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"An investigation of *Abnormal Returns* in Distress Exchange: A Norwegian Case"

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ABSTRACT

The main objective of this research is to investigate whether distress firm creditors get better or worse recoveries during the financial restructuring process in Norwegian Bond market. To investigate that question we have created a sample using Norsk Tillitsmann database. For the criterion we needed firms in the data sample that went through financial restructuring due to financial distress or financial. We managed to get hold of ninety seven bonds using the above criterion. The sample was composed of different classes of bonds according to their seniority, but majority was senior secured and senior unsecured bonds. We have also divided the sample into five broader industry classifications and the majority of the sample firms were oil and gas related.

During the literature review process we came up with a few hypotheses and tried to find evidence of them in the sample. For this purpose we conducted a layman analysis, i.e. descriptive analysis in which we came to conclusion that creditors are better off if the borrower is in oil and gas industry and if they hold senior secured or senior unsecured securities. We also found descriptive evidence that debt exchange produce higher "abnormal" return for distress firm's creditors than debt to equity swap.

Finally we conducted statistical tests on the sample to find the evidence of stated hypotheses to see if the results are statistical significant or not. The results were not significant to the hypothesis that seniority and collateral leads to higher abnormal returns; however there are strong indications that the industry as well as debt exchange or equity swap are relevant factors for higher abnormal returns.

Also examined was if bondholders recoveries are being affected by the gearing (leverage) of the distress firm and also by the time to maturity (settlement date) of the bonds. In regression analysis we did not find both of these to be significant affecting bondholders' returns however we did notice that almost all of the firms had 66% to 80% debt in their capital structure. As well we believed that high leverage is the reason for them to be in distress. In our sample of there is one financial restructuring (Sevan Marine ASA) that stands out with the clear violation of Absolute Priority Rule (APR), and there were other minor APR violation in not so strict sense.

The final conclusion we drew from analyzing the sample is that a creditor's or investor's in the Norwegian bond market should place themselves in the Oil & Gas industry and negotiate for debt exchanges during restructurings process to get higher abnormal returns.

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1. INTRODUCTION

Financial distress is a condition, where a firm has broken or finding it hard to honor the promises made to creditors. The most comprehensive definition of distressed and marginal firms is found in (CHAN & CHEN, 1991). They have defined a distressed firm as one that "have lost market value because of poor performance, they are inefficient producers, and they are likely to have high financial leverage and cash flow problems. They are marginal in the sense that their prices tend to be more sensitive to changes in the economy, and they are less likely to survive adverse economic conditions." Important question that arises in here is why to rescue a trouble company when it has no viable future in the long term? To answer this question we have to look into the concept of market-based economy, if the liquidation value of a distressed firm is greater than the realized value as an ongoing concern, then the distress firm should be liquidated and financial, physical and human resources are to be released for more productive use in the economy (Chatterji & Hedges, 2001). However, if the realized value is greater than the liquidated value of the distressed company, the stakeholders and economy would benefit if the firm is rescued. Often in practice it is very difficult to accurately determine whether the firm has a viable long term future and should be rescued or whether it should be liquidated. To some extent this could be attributed to the fact that managers have superior information regarding the company then stakeholders, and liquidating a company is against their interest even though it may be the best option available. This information asymmetry gives rise to lot of uncertainties among stakeholders during the financial distress.

Creditors in a financially distressed firm face a dilemma, in which the firm cannot fulfill its' commitments towards the creditors because of insufficient cash flows. Then the creditors have to choose between selling their securities at market price, which is very low compared to the nominal value of security, or accepting the distress exchange in the form of debt exchange or debt to equity swap[1]

The main objective of this research is to investigate whether creditors in the Norwegian bond market obtained higher or lower return when they accept the restructuring deal put forward by management as compared to trading price returns. We call this measurement "abnormal returns" in a sense that if the return of accepting the deal has positive value then creditors got a good deal and vice versa. The term "abnormal return" is preferred because it can have a

[1] [1] Debt exchange (for detail see section Distressed Exchange 4.1.5) and debt to equity swap (for see details section 4.1.6).

both positive and negative value and convey a meaningful explanation to the creditors and readers of this research. As well it measures the "extra" returns credit-holders of financially distress firm earn by not selling their security at the market price to earn trading price recovery. Trading price recoveries is an elusive concept in a sense that we are taking the average trading price recovery of a same class of securities and comparing it with ultimate recoveries (discounted value of cash flow and equity value if any, of restructuring proposal). There could be many factors that could affect the trading price recoveries, one such being is the market or fund liquidity, if the funds available for distressed investments are not enough to cover for the distress investment opportunities. This is much harder to measures because of information access and also it is beyond the scope of this study.

