 and 2022 is 32.9%, which means there has been a dramatic drop. For the companies analyzed, the historical mean for bonds issued in NOK has been 39.1%. The historical mean for issuing floating rate securities has been at 34,64%. The 2022 number was 7.4%, with the 5-year average being 31.0%. This suggests a sudden drop in the issuance of floating rate securities.

Table 7: Issuance of bonds and loans between 2021 and 2022

Total	Bonds as % of issues	% of total issues floating	Average Term
Mean	38,4 %	34,64 %	7,4
Std.deviation	0,32	0,19	3,2
Median	25,0 %	31,3 %	6,4
75 Percentile	76,0 %	50,7 %	7,9
25 Percentile	12,6 %	17,7 %	5,7
2022	7,3 %	7,4 %	8,4
5yr Average	32,9 %	31,0 %	5,6

There has been a comparable development in the issuance of loans, although not as extreme as bonds. 92.7% of all issuances in 2022 were loans. Still, the average term increased from the historical mean at 5.7 to 8.0 years. For fixed rate loans specifically, the average is 8.1. And for floating 4.4, which matches perfectly with the 5-year average at 4.4. Although, in 2022 only 7.4% of issuances across loans and bonds were floating.

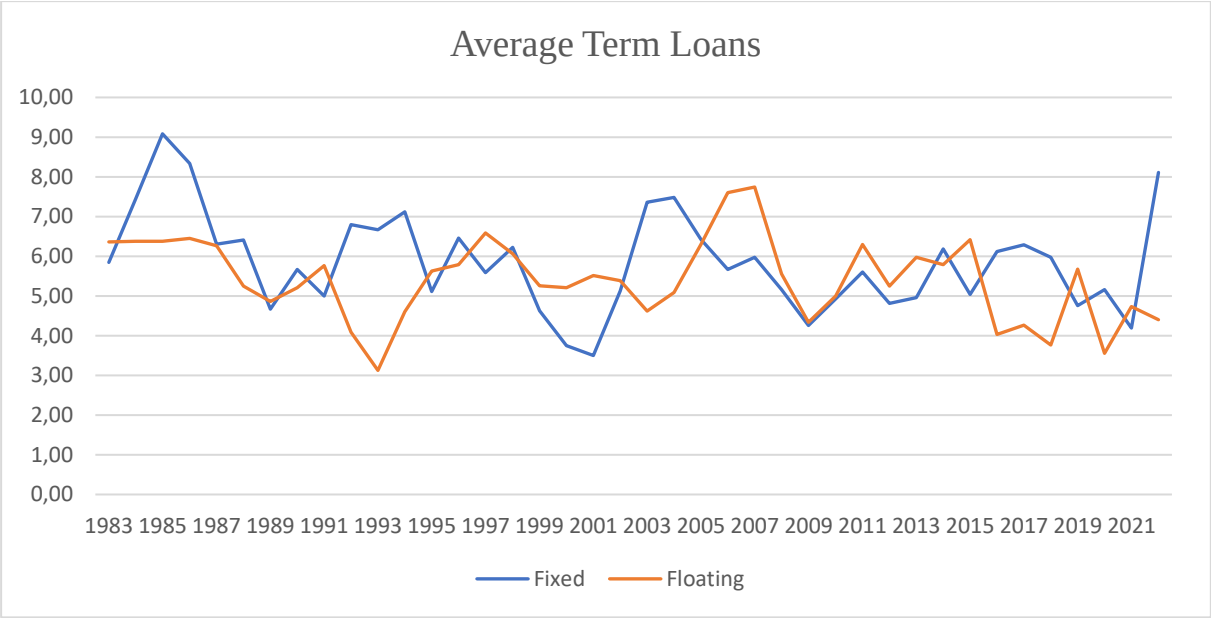

Figure 13: Average Term Loans. Data based on Table 8

As seen in Table 8 the NOK issuance rate in 2022 sits at 95.8% as opposed to the 39.1% and 44.6% mean and five-year average, respectively. Further, the percentage issuance in USD has a historical mean of 32.1% which has sunk in the last five years to 14.3%. Although, in 2022 it plummeted to 3.7%. This data shows companies flocking to the local currency and avoiding foreign currencies like the dollar. Additionally, the number of call-options has increased accordingly. The 5-year average sits at 35.5%, whilst the 2022 number is 38%.

Table 8: Statistics for bonds and loans separately

Bonds	**Term**					
	Average	Fixed	Float	% with Call option	% in NOK	% in USD
Mean	8,7	9,1	7,6	9,2 %	39,1 %	32,1 %
5yr Average	6,5	6,9	6,2	35,5 %	44,6 %	14,3 %
2022	13,2	11,8	13,8	38,0 %	95,8 %	3,7 %

Loans	**Term**				
	Average	Fixed	Float	% in NOK	% in USD
Mean	5,7	5,7	5,6	61,4 %	21,6 %
5yr Average	5,1	5,3	4,4	57,1 %	18,5 %
2022	8,0	8,1	4,4	61,4 %	11,0 %

4.4. Changes in debt-ratio

The last five years provide a quite significant change in the cash balances across all sectors. In 2019 and 2020 the 50th percentage interval widened significantly as seen in Figure 14. It rather quickly closed again, and the blue line shows a slight decline in the median cash balance of companies. For 2021 and 2022, the median cash balance increased by 11,95% and 4,34% respectively.

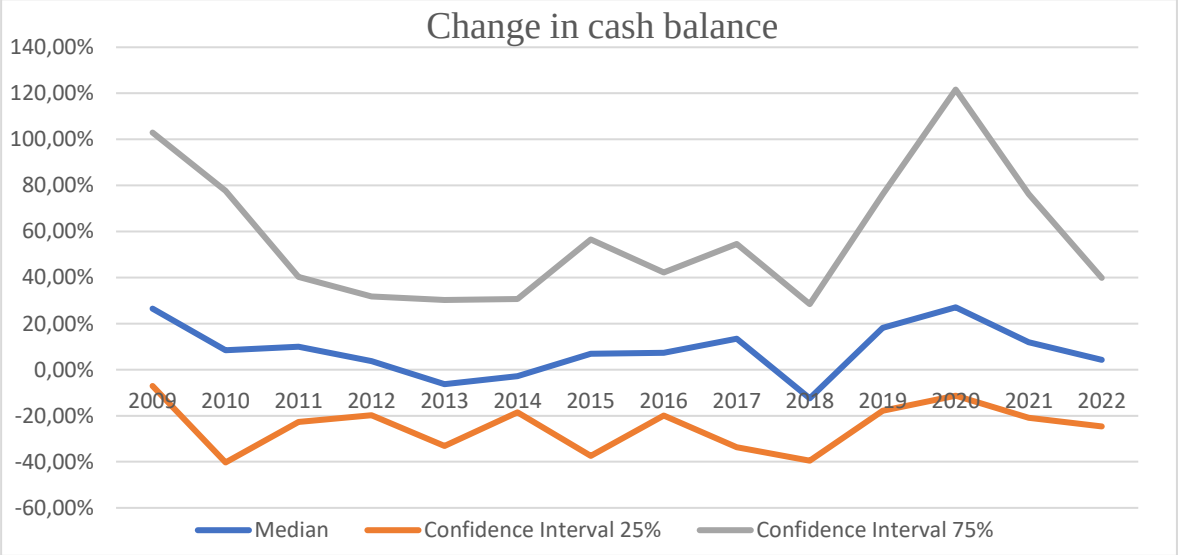

Figure 14: Cash balance for all companies

The percentage of cash when compared to total capital sunk from 9.3% to 7.9% between 2021 and 2022. The interesting outlier here is the mineral resources sector. Here the ratio increased from 6.6% in 2021 to 30.7% in 2022. Notably the mineral resources sector surged from 6.6% in 2021 to 30.7% indicating a massive amount of disposable funds. It was the only sector that had over 20% cash as a percentage of total capital. There were 4 sectors; Automobiles & Auto Parts, Industrial & Commercial Services, Pharmaceuticals & Medical Research and Renewable energy, which had between 10-20%. Which means that only 5 out of 19 sectors had over 10% cash as a percentage of total capital.