2. Research Question and Hypotheses

The central question this research is investigating is *"whether creditors in financial distress firm are obtaining higher returns than trading price returns during the financial restructuring in the Norwegian Bond Market?"* Along with the central question the following hypothesis that emerged during the literature review process are to be confirmed or rejected by analyzing the sample for the study.

- *Distressed firm's creditors only accept the restructuring deal when their ultimate recoveries are higher than trading price recoveries i.e. (have positive value of abnormal returns).*
- *If distressed firm's creditors accept the restructuring proposal then their recoveries should not depend on which distress exchange instrument is used i.e. debt exchange or debt-to-equity swap.*
- *When distributing the value to creditors in financial restructuring Absolute Priority Rule (APR) should hold up.*

3. Importance of the research

According to the authors' point of view this study has far reaching implication, in the sense that this study can enhance the chances of sound investments in the bond market in general and mitigate the risk associated with holding distressed bonds in particular. The first option is for distressed securities investors, and the second would be more inclined to help large fund

holders of bonds in the portfolio to decide if holding the bond throughout a restructuring of a borrower in distress is worth risk taking for.

The study can have a profound impact on financial distress creditors' decision making e.g. their decision about what class of securities to hold, decision about which type of restructuring instrument (debt exchange or debt-to-equity swap) to accept in the restructuring negotiations. As well with the help of this research the creditors will have a significant insight to all the issue related to restructuring of a distress firm. This study will contribute toward the better understanding of financial restructuring process because of financial distress from the creditors point of view and the reason being is during the literature review we have not come across a research which has looked into the matter from creditors point of view, and measure if the creditors were better or worse off as a result of restructuring proposal. Even though creditors have their own risk preferences but with the help of this study they will get an insight into risk associated with different class of debt claims for distress firm.

Financial institutions that are engaged in the consulting business can also benefit from this study, by giving advice to creditors and distressed firms alike as to which course of action is in their best interest to remedy financial distress, and to acquire better returns than trading price returns in case of creditors.

It also serves as a thesis to gather ideas for future students in finance and business to either test the results of this thesis, or develop the models further than what is done in this thesis.

4. Theoretical foundation

This Thesis is divided into different sections. These sections are set to mimic the narrative of the whole thesis.

Section 4 will lay down the theoretical foundation for the thesis by defining various concept used in the thesis like distress, defaults, restructuring etc. As well it will explain different instruments used to resolve distressed situation. Along with that this section will also present theory regarding calculate recovery rates, absolute priority rule and what is order of priority of claims in Norway.

Section 5 will describe the different valuation techniques used to value distressed exchange instruments. This is an important section because it forms the foundation for the calculation of

the value of the restructuring proposals to the bondholders. This in turn will be used to calculate "Ultimate recovery" and "Abnormal returns".

Section 6 with explains the measurement called "Abnormal returns" that has been used in the thesis. The term abnormal return measure is nonexistence in the literature review performed. This is not to say that it cannot exist, perhaps described in another form however it was not come across in the literary review.

Section 7 will describe the sample data in details.

Section 8 will describe different analysis methods used to analyzed sample data. Mainly Descriptive analysis in which data will be analyze in the form of table and graphs for the layman to understand the association between abnormal and ultimate returns and various bond characteristics. This section as well has statistical analysis. It will explain and describe the different statistical models that are used in the thesis. As well this section will test whether the results obtained in statistical tests can be used for statistical inference by using Best Linear Unbiased Estimator (BLUE) criterion.

Section 9 will mention in detail the limitation for the thesis and suggests issues for further research.

Section 10 will have a detailed conclusion based on the descriptive and regression analysis and reason for getting specific results.

4.1. Distress, Default, Restructuring & Recoveries

4.1.1. Financial Distress:

A firm is said to be in financial distress when it cannot honor its commitments to creditors, then lenders have the option to restructure the loan or foreclose. In case where lenders decide for liquidation, they either sell the assets immediately or sell it on a later date, it is costly for lenders to carry an asset in inventory(Brown, Ciochetti, & Riddiough, 2006).

Financial distress in a firm occurs when operating cash flows of the firm are not adequate enough to fulfill debt obligation and this will force the firm to make some corrective actions. The consequence of the financial distress could be that it can default on its debt obligations this can either lead to either liquidation or financial restructuring; financial restructuring could be private workout or in court legal bankruptcy proceeding. Financial distress for firms does

not means that they will cease to exist. There are difference techniques used by the distressed firms to solve financial distress, which are as followings

- Divestment of assets.
- Issuing new securities.
- Debt for equity swap.
- Negotiations with creditors to amend term/terms of covenant.
- Filling for bankruptcy proceeding.

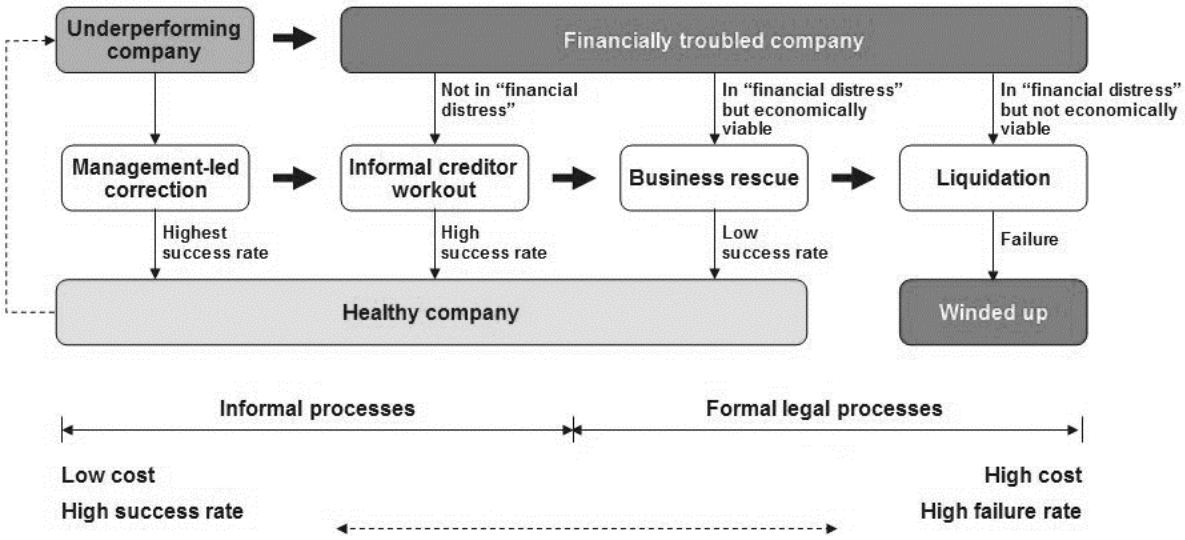


Figure 1: Timeline of financial distress firm adopted from adopted from (CRS, 2008)

Figure 1 depicts the timeline of a financial distressed firm when it is underperforming, in the first phase management will make some corrective action to fix the problem, normally banks or major creditors consent is not required but maybe informed as a matter of courtesy. The management led actions are taken before the financial health of the company deteriorates further and creditors become concerned about the future of the firm. Normally management led corrective action have a high level of success rate either because the problems are not too severe or that the management is in the best position that understand the problem and suggest solutions. These management led corrective actions can lead the financially underperforming firm to a healthy company or the firm continues to underperform and then get into the situation where its operating cash flows are not enough to cover the debt obligations (interest payment and installment) it has, then the company is in serious financial distress, at this point firm's management has to inform creditors about the situation and work-out a solution to reduce the firm's liabilities so that it can reemerge as a financially healthy firm. There are

number of ways creditors can help reduce financial obligations of the firm, such as by extending the maturity of the loan, lowering the interest rate, reduction in the nominal debt amount and even debt for equity swap. But all this is conditioned on one major point i.e. whether distress firm has a viable economic future or not, if creditors believe that the firms has a viable economic future they will work together with the management and will find the solution to distressed situation and as a consequence firm might emerge as financially healthy state, but if they do not see that the firm has a viable economic future they will prefer to liquidate the firm for the fulfill their claims.

It is also important to explain the difference between insolvency and financial illiquidity (cash flow insolvency). The insolvency occurs when the firm's assets are less than the value of its debt and cash flow insolvency occurs when the firm's operating cash flows are not enough to cover its contractual obligations towards the debt holders.