Table 9: Cash as % of Total Capital, excluding minority interest.

Cash as % of Total Capital (Debt + Equity)	**2022**	**2021**	**2020**	**2019**	**2018**
Applied Resources (2)	7,6 %	11,0 %	12,7 %	7,2 %	8,8 %
Automobiles & Auto Parts (1)	15,0 %	3,6 %	5,1 %	1,7 %	11,4 %
Chemicals (4)	7,5 %	10,1 %	17,4 %	0,9 %	1,8 %

Cyclical Consumer Services (2)	3,1 %	1,9 %	5,7 %	2,4 %	5,9 %
Energy - Fossil Fuels (25)	7,6 %	6,7 %	6,4 %	5,3 %	11,6 %
Food & Beverages (9)	2,8 %	4,1 %	5,9 %	4,7 %	5,6 %
Industrial & Commercial Services (5)	12,0 %	17,3 %	7,8 %	3,9 %	19,2 %
Industrial Goods (4)	5,4 %	7,0 %	16,5 %	4,5 %	27,8 %
Mineral Resources (2)	30,7 %	6,6 %	6,4 %	4,4 %	30,4 %
Personal/Household Products & Services (1)	3,3 %	5,2 %	7,7 %		
Pharmaceuticals & Medical Research (3)	19,5 %	24,1 %	16,4 %	18,4 %	14,0 %
Real Estate (4)	1,9 %	2,0 %	3,3 %	2,6 %	7,4 %
Renewable Energy (4)	10,7 %	12,7 %	21,9 %	16,7 %	38,7 %
Retailers (3)	2,5 %	3,1 %	6,8 %	3,7 %	7,9 %
Software & IT Services (9)	7,5 %	10,5 %	23,6 %	11,6 %	33,4 %
Technology Equipment (4)	8,7 %	12,8 %	9,3 %	7,1 %	37,7 %
Telecommunications Services (1)	3,8 %	6,5 %	7,1 %	5,0 %	16,4 %
Transportation (6)	8,6 %	21,3 %	4,7 %	3,3 %	20,4 %
Utilities (3)	8,0 %	9,1 %	16,2 %	15,9 %	20,8 %
Mean	***7,9 %***	***9,3 %***	***10,2 %***	***6,7 %***	***17,0 %***

Figure 15 shows that the median company has steadily paid more debt than it has been issued. In contrast, the mean net issuance has been sitting around 0% between 2019 and 2021. Then in 2022 there was a sudden drop to -7.7%. This means that even though the median company has been reducing its' debt for the last few years, 2022 saw more extreme reductions.

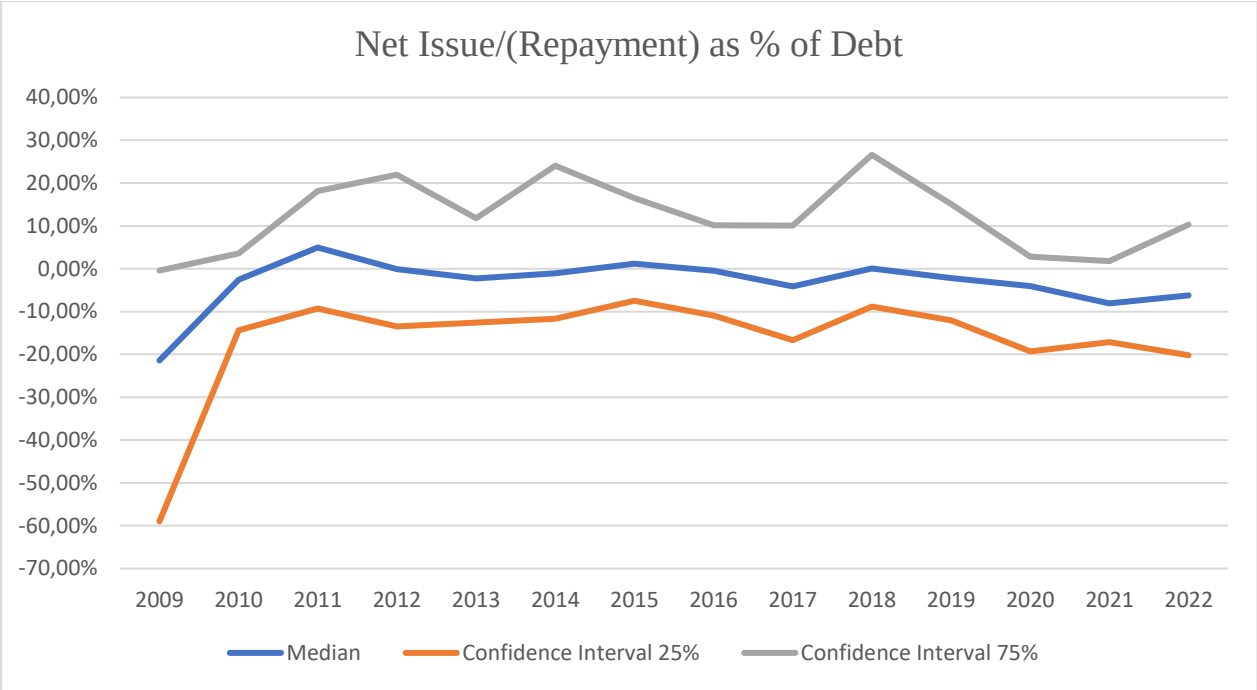

Figure 15: Net issuance(repayment)) per year, as % of average annual debt

Even though the average across all sectors had a significant increase in the amount of debt repaid, the differences across the sectors are quite significant. When looking at the pharmaceutical and medical research sector, they have been repaying debt rapidly over the last five years. When looking at 2018 they have a repayment rate of 144.2%, which in theory seems strange. The reason for the high number is that the debt used in calculating is annualized, while the repayment happens quarterly. The debt part of the equation is therefore just an average, meaning that the really high numbers just is a result of repaying a lot of debt early in the year. On the other hand, Applied Resources and Mineral Resources have been increasing their debt, even though the interest rates have risen significantly.

Table 10:Net Issuance (Repayment) of debt as a % of average annual debt all sectors.

Sector	2022	2021	2020	2019	2018	2017
Applied Resources (2)	25,0 %	36,6 %	-21,2 %	-2,7 %		
Automobiles & Auto Parts (1)	-40,7 %	0,9 %	-6,0 %	-0,5 %	12,7 %	-8,2 %
Chemicals (4)	-0,1 %	-7,5 %	-1,3 %	-2,5 %	20,0 %	-10,8 %
Cyclical Consumer Services (2)	-12,1 %	14,3 %	17,4 %	0,4 %	38,2 %	-13,2 %
Energy - Fossil Fuels (25)	-24,0 %	-3,3 %	-5,3 %	24,8 %	3,5 %	-3,8 %
Food & Beverages (9)	21,2 %	19,5 %	45,6 %	13,3 %	-15,0 %	5,7 %
Industrial & Commercial Services (5)	-34,7 %	-10,8 %	-60,0 %	8,3 %	15,7 %	-13,9 %

Industrial Goods (4)	9,1 %	0,6 %	26,4 %	1,4 %	-28,2 %	16,1 %
Mineral Resources (2)	19,6 %	-4,0 %	4,0 %	9,8 %	31,8 %	-14,6 %
Personal/Household Products & Services (1)	4,9 %	-9,0 %	0,6 %			
Pharmaceuticals & Medical Research (3)	-22,3 %	-12,7 %	-35,4 %	-33,5 %	-144,2 %	41,1 %
Real Estate (4)	13,2 %	4,4 %	8,8 %	5,3 %	-5,1 %	8,0 %
Renewable Energy (4)	10,6 %	-5,4 %	3,8 %	-11,7 %	-9,1 %	-8,6 %
Retailers (3)	-9,0 %	-17,6 %	-32,2 %	-13,9 %	-0,1 %	12,4 %
Software & IT Services (9)	-13,2 %	7,2 %	-17,3 %	0,9 %	-19,1 %	-3,2 %
Technology Equipment (4)	-1,6 %	5,5 %	-0,6 %	-149,5 %	-16,7 %	8,9 %
Telecommunications Services (1)	-6,2 %	-8,6 %	-5,1 %	19,1 %	-14,2 %	6,5 %
Transportation (6)	-20,3 %	-13,4 %	-8,8 %	-4,7 %	19,1 %	5,6 %
Utilities (3)	19,6 %	-2,3 %	58,6 %	-1,2 %	14,9 %	1,6 %
Mean	***-7,7 %***	***-0,1 %***	***-0,2 %***	***0,1 %***	***-1,8 %***	***1,2 %***

4.5. Cash Investments

In the period from 2018 to 2022 there has been a steady increase in the percentage of investments made by cash as opposed to debt across all sectors. The percentage of companies funding their investments through cash was 48% in 2018, compared to 73% in 2022. The rise has been steady with the exception between 2020 and 2021. This small dump is likely due to the post-covid boom that the entire stock market experienced, before the rate hikes set in.

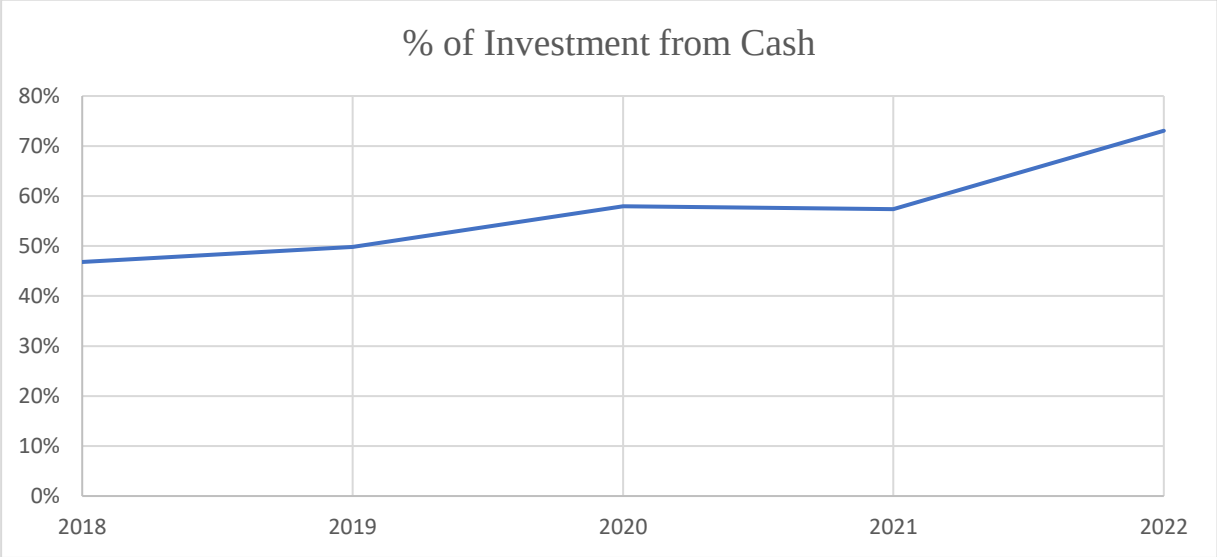

Figure 16: Percentage of investments from cash

Chemicals, Personal & Household Products & Services, Telecommunications, and utilities stood out as they solely funded their investments from cash in 2022. Pharmaceutical & Medical research along with Mineral resources and Renewable energy funded over 95% of their investments through cash. When comparing to 2021 these sectors, with the exception of Personal & Household Products & Services, have all more than doubled the percentage of investments coming from cash.

Table 11: Percentage of investments from cash by sector, YoY. Not weighted.

Sector	2022	2021	2020	2019	2018
Applied Resources (2)	58 %	49 %	100 %	30 %	50 %
Automobiles & Auto Parts (1)	11 %	0 %	100 %	84 %	100 %
Chemicals (4)	100 %	50 %	50 %	50 %	25 %
Cyclical Consumer Services (2)	50 %	37 %	41 %	50 %	100 %
Energy - Fossil Fuels (25)	70 %	69 %	69 %	56 %	59 %
Food & Beverages (9)	61 %	68 %	64 %	58 %	41 %
Industrial & Commercial Services (5)	60 %	40 %	60 %	60 %	59 %
Industrial Goods (4)	64 %	73 %	40 %	75 %	49 %
Mineral Resources (2)	97 %	50 %	0 %	100 %	50 %
Personal/Household Products & Services (1)	100 %	100 %	100 %	75 %	100 %
Pharmaceuticals & Medical Research (3)	99 %	67 %	57 %	42 %	33 %
Real Estate (4)	61 %	3 %	19 %	27 %	4 %
Renewable Energy (4)	98 %	50 %	41 %	54 %	75 %
Retailers (3)	71 %	57 %	62 %	67 %	67 %
Software & IT Services (9)	78 %	67 %	47 %	33 %	22 %
Technology Equipment (4)	75 %	64 %	45 %	25 %	25 %
Telecommunications Services (1)	100 %	24 %	0 %	28 %	14 %
Transportation (6)	67 %	45 %	80 %	27 %	37 %
Utilities (3)	100 %	45 %	67 %	33 %	33 %
Mean	***73 %***	***57 %***	***58 %***	***50 %***	***47 %***

5. Discussion

The results showed an elevated IE for both the average and median company—seen by ICR and INICR. However, some outliers affected the mean throughout the year. Mostly positive at the start, the majority of outliers were found in the negative territory towards the end of the year. As for the comparison to forecast, the results showed that the $eICR$ was converging towards zero. This implies elevated IE in line with forecast. Despite this, the $eICR$ was off by quite the margin in the first quarters. For INICR, it converged earlier than ICR, before suddenly turning quite negative in Q4. As for the prediction models success rate, results show that an equal number of companies under- and outperformed forecast.

For 2022, the average term for both loans and bonds spiked compared to the trend. For bonds, the elevated term happened for both fixed- and floating-rated debt. For loans, the two diverged with only fixed increasing significantly. During the year, the amount of debt issued in bonds as compared to loans sank drastically. The same goes for the general issuance of floating-rated debt. Additionally, the amount of debt issued in NOK rose compared to the trend. In contrast, the issuance in USD dropped significantly.

Looking at the cash balance, the median company continued to see an increase in 2022. However, weighing the cash to total capital the results show a reduction compared to 2021. Corroborating the result, the percentage of investments funded by cash rose compared to previous years. Further, the average company has also been a net reducer of debt in 2022 compared to previous years—catching up to the median which have done so since 2018.