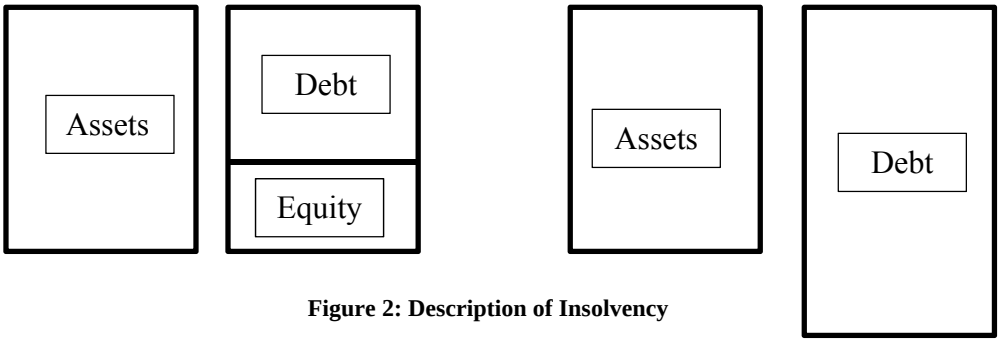


Figure 2: Description of Insolvency

In the left hand side of Figure 2 it is clearly evident that value of firms assets are more than debt and the residual value is for equity holders, but on the right hand side it is a different story, the value of firm's assets is less than the value of its debt obligation and there is no residual value for equity holders, because equity is like a call option with following function max(0, V-D). If any firm is in this situation then it is said to be insolvent.

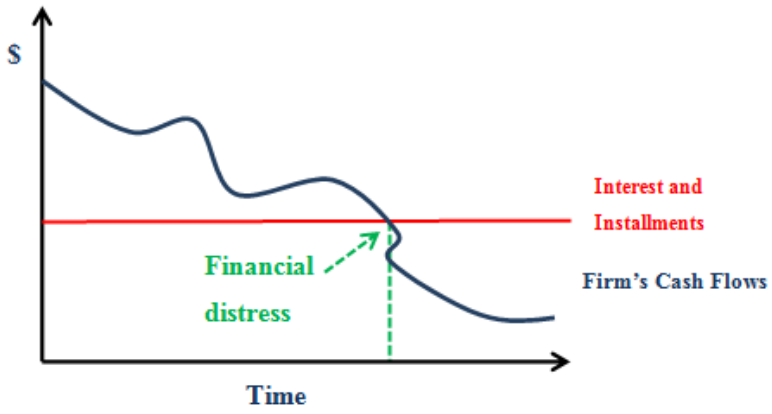


Figure 3: Depiction of financial distress when firm cannot service interest payments and installments

In **Error! Reference source not found.** it is clearly evident that the firm's financial health is deteriorating with time and its operations are not producing enough cash flows to cover for contractual obligation, this force the firm to be in financial distress. There could be number of different reasons for the firm to go into financial distress e.g. economic downturn, uncompetitive products or services, unrealistic business plan, poor management, lack of access to market, deterioration of operating performance and large off balance sheet contingent liabilities. (Moyer, 2005; Whitman & Diz, 2009)

4.1.2. Default

In its simplest form default means a borrower will fail to meet its obligation set according to agreed terms. More specifically "A failure to pay principal of or interest on a bond when due or a failure to comply with any other covenant, promise or duty imposed by the bond contract. The most serious event of default, sometimes referred to as a "monetary" default, occurs when the issuer fails to pay principal, interest, or both, when due. Other defaults sometimes referred to as "technical" defaults, result when specifically defined events of default occur, such as failure to maintain covenants. Technical defaults may include failing to charge rates sufficient to meet rate covenants, failing to maintain insurance on the project or failing to fund various reserves. If the issuer defaults in the payment of principal, interest, or both, or if a technical default is not cured within a specified period of time, the bondholders or trustee may exercise legally available rights and remedies for enforcement of the bond contract".(MSRB, 2004)

Technical default occurs when affirmative or a negative covenant is violated. When certain clauses in the indentures stipulates that the borrower has to maintain certain ratios or capital

such as net working capital, debt service coverage etc. are violated, it is called affirmative covenant violation.

When certain (negative) clauses in the debt contract that restrain, limit and prohibits the borrower from certain actions, such as sales of certain assets, payment of dividends etc. that can damage creditors are violated it is called negative covenant violation. Violations of negative covenant are very rare.

A default is recorded upon the first occurrence of a payment default on any financial obligation, rated or unrated, other than a financial obligation subject to a bona fide commercial dispute; an exception occurs when an interest payment missed on the due date is made within the grace period.

Preferred stock is not considered a financial obligation; thus, a missed preferred stock dividend is not normally equated with default. Distressed exchanges, on the other hand, are considered defaults whenever the debt holders are coerced into accepting substitute instruments with lower coupons, longer maturities, or any other diminished financial terms.(S&P, 2003)

Moody's definition of default is applicable only to debt or debt-like obligations (e.g., swap agreements). Four events constitute a debt default under Moody's definition:

a) A missed or delayed disbursement of a contractually-obligated interest or principal payment (excluding missed payments cured within a contractually allowed grace period), as defined in credit agreements and indentures;

b) A bankruptcy filing or legal receivership by the debt issuer or obligor that will likely cause a miss or delay in future contractually-obligated debt service payments;

c) a distressed exchange whereby 1) an obligor offers creditors a new or restructured debt, or a new package of securities, cash or assets that amount to a diminished financial obligation relative to the original obligation and 2) the exchange has the effect of allowing the obligor to avoid a bankruptcy or payment default in the future; or

d) A change in the payment terms of a credit agreement or indenture imposed by the sovereign, that results in a diminished financial obligation, such as a forced currency re-denomination (imposed by the debtor himself, or his sovereign) or a forced change in some other aspect of the original promise, such as indexation or maturity.