5.1. Change in ICR/INICR, first three quarters

At first glance in Q1 2022 companies looked to fare better than in the last quarter of 2021. This seems to be caused by some extreme outliers. Interestingly, the extreme outlier was from AF Gruppen, which peaked at almost 100. While the company had a D/C-ratio of 49% for Q1, roughly 90% were leases which did not incur any recorded IE for the quarter. Consequently, the IE for Q1 was low compared to Q421, and the result was a massive increase in ICR for the start of the year. AF Gruppen was not the only company which posted

as an outlier during Q421, MPCC saw an increase in its ICR above 40 for the same period. In contrast though, MPCC had no leases, and posted a moderate 10% decrease in debt for the period—all the while IE were reduced by over 80%. Other outliers did record a significant reduction in debt for the period. Perhaps as a risk-mitigating act as future interest hikes loomed. At the start of 2022, there were yet to be considerable rate hikes from the relevant central banks—which could cause some companies to exploit the chance to refinance or pay down debt. Thus, it is also worth noting that companies that refinanced their debt at the start of 2022 ended up in a considerably better position as opposed to those who didn't refinance until the end of the year. Looking at INICR, if more companies shifted to the cash balance as the primary source of funding, both net debt and NIE should increase. For Q1 this is evident, with the ratio increasing.

The Q2 increases in IBOR happened both domestically and internationally—without the mean value of ICR turning negative. However, the rate of change trended negatively, while the skewness remained very positive — indicating outliers like MPCC and AF Gruppen. During the second quarter of the year, the oil price rose significantly. OBX hosts many companies in the energy sector, which earned record profits. Consequently, companies within this sector decreased their debt by 17%, which should result in lower IE. Furthermore, they averaged a 70% increase in their cash balance every quarter of 2022, indicating better INICR for the sector. As a result, it's likely skewing the ICR/INICR in a positive direction. Given that 25 of the 92 companies come from this sector, it's likely to influence the overall ICR/INICR for the remainder of 2022.

The mentioned extreme outliers in Q1 and Q2 for ICR decreased quite significantly in the third quarter. From the peak of almost 100, the most extreme outlier is just above 30—which still is AF Gruppen. Although high compared to Q421, the change shrunk to a third of its peak value. As a result of fewer extremes, the mean value decreases and the trend is still negative. This is as expected, given the extreme hikes in relevant interest rates that IBORs are based on, with more and more companies experiencing greater IE than in Q421. However, looking past INICRs major increase in mean value for Q3, the median was negative. With a high positive skew and particularly one extreme outlier weighing on the mean, it would seem like the INICR is turning from a positive to a negative trend. Its divergence from ICR is probably caused by increases in cash balances for companies. The question is whether this is related to the mentioned energy sector, or if it's a broader change for more companies.

5.2. Short-term actions and its effect on the final quarter

It's interesting to look at any short-term action taken by companies in response to the increase in IE derived from the interest hikes. Reduction in debt, using cash balances to fund investments, hedging gain or increase in interest-bearing cash could reduce the additional expenses. Another possibility is stock issuance, which is not directly explored in the research. However, any effect of issuance as an alternative to debt should be seen in Table 11. As for reduction in debt, the median company have done so since 2018, ranging from –4 to –8%. However, looking at the mean net reduction in Table 10, 2022 saw a 7.7% decrease compared to a moving average of roughly zero. With the mean and median diverging for many years, to suddenly correlate is rather significant. Hence, the data implies a more drastic reduction in debt for the average company than before—with some potential outliers. It's possible that the rapid decline of the mean is due to the mentioned energy sector, reporting an average 24% decrease. Looking at the quarterly change excluding the extreme outliers of the volatile minerals sector shows a shifting trend. From a modest reduction of 1.4% in Q1, it contracts to 19.3% in Q4. Further, the timing of the reduction starts in Q2, occurring simultaneously as the steepening of the rate curve started to unfold. This is significant, implying a correlation between rate hikes and reduction in debt. Hence, data suggests the average company acted to the elevated interest rates rather forcefully by reducing debt.

As mentioned, the energy sector saw huge increases in their cash balances for 2022, indicating a reduction in NIE, and thus a lower INICR. But the question remains: is this a broader change which includes all sectors? As for the other sectors, the average cash balance change increased from 52% to 75% on a yearly basis. But, excluding the effect from the Mineral Resources sector, the increase was 35%. Still, an increase that would aid in reducing the overall NIE. The average company seemed to improve their cash balance for 2022, implying lower NIE than predicted. As an alternative approach, Table 9 provides cash as a ratio of total capital—which is interest-bearing debt plus equity. This provides a weighted average like the ICR/INICR do in contrast to only exploring changes in percent. Here, the average company decreases its ratio compared to 2021—with a negative trend starting in 2020. With the mentioned 7.7% reduction in debt, the cause must be a decrease in cash. Given increased EBIT for 2022, the data implies that companies utilized more of their cash for financing—either by reducing debt or to fund investments. Based on Miller and Modiglianis' proposition, only debt reduction should influence a company's results. However, Table 11

shows an increase in cash used for investments from 57% to 73%. This contradicts the statement, implying that surging interest rates make debt unfavorable in contrast to cash. With cost of debt elevated, cash works as an alternative source of funding. Companies with elevated cash balances can in turn fund more through cash without necessarily affecting the D/C-ratio. However, short-term actions that reduce the cash balance imply an increase in NIE and INCIR. As a result, most companies are expected to see higher INICR. Consequently, the mentioned change in INICR for Q3 probably stems from the energy sector's outperformance.

During the analysis of the annual reports, many companies entered or had previously entered hedging strategies, especially IRS. Of the 92 companies 34.8% reported entering into IRS to hedge the interest rate risk associated with floating-rated debt. Including companies that reported to have no debt, the number is 51.1%. As per IFRS standard, the journal entry of a hedging instrument characterized as a perfect hedge is in other comprehensive income PricewaterhouseCoopers. (2016). Given the number of companies reporting that a significant portion of the floating-rated debt was hedged, one should expect to see an increase in the hedging accounting line. Of course, the numbers will include any gain or loss in other hedging instruments such as currency swaps. Looking at the yearly change in hedging gain reported in OCI, the median value is an 31.6% increase. However, the mean value is dragged down by renewables and automobiles reporting a loss of over 3000%. Apart from the energy sector, companies saw massive declines in their hedging instruments. It's possible that other types of swap agreements and fixed contracts weighed negatively on the general accounting line. However, with massive rate increases seen during 2022 one should expect significant gains from the mentioned IRS. To summarize, companies seem to act on the onset of higher interest rates by reducing debt and using more cash to fund investments. However, the gain from hedging instruments indicates that companies did not mitigate the risk enough to withstand the magnitude of hikes.

5.2.1. Exploring the impact on the final quarter of 2022

Did short-term actions taken by companies during 2022 have any immediate impact in terms of ICR or INICR? For ICR in Q4, the trend was still negative. Nevertheless, the rate of change improved some even with soaring hikes happening throughout the last quarter of 2022. At the same time, the skewness turned negative which means that some companies

fared worse than the rest—which is evident in Figure 6. Comparing all four quarters, it seems that the picture for Q4 is the opposite of Q1, with the outliers now mostly negative. Surprisingly, the extreme outlier is AF Gruppen with a decrease of 40 compared to Q421—which was the most positive outlier for Q1 to Q3. During 2022, the company issued a new loan with fixed rate which increased their amount of debt ex lease by 250% compared to Q421. Consequently, the IE increased by 140% for the same period. Assuming the company issued the loan based on their credit spread, they must pay between 4-6% interest as a minimum, excluding all other factors. It's highly probable that the actual interest rate is even higher. Consequently, AF Gruppen's weighted-average interest rate doubled from 3.15% to 6.39%. Given the low reported interest on lease debt, the change is rather significant.