Moody's definition of default does not include so-called "technical defaults," such as maximum leverage or minimum debt coverage violations, unless the obligor fails to cure the violation and fails to honor the resulting debt acceleration which may be required. Also excluded are payments owed on long-term debt obligations which are missed due to purely technical or administrative errors which are 1) not related to the ability or willingness to make the payments and 2) are cured in very short order (typically, 1-2 business days).(Moody's, 2011)

4.1.3. Bankruptcy and Restructurings

When a distressed firm defaults on its obligations towards its creditors, the creditors have a claim on the assets of the firm. In some cases reorganization occurs and the creditors agree to a partial payment of their claims. In other cases assets are sold and the proceeds are distributed among the different creditors based on the priority of their claim. In principle junior claimants should not get any proceeds before a full settlement of the senior claimants are performed, this is known as the "Absolute Priority Rule".

Stakeholders in the firm rank differently in priority of their claims, for example secured creditors rank higher than unsecured if the borrower is to be liquidated then proceeds from liquidation will be distributed to the firm's creditors according to the rule of Absolute Priority Rule (APR). The APR stats that unsecured creditor should not receive any proceeds before the secured creditors claim is *fully* satisfied, which mean the prospect of loss is greater for unsecured creditors.

Creditors in the firm have different seniorities in the capital structure and for that reason the risk and reward they have in a restructuring process, makes them follow different courses of action and also they have divergent interest. To avoid this problem corporate rescue and recovery framework are developed that provides rules and mechanism to reduce the uncertainty and to protect the interest of stakeholders'. (Chatterji & Hedges, 2001). These frameworks provide rules regarding how to distribute firm's assets among different stakeholders in accordance with the agreed upon principals of claims priority (APR).

Frameworks to rescue distressed firms can be of two types. The first can be based on insolvency legislation of the country where the company is registered. The second can be voluntary and not backed and dependent on any legislation.

Statutory insolvency frameworks provide rules and procedures on how to distribute proceeds from assets sale. These frameworks also provides a mechanism to preserve the firm intact if the value realized from keeping the firm as a going concern is greater than the value realized if it were liquidated.

The frameworks will also include the procedures to provide for a change of ownership, this would be the case when debt to equity swaps takes place and ownership of the firm is simply transferred to the debt holders.

Statutory insolvency frameworks in different countries can be categorized into either creditor or debtor friendly. In creditor friendly countries control of the company is taken away from management and shareholders when the firm files for formal procedures. In debtor friendly countries the company is allowed to continue operating by the incumbent management or by an appointed trustee and it also encourages the debtors to forgive some parts of their claims for the restructuring to be successful.

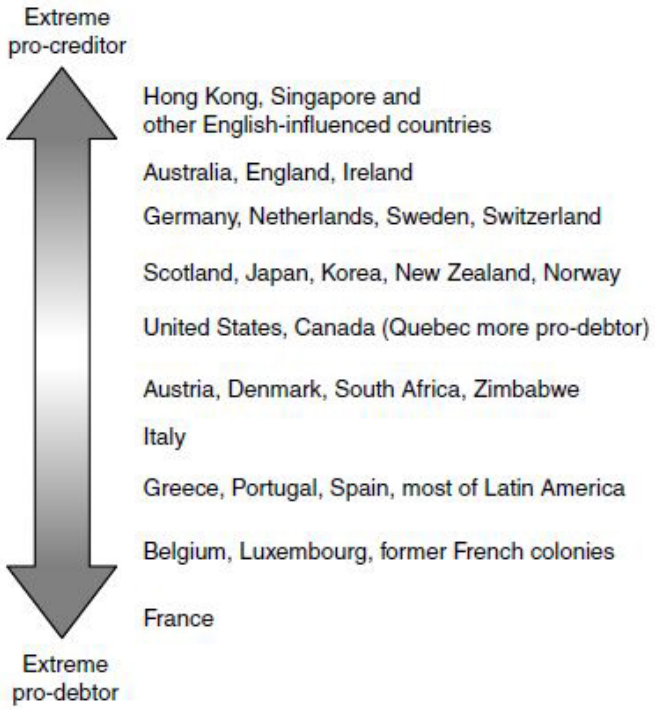


Figure 4: Creditor- and Debtor-friendly countries (Wood, 1995) cited in (Chatterji & Hedges, 2001)

Figure 4 depicts countries from pro-creditor to pro-debtor on a horizontal scale. Norway is ranked somewhat in between pro-creditor and pro-debtor. In some cases the parties involved in a financial restructuring agree to restructure voluntarily out of court rather than going to the court of law. This approach was first proposed by the Bank of England in the 1990s, and it is

known as the London Approach. The main advantage of this approach is that different parties involved in financial restructurings can engaged in the negotiation without losing their relative position in the process. Voluntary rescue frameworks can be formally defined as "A set of principles or guidelines that facilitate the rescue of commercially viable enterprises by providing a framework under which the stakeholders (principally financial creditors) can agree to a mutually acceptable course of action, in a stable environment on the basis of full and reliable information, without resort to the courts"(Chatterji & Hedges, 2001)

4.1.4. Loan workout or out of court settlement

Sometimes the parties involved in financial restructurings enter into a negotiation to find a workable solution to solve the distressed situation voluntarily, not compelled by the court to do so. The main advantage of this type of settlement is that negotiation can be held in private without making them public and this will avoid uncertainty, and will not make the firm unstable. The largest disadvantage of out-of-court settlement is that all the parties involved or affected by the restructuring have to agree to the restructuring proposal, this can sometimes create a problem called "hold out"[2]

The main objective for the distressed firm is to enhance its ability to service the debt obligations. This can be done by one of the following

1) Reduce the nominal or present value of debt.
2) Extension of the maturity date.
3) Induction of new finances.
4) An appropriate restructuring of the firm, so that it can have a commercially viable long term future.

4.1.5. Distressed Exchange

The classic technique that is employed by distressed firms to solve their distressed situation is distressed exchanges (DE). This tactic is normally employed to avoid bankruptcy of the distressed firm who is unable to meet its obligations to the creditors. In distressed exchanges the firm proposes a fundamental change in contractual relationships between the debtor and

[2] The holdout problem occurs when some bondholder in a distress firm withhold their consent to financial restructuring to disrupt the restructuring process, they are gambling on the fact that restructuring will go through even without their consent and they will receive full payment of their claims as they are entitled to according to the debt contract but same time other bondholders who have consent to restructuring will receive reduce payment as set forth by the restructuring plan.

the various creditors classes, and it is voluntarily agreed upon by a sufficient percentage (normally 90% or more) of relevant creditors' claims (Altman & Karlin, 2009).

Distressed exchanges can involve one of, or a combination of the following

1) Exchange of debt claim to lower priority equity.
2) Extension of the maturity date.[3]
3) Reduction of effective interest rate on the debt.
4) Subordination of claims
5) New securities with face value less than the face value of the original claim.

The main rationale behind distressed exchanges is that the restructuring is less costly than a bankruptcy to the firm, however a few studies have found that a majority of the firms that performed distressed exchanges ended up in bankruptcy at a later date.(Altman & Karlin, 2009; Gilson, John, & Lang, 1990)

4.1.6. Debt to Equity Swap

Since one of the main objectives of a distressed firm is to reduce their debt level to a level where the business can service the debt without any difficulty and continue as a viable business for a long term, one of the techniques used is a debt-to-equity swap i.e. the financial creditors receives equity interest in a reorganized capital structure for reducing their claims.

Converting debt to equity strengthens the distressed firm's balance sheet and the firm's financials, and avoids an imminent insolvent liquidation. Sometimes opportunistic creditors/investors purposely get a hold of sub-performing debt, to gain control of the debtor in a so called "loan to own" strategy.

Debt-to-equity swaps can be formally defined as "Capital reorganizations in which the creditors (usually, but not exclusively, lenders) exchange or convert a proportion of a company's indebtedness for one or more classes of its share capital[4]"(Chatterji & Hedges, 2001). Debt to equity swaps change the structure of the liabilities in the balance sheet and replace the firm's obligations to its creditors with share capital. There are few ways this can be carried out i.e. debt can be converted to equity, it is a book transaction where repayment received by creditors is used to subscribe for new shares in the firms.

[3] It is a custom in Norway when there is extension of maturity date, coupon rate increase by 5% p.a.
[4] Fund raised in the firm, by issuing new shares, in return for cash or other considerations.