While ICR continues with a negative trend, INICR turned from peak in Q3 to a negative trend, going from 14,42 to 4,93 scaled by 100. With the increased cash balances for the energy sector its weight could influence INICR. However, more companies from the remaining sectors turning to cash for funding would cancel some of the effect. While the median was negative for Q3, it has again turned positive, as the mean is primarily weighed down by outliers seen in Figure 8. The most extreme outlier is Hunter Group, which sold off all its assets during 2022 and in turn maturing all outstanding debt. The next most extreme outlier is Havila Group, which turned NIE from positive to negative. While some of the change is explained by the 46% increase in cash, half the company's debt is convertible loans. Although they do not carry any immediate interest, they will potentially be converted to equity leaving the company and shareholders worse off. Hence, the most likely explanation is the influence of the energy sector's increased cash balance.

5.2.2. Exploring the impact compared to forecast

Ultimately, there is not any clear sign of companies' short-term actions affecting the trend for ICR or INICR. They could have eased relative to the forecast changes. If so, it would insinuate that companies have acted during 2022 to minimize their exposure to higher rates in one way or another. Looking at the residual from ICR for the first half of 2022, the average is positive for Q1 and Q2—although the same extreme outlier from AF Gruppen and MPCC affect the mean value. This is reflected in a skewness of 5,43 and 3,74 respectively. Excluding the outliers in Figure 11, the concentration of residuals is positive—which coincide with the positive mean from ICR. As mentioned previously, the biggest increase in interest hikes started later in the year. Therefore, it's fair to assume that most companies did not act before later in the year. However, the residual in ICR is positive. Given that the prediction is based on IBOR rates at the end of each quarter, it's possible that there is a lag in the transferal of increases in interest expense for floating debt. Also, it's common that some floating-rated bonds update the IBOR-element in the interest rate every six months. As for loans, Norwegian law requires at least six weeks' notice before raising the interest rate—creating lags from IBOR increases to elevated IE for companies. Summarized, it would indicate that the positive change in the residual measured in the first half of 2022 is due to a flaw in the prediction model, rather than actions taken by companies. Given the magnitude of interest hikes starting late in Q2, it's possible that there is a higher spread during the second half of 2022.

Comparing the residual of INICR to ICR for the first half of 2022, the results diverge. Despite Q1 showing the same signs as ICR, Q2 turns negative for the residual. While the mean rounds to zero, there is a spread compared to ICR—as well as an increase in skewness. This could indicate that most companies are trending towards the forecast (or worse), while some surprise to the upside—given the increase in skew. What could cause the spread between ICR and INICR? The only difference between the two ratios is the interest-bearing cash balance. Observing the change in cash for each quarter compared to Q421, Q1 and Q2 reports an increase of 14.22% and 9.37% respectively. However, excluding the mentioned outperforming energy sector from the statistics, the result is a 6.51% increase in Q1 and a decrease of -3% for Q2. On that basis, the average company ex energy drained its cash balance in Q2. How do Miller and Modiglianis' theorem compare to that result? Given the increase in EBIT for 2022, it's probably due to the mentioned increase in cash as the source for funding investments. Thus, it coincides with the increased cost of debt due to elevated

interest rates and a riskier environment. Consequently, it causes lower interest income and INICR. Given a shift towards equity, the results in Q2 contest Miller and Modigliani's proposition.

Further corroborating the "cash drain" explanation for the divergence in Q2 between ICR and INICR is the result for Q3—which is turning positive for the mean. Yet another quarter where ICR and INICR diverge, just the opposite way from Q2. Checking the change in cash balance for Q3 excluding energy, there is an increase of 19% compared to Q421. However, the median is continuing to decline. Exploring the quarterly change from the appendix shows that the main contributor to the increase in cash balance came from the minerals sector, which saw over 700% increase for Q3. Excluding it, the change kept almost steady with Q2. As a result, it seems as if some positive outliers are weighing the mean in the positive direction. Hence, it's probable that the cash drain is causing the actual INICR to be worse than predicted for the average and median company—causing divergence with ICR.

Despite a high residual for ICR at the start of the year, the average and median for Q4 are almost exactly in line with the forecast. Moreover, the forecast seems to lag the actual reported IE in the first half of 2022, while catching up in the last period. However, looking at the boxplot in Figure 10, there are more outliers than previously with the majority being negative. This is corroborated by the standard deviation, which ticked higher compared to the decreasing trend from the previous three quarters. Thus, the outliers cancel each other out, seen with a low skew compared to previous quarters. Still, the majority of residuals seems to center around zero for the final quarter. The mentioned lag in floating-rate loans and bonds could be one reason for the low residual. As for INICR, the average company feared far worse than predicted for Q4. But the drop is not justified when exploring the median—which improved compared to Q3. It looks as if extreme outliers weigh the mean negatively, corroborated by the almost -8 change in skew. Leaning on the "cash-drain" explanation, cash ex minerals and energy improved to 11.25% compared to Q421.

Given that the arguments for the lag in prediction are valid, there is an indication that the median company did not act to the elevated interest hikes. The median company fared just as predicted, resulting in vast increases in IE compared to 2021. Summarized, the residual ICR converges to zero, indicating that short-term actions taken by companies during 2022 had no material impact on the IE compared to the initial prediction. As for INICR, the median

company seems to have drained enough cash to produce results worse than estimates—including some extremely negative outliers. Consequently, there is a discrepancy. Companies are reducing debt and using more cash to fund their operations, but the residual for ICR in Q4 indicates no effect.

Table 4 strips away the value and instead looks at each company unit-vise—providing statistical data unaffected by outliers. Coinciding with the residual and interest rate hikes, the actual and predicted decrease of ICR elevate throughout the four quarters. Further, the number of companies increasing their ICR when predicted decreases from Q1 to Q4. All three factors corroborate with the arguments in the discussion above. However, comparing them tells a different story. For Q4, with the residual almost zero, 57.3% of companies were expected to decrease their ICR. Despite this, only 27.5% of those companies reported it—which is irregular. Consequently, it's probable that the prediction on average misses as much to the downside as it does to the upside—cancelling each other out and averaging to zero. Another explanation is that companies expected to see vast increases in IE, acted to avoid it through the mentioned short-term actions. At the same time, companies forecast with small changes issued debt—which incur high interest rates given the surge in credit spreads. It would indeed explain the discrepancy seen in the data mentioned previously. Exemplified with AF Gruppen, which as mentioned went from the most positive to negative outlier in ICR due to issuance of new debt. Further, exploring the companies with a negative change yet outperforming forecast—the number increases from Q1 to Q3 before retracting some. Still one fourth of companies doing poor acted in some way to ensure that the result became less costly. The latter explanation seems more reasonable, which would contradict the assumption that short-term actions taken by companies had no material effect.

As for INICR, the result coincides with ICR with only a small deviation. Where the number of companies decreasing ICR went higher in Q4, the opposite effect was for INICR. The number of companies faring better than in Q421 ticked up in Q4, with only 42.4% reporting an increase as for 52.2% in Q3. This further corroborates the findings mentioned earlier in the discussion regarding the correlation to cash drain.