A debt-to-equity swap is beneficial for the debtor because it reduces the debt to an optimal level, and the firm can operate effectively as a going concern. Resources (time and money) spent in formal restructuring procedures is quite considerable as compared to debt-to-equity swaps; it can make a distressed firm viable in medium to long term. However this does not mean that debt-to-equity swaps is simple procedure, it is highly complex transaction. The major issue in debt-to-equity swaps is to determine the value of the business and how much debt the firm is likely to support. The major drawback of debt-to-equity swap is, it only cures the financial symptoms of the distressed firm rather than the underlying problems of the company.

4.1.7. Recovery calculation:

There are two ways to calculate recovery rates on a bond i.e. trading price recoveries and ultimate recoveries. Trading price recoveries on the bond is the bond's market value a few days[5] after the default as a percentage of bond's face value.

Ultimate recoveries are the values that creditors realize at the time of resolution of the default event. For example, when a firm files for bankruptcy, the ultimate recovery is the present value of the cash and or securities that the creditors actually receive when the firm exits bankruptcy, normally 1-2 years following the initial default date. (Moody's, 2011)

The recovery rate[6] is the amount that creditors recovers of their principal and accrued interest due to default. (Mora, 2012) has found that recovery and default rates are inversely related, which means that if adverse economic conditions makes defaults rise, such bad economic conditions can also make the recoveries to the creditors fall i.e. creditors recoveries depends on collateral value and during economic downturn the value of the collateral is expected to fall because of reduce business opportunities.

(Mora, 2012) used thirty years recovery data on defaulted debt instruments from the United States and found that the state of the economy does determined the creditors recovery rate and in addition industry distress also drives recovery rates down, as this is triggered by overall weak economy conditions.

Credit risk is defined by Bank for International Settlement as the potential that a borrower will fail to meet its obligations in accordance with the agreed terms. Or simply it is the risk that the

[5] Moody's use 30 days after default date.
[6] Majority of this section is based on Moody's Default Risk Service Data compiled by (Mora, 2012)

borrower will default on the debt by not making the payments which it is obliged to pay under the contract.

Credit risk consist of the probability that a borrower will default on its obligation, its loss given default (which is one minus recovery rate) and exposure at default. That means credit risk includes both default risk and recovery risk. The most common assumption that is made when analyzing credit risk is that the recovery rates are known with certainty and thus the analysis focus on determining the probability of default.

Recovery rates are assumed to be constant based on historical average between 40% and 50% on debt issued by U.S. corporate borrowers (Das & Hanouna, 2009). Some researchers (Longstaff & Schwartz, 1995) argued that since the recovery rate is the outcome of bargaining processes between debtors and creditors, and for that reason it is unsystematic and should not be modeled.

According to (Altman & Hotchkiss, 2006) credit risk models assume recovery rates to be dependent on individual features such as (collateral and seniority) and these features do not represent the systematic factor and should be independent of probability of default. Some researchers found that when default probabilities and recoveries are assumed to be uncorrelated the potential losses are understated by roughly 30%.(Altman, Brady, Resti, & Sironi, 2005)

Is there variation in recovery rates? Research has shown that there is considerable variation in recovery rates across different types of debt instruments, and industry types, and that recovery rates are systematically related to business cycles. (Mora, 2012)

The histogram below (Figure 5) shows that Moody's Default Risk Service distribution of recovery rates varies across different debt instruments based on trading price recoveries calculated 30 days after the credit even on the defaulted debt instruments over the period of 40 years.

Average recoveries are 39% and have a standard deviation of 29%. The histogram also shows that sometime recoveries are more than 100% it happens when the coupon rate on the bond is much higher than the current term structure.

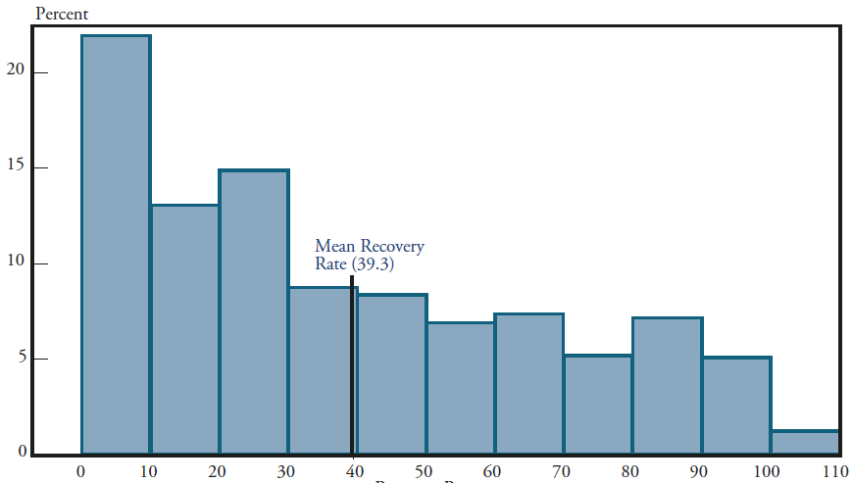


Figure 5: Histogram of recoveries rates based on Moody's DRS 1970-2008 cited in (Mora, 2012)

Seniority of debt claim, industry type and also collateral determines the recovery rates for the creditors. An average recovery among different industry sectors varies from 25% to 58%. For example, recovery rates for the period 1970-2008 in the utility sector are, 58% which is 19% higher than the mean recovery rate of 39.3%.