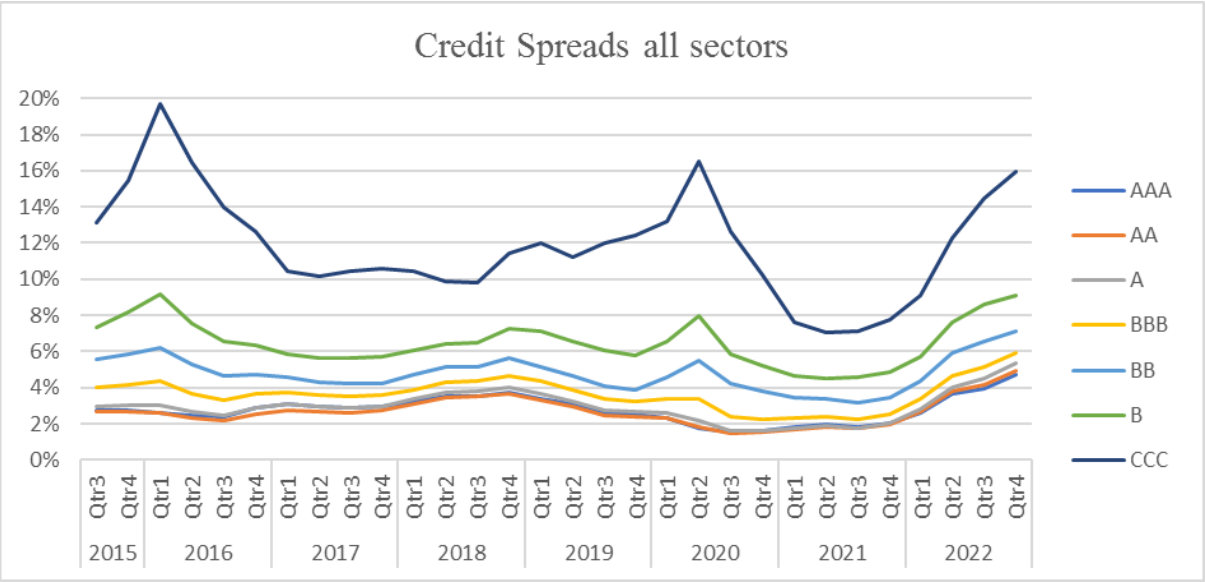

Figure 17: Credit Spreads all sectors, based on data from https://fred.stlouisfed.org/series/BAMLC0A4CBBBEY#0

To further elaborate on the findings in Table 4, credit spreads for all ratings have surged in relation to the hikes in interest rates. As per Figure 17, the different B-ratings have doubled in yield compared to 2021. Most of the companies measured have a rating in the range of BBB to B, implying an elevated level of refinancing costs. Data extracted from Refinitiv show that the number of net issuers of debt went from 7.6% in Q1 up to 26.1% in Q4. Back to Figure 17, there is a steep increase in B-rated yields from Q1 to Q4. More companies issued new debt while the credit spreads surged—implying an increase in IE. Further, the number of companies net reducing their floating-rated debt increased from none to 14.1% in Q4. Given the mentioned "cash-drain" and increased EBIT in 2022, it's possible some of that cash went into down payments. Consequently, 14.1% of companies reduced debt that were predicted to elevate their ICR/INICR during the final quarter. As a result, it creates higher residuals. Summarized, the data implies that 26.1% of companies perform worse than predicted, and 14.1% perform better. Without any further analysis, it's probable that this effect to some extent cancels each other out, leaving the residual close to zero.

5.3. Change in actual ICR/INICR on an annual basis

As all ICR/INICR data uses the EBIT for Q421, it's interesting to compare it to the actual ratio on an annual basis. Table 5 summarizes actual ICR on an annual basis for all companies, with accumulated IE and EBIT for all four quarters. Looking at all sectors, the mean and median company improved their ICR compared to 2021. Despite an increase in IE, the surge in income seems to outweigh the expenses. Year-on-year, the average EBIT increased by 219%, with a median of 25.3%. Thus, it would appear as if the average company had no immediate reason to act on the increased cost of debt—except gaining better margins. With all that happened in 2022, one could assume that companies decided to focus on other matters than their increased expenses when the result was an improvement. However, stripping out the deviating energy sector, the data fits the narrative drawn earlier. Both the average and median company reduced their ICR by –2.8% and –3.8% respectively. One could argue that a 3-4% contraction given the vast increases in IBORs proves that most companies succeeded with their capital structure. But, adding in an 82% average increase in EBIT implies that the resulting IE elevated by 87.7%! Using the same implication for all companies, IE increased on average by 161.1%. ICR contracted despite major growth in EBIT, proving that the average company occurred increased IE in line with the interest hikes affecting IBORs. With a more suited capital structure, the average company could have increased their margins significantly. But the increased cost of debt cancels out the growth in income.

The results are interesting. On one side, the energy sector sees increased annual ICR due to record profits. On the other, the average company sees contraction in its ICR—with the median just above what's normally considered a red flag. Given the size of the sector, it's easy to ignore the massive increase in expenses for the average company on the OBX. As for cost of debt, the energy sector is often associated with higher risk, given its dependence on the spot oil price. In turn, the sector is expected to see the most elevated cost compared to the other. This indicates that the average result could have been even worse, had it not been for their abnormal profits. But the current inflation peaks seen around the world were highly correlated with spikes in the oil price. This indicates that interest hikes and record profits coincide with one another. To summarize, most of the surge in IE is hidden in the average data due to record profits from the oil companies. Looking past energy, the results stink.

Given the average increase in cost of debt explored through ICR, can it all be related to the floating-rated instruments and issuance of debt during a period with elevated credit spreads? During 2022, the USD has strengthened against NOK by almost 17%. For companies with dollar-denominated debt, the strengthening implies an equal elevation in IE. For companies reporting in USD with debt in NOK, the opposite is expected. The same goes for debt or reporting in other strengthened currencies, like EUR and GBP. The effect is difficult to measure given the possible cross-currency swaps but is definitely something that can create outliers in the residual.

5.4. Long-term actions regarding capital structure

What about long-term actions given the current environment regarding cost of debt and equity? Firstly, looking at the percentage of new issuances which are bonds it constituted only 7.3% in 2022. Compared to a 5-year average of 32.9%, it looks as if companies turned away from bond issuance in the wake of tighter lending conditions. Compared to the financial crisis and the European debt crisis starting in 2008, there was a spike of 82.7% before contracting to 12.9% and 3.5% in 2009 and 2010. The debt crisis in Europe showed similar signs as in 2022. Why do companies seek loans in times of uncertainty? Loans are issued through a bank, which may offer flexible terms that are negotiable during the term. As for bonds, except for the call option there is minimal flexibility during the period. Further, bonds react quickly to changes in credit spreads while loans do not. Also, interest rates on loans are easier to negotiate if market conditions ease, compared to bonds. If that's the case, it's probable that companies believe the current interest rates will decrease soon, giving them the opportunity to renegotiate.

As previously mentioned, 14.1% of companies reduced their floating-rated debt during Q4. While it reduces IE short-term, it's also a long-term action regarding the company's capital structure. Given the argument in the previous paragraph, issuance of loans could imply that companies bet on reductions in interest rates. If so, one should expect companies to generally issue floating-rated debt and rather pay down fixed debt. Nevertheless, only 7.4% of issues in bonds and loans were floating-rated in 2022. Compared to a 5-year average of 31%, it indicates a significant contraction compared to the trend. Further, half as many companies

reduced fixed debts as floating-rated. This does not corroborate with the rate-cutting story. While issuing floating-rated debt is a bet on rate cuts, fixed-rated is the opposite. However, it could be other reasons for companies to issue fixed- over floating-rated debt given the current market conditions. It might be that most companies view issuance of fixed-rated debt as risk mitigation regarding interest rate risk. If so, it's regarded as an insurance more than a bet on rate hikes.

Exploring the average term for new issues, bonds and loans increased to 8,4 from a 5-year average of 5,6 combined—above the 75th percentile historically. Looking at loans separately, the elevated average term is only due to elements with fixed rate, since the floating-rated were unchanged. Compared to the theory that companies expect rate cuts, this follows the line of data points contradicting it. More companies locking in higher IE for longer periods than usual seems strange, unless the general view is to insure against further increases in rates. It's probable that companies assess it too risky to hold floating-rated debt over longer periods in uncertain times. While issuance of fixed-rated debt constitutes higher IE, it's also predictable—gaining certainty in a company's future cost of debt under tight lending conditions. It greatly reduces the risk associated with potentially higher interest rates in the near term. Given that the average company only saw a 3-4% decrease in actual annual ICR, companies would be more inclined to accept the current market conditions. Additionally, some companies could be compelled to issue debt at longer terms, given their current credit rating, capital structure and outlook. If the other options are exhausted, or inducing higher costs, fixed-rate loans at longer terms make more sense.

As for bonds, the average term doubles. It could be an implication of very few data points due to the mentioned decrease in issuance. However, the few companies funding through bonds locks the maturity farther than before. Compared to loans, the divergence comes from floats increasing more than average, contradicting to some extent the arguments in the previous paragraph. Like the financial crisis in 2008—which saw the average term spike to 25 from a 5-year average of 8, there are divergences between loans and bonds. Both periods hold similarities, with elevated interest rates, a tighter lending pool and general risk aversion. Further, the ratio of bonds as percentage of total issuance were around the same level in 2009 and 2010 as seen today—although it constituted 82% of it in 2008. If the two periods are similar in nature, then the data corroborates the argument for a general risk mitigation strategy

amongst the average company today. Consequently, the majority shy away from bonds, while those who do lock them in for longer periods.

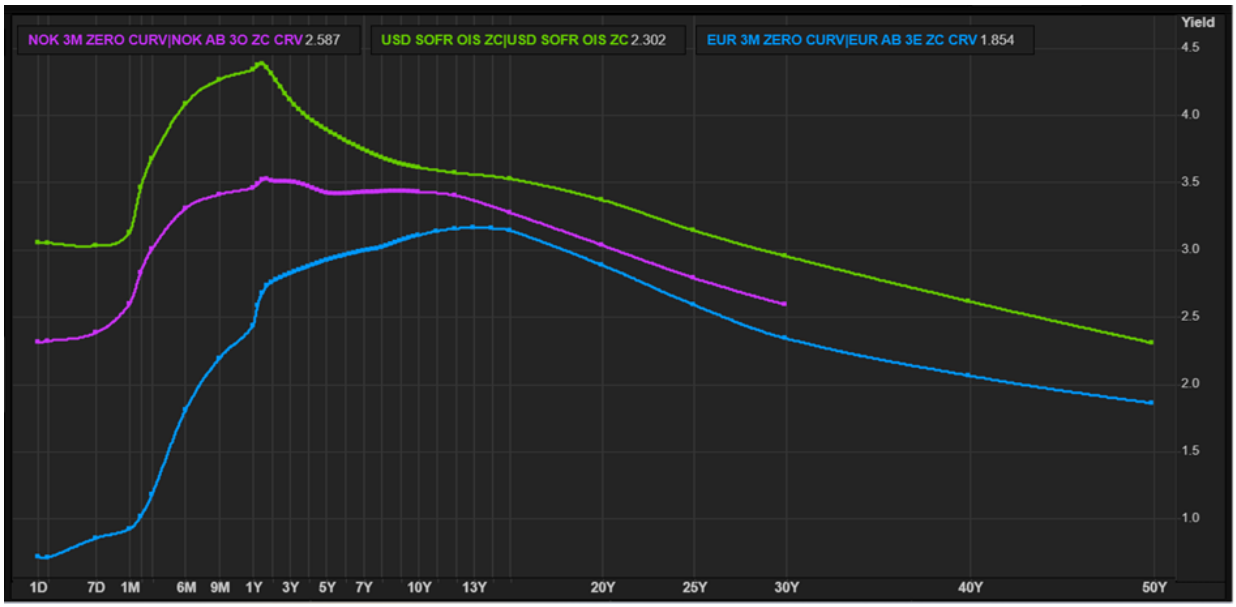

Figure 18: Yield curve of US, Norwegian and European rates, dated 30.09.2022, from https://emea1-apps.platform.refinitiv.com/web/Apps/curvechart/

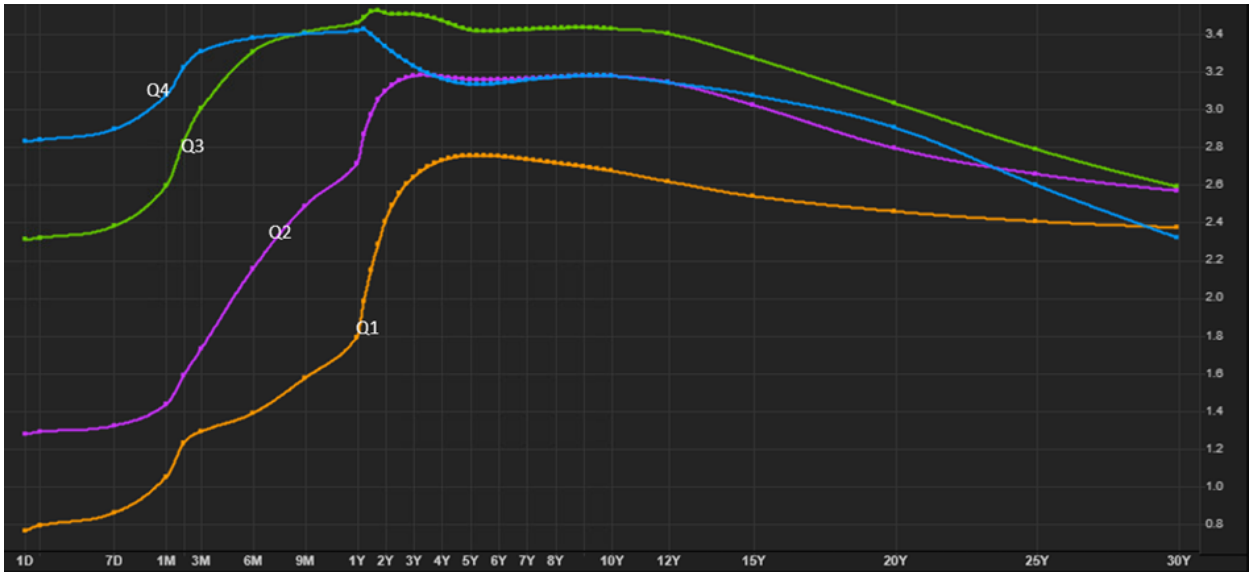

Figure 19: Yield curve for 3-month NIBOR, all quarters of 2022, from https://emea1-apps.platform.refinitiv.com/web/Apps/curvechart/

While the data mentioned points towards risk mitigation as the general strategy, the yield curve shows that companies were incentivized to issue long-dated debt. Viewing Figure 18, rates for longer-term IBORs are beneath short-term, also known as yield curve inversion. The implication is first and foremost that markets bet on rate cuts in the near term. Thus,

companies could “strike a bargain”. Firstly, companies with inferior credit rating and worsening outlook have more to gain on long-dated fixed debt than short-dated or floats. Secondly, the average company with maturing debt has an opportunity to refinance at a lower cost than what the current market conditions imply. Thirdly, all companies interested in mitigating its interest rate risk can insure themselves by locking in lower rates for increased periods of time. Looking at Figure 19, as quarters passed the rate curve elevated. As a result, companies bound to refinance or invest in 2023 see increasing risk to its cost of debt every day they wait to issue debt. This could influence some of them to lock in rates to reduce the risk of even higher rates next year. Ultimately, the average company can avoid an incremental increase in the cost of debt and at the same time mitigate the interest rate risk. Conversely, it seems as if companies are in no need to bet on rate cuts, as the markets have done it for them. This further corroborates the assumption that the average company’s long-term action towards debt issuance is to mitigate risk.

What about the issuing currency? As mentioned, companies with debt in either USD or EUR saw elevated market value for their debt. Per 31.12.2022 both currencies traded above 10 compared to NOK. With the USD’s increase in 2022, it is possible that the ratio will fall to some extent soon, reverting to mean. If companies believe that to be the case, they should indeed issue debt in USD. However, only 11% and 3.7% of loans and bonds respectively have USD as issuing currency—considerably lower than their 5-year average. For bonds historically, companies have issued most of their debt in USD at periods where it was weak compared to NOK. Consequently, when the risk is to the upside, companies seem to bet on reversion to the mean. But, in the opposite direction, there seems to be more risk aversion—by issuing in NOK. This in turn coincides with the risk mitigation assumption.

There are indications that more companies prefer their cash balance for investments. Contradicting Miller and Modiglianis’ theorem, it’s possible that companies regard the cost of equity to be lower than cost of debt. In contrast, as the risk-free rate has increased in line with other IBORs, the cost of equity is elevated too. Further, companies can have thresholds regarding D/C-ratios, ICRs and covenants—hindering net issues of debt. However, those thresholds should not affect pure refinancing. Thus, the average company should be able to issue debt without breaching any agreements. The question is then why most of them decide not to. With the average company reducing its debt by 7.7%, and simultaneously elevating cash as funding to 75%, the trend is towards equity. Given that the risk mitigation assumption

is correct, companies choose to fund by cash now to reduce exposure to higher IE. If instead companies bet on rate cuts, companies use cash now because they are waiting for better conditions to issue debt. Given the data point of cash balance and I&R, neither assumption can be excluded. But if any of the assumptions are correct, they contradict Miller and Modiglianis' theorem.

Ultimately, most of the data coincide with the theory that the average company's long-term action regarding debt issuance is to mitigate further interest rate risk. The assumed general strategy is to issue loans at a fixed rate for longer periods of time, resulting in lower rates relatively and avoiding exposure to rate hikes. Nevertheless, that strategy has implications, with elevated cost of debt for a longer period regardless of rate cuts. However, it's possible that the short-term actions could eventually have an effect, which would cancel some of the increased cost of debt.

5.5. Recommendations for Further Research

Continued research on the subject that includes 2023 and further would offer more explanation on the actions taken by companies. Also, the continued implications of the long-term actions taken during 2022 for the future market environment. Especially if the rate level should change during 2023 or later.

The research suggests that companies would gain on a proactive approach towards interest rate risk management.

6. Conclusion

How did companies act to elevated interest rates in 2022, and what was the effect on their cost of debt compared to their own risk analysis? The discussion section consisted of three main parts: how companies' cost of debt changed during 2022, what short-term actions were implemented to reduce exposure with any resulting effect compared to forecast, and lastly any long-term actions given the tight lending environment.

Companies in the research saw higher cost of debt during 2022. Positive outliers elevated the mean ICR value at the start of the year—coinciding with low policy rates. Most companies saw an increase in IE early on, which continued to worsen in line with the increased IBORs. This led to the ICR continuing to decrease quarter by quarter, ending 2022 with a negative trend. As IBORs increased rapidly, the majority of the outliers were negative at the end of the year, compared to the start as mentioned. Affecting almost every sector, energy outperformed during the year due to record profits. The sector continued to influence the statistics positively throughout the year consequently.

For the actual ICR with correct EBIT, the mean was inflicted by the energy sector's surge in profits. Excluding it, the average company saw a rather small decrease due to abnormally high EBIT during the year. The effect of elevated cost of debt were mostly affecting the net income, cancelling out any gain from the growth in EBIT—keeping the profits steady.

As for short-term actions, the average company implemented some measures during the year. Most companies were reactive, acting in response to elevated rates rather than insuring against the risk. The recurrent measures were to reduce debt and to finance investments with more cash than previously. In spite of this, data suggest no immediate effect on ICR for the final part of 2022.

Compared to the forecast, most companies fared better than predicted at the start of the year. This is probably caused by a lagged impact from the rate hikes and positive outliers. As the IBORs started to affect the floating-rated debt, the average company fared in line with expectations. However, high standard deviation and a significant amount of under- and outperformers implies mixed results. Consequently, data suggests that an equal number of

companies reduced their exposure to elevated interest rates, as companies that refinanced at a high cost. As the lending environment tightened, issuance of new debt became increasingly expensive, leading to underperforming companies. In contrast, some companies' short-term actions seem to withstand the elevated interest rates—leading to the mentioned outperforming companies.

Long-term actions in the current lending environment can be split into bets on either rate cuts or risk mitigation on a general basis. Data suggests that most companies preferred the latter, ignoring the market's expectations for future IBORs. Conversely, actions taken involve reducing exposure to floating-rated debt, avoiding dollar-denominated debt, issuing fixed-rated debt for abnormally long periods and turning to equity as the primary source of financing. Consequently, the average company accepts higher levels of IE to insure against further increases—accepting elevated cost of debt for the near future as a result. Even with the yield curve dampening the cost for longer-date issues, predictability seems to triumph profitability.

To sum up, companies saw elevated cost of debt throughout the year—partially saved by the increases in EBIT. During the year, most companies implemented actions both short- and long-term to combat the steepened rate curve. Of those actions, the average strategy was to mitigate the risk of further rate hikes compared to bets on rate cuts, especially for the long-term. A significant number of those companies saw the material effect of their short-term actions during the year, outperforming forecasts. However, approximately the same number of companies performed worse than forecast, leading to the average company's actions having no short-term effect compared to its prediction.

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8. Appendix

All appendixes, including research, analyses, data and figures can be found at the following link:
Link to appendix files

Table 12: Change in cash balance by sector, YoY. Not weighted

Sector	2022	2021	2020	2019	2018	2017
Applied Resources	9 %	115 %	-4 %	75 %		
Automobiles & Auto Parts	315 %	-24 %	167 %	-57 %	14 %	-13 %
Chemicals	68 %	-2 %	181 %	19 %	17 %	15 %
Cyclical Consumer Services	130 %	-27 %	55 %	28 %	28 %	-33 %
Energy - Fossil Fuels	100 %	35 %	36 %	608 %	-3 %	6 %
Food & Beverages	20 %	102 %	375 %	53 %	40 %	38 %
Industrial & Commercial Services	-17 %	64 %	743 %	4 %	47 %	31 %
Industrial Goods	-1 %	9 %	687 %	-16 %	34 %	40 %
Mineral Resources	1818 %	13 %	49 %	20 %	-31 %	61 %
Personal & Household Products & Services	-27 %	14 %				
Pharmaceuticals & Medical Research	-4 %	426 %	70 %	100 %	13 %	118 %
Real Estate	-17 %	-7 %	44 %	29 %	-18 %	39 %
Renewable Energy	-7 %	22 %	224 %	43 %	25 %	-21 %
Retailers	44 %	-31 %	25 %	65 %	39 %	29 %
Software & IT Services	-16 %	25 %	271 %	39 %	39 %	17 %
Technology Equipment	11 %	86 %	29 %	97 %	20 %	-7 %
Telecommunications Services	-36 %	-24 %	43 %	-23 %	-5 %	66 %
Transportation	2 %	122 %	29 %	9 %	39 %	0 %
Utilities	-30 %	-28 %	58 %	31 %	126 %	-22 %
Mean	***75 %***	***52 %***	***155 %***	***196 %***	***20 %***	***18%***