It is argued that Utilities have higher recovery rate because they are monopolies and have substantial tangible assets. Their many tangible assets and monopoly position in most countries give them the opportunity to charge higher prices, which is why there are higher recovery rates in this sector compared to other sectors.

Industry	Defaults	Firm Defaults	Mean	Median	Standard Deviation
Overall	4,422	1,307	39.3	30.5	29.1
A. Agriculture, Forestry and Fishing	18	6	39.9	46.5	25.6
B. Mining	81	38	50.8	48.6	26.0
C. Construction	36	14	28.7	20.0	31.4
D. Manufacturing	726	293	43.7	41.4	29.1
E1. Transportation	475	33	32.7	28.3	16.3
E2. Communications	331	87	39.6	30.0	31.0
E3. Utilities	164	22	57.5	62.9	31.8
F. Wholesale Trade	87	37	43.2	48.5	33.2
G. Retail Trade	235	91	43.3	41.0	29.8
H. Finance, Insurance and Real Estate	1,020	64	24.6	10.0	27.7
I. Services	339	115	49.3	56.8	31.2

Figure 6: Recoveries rates by industry type source Moody's cited in(Mora, 2012)

The type of debt instrument and its seniority also determines the recovery rate, which creditors are going to realize. For example senior secured securities average recoveries were 64% during the period 1987-2010[7] compared to 49% for Senior unsecured, this highlights the importance of collateral. The table below shows that, the higher the claim is in the capital structure according to APR, the higher the recovery rate in case of a default.

	Emergence Year			Default Year[8]		
Lien Position	2010	2009	1987-2010	2010	2009	1987-2010
Loans	78.6%	77.1%	80.3%	80.2%	78.9%	80.3%
Bonds						
Sr. Secured	64.4%	59.0%	63.5%	56.3%	65.6%	63.5%
Sr. Unsecured	51.0%	48.3%	49.2%	26.5%	51.6%	49.2%
Sr. Subordinated	20.5%	26.2%	29.4%	21.7%	28.0%	29.4%
Subordinated	53.4%	34.3%	29.3%	0.0%	58.3%	29.3%
Jr. Subordinated	n.a.	0.5%	18.4%	n.a.	0.0%	18.4%

Figure 7: Average Corporate Debt Recovery Rates Measured by Ultimate Recoveries, 1987-2010 (Moody's, 2011)

Different types of defaults such as voluntary out of court reorganization, reorganization under insolvency proceeding (chapter 11 in U.S.) and liquidation (chapter 7 in U.S.) can result in different recovery rates.

Distress exchanges where the creditors hold negotiations out of court and accept to lower the coupon rate, or lowering the debt par value have higher recovery rates than under the bankruptcy proceeding. (Franks & Torous, 1994)

Lien Position	Distressed Exchange Defaults	Bankruptcies & Payment Defaults
1st Lien Bank Loan	74.8%	70.2%
2nd Lien Bank Loan	24.5%	15.7%
Sr. Secured Bond	87.2%	57.5%
Sr. Unsecured Bond	62.2%	40.7%
Sr. Subordinated Bond	60.0%	30.2%
Subordinated Bond	33.7%	n.a.

Figure 8: 2010 Recovery Rates: Distressed Exchanges vs. Non-Distressed Exchanges (Moody's, 2011)

Insolvency proceedings across different countries can also contribute to recovery rates because of the legal systems can give different creditor powers to influence the outcome of

[7] Observation from Moody's some of 2009 and 2010 defaults are not included in the ultimate recovery rate calculation because some companies have not emerged from defaults.

the negotiations. Some countries are termed as creditor friendly and others as debtor friendly. (Davydenko & Franks., 2008) has found that median recoveries rate in United Kingdom is 92%, 67% in Germany and 56% France.

Creditors' recovery rate is also pro-cyclical, meaning the aggregate recovery follows the ups and downs of business cycles. Studies have found positive correlation between real GDP growth and recovery rates, and where recessions depress bond recoveries by up to one third from normal year averages. (Frye, 2000; Mora, 2012; Schuermann, 2004)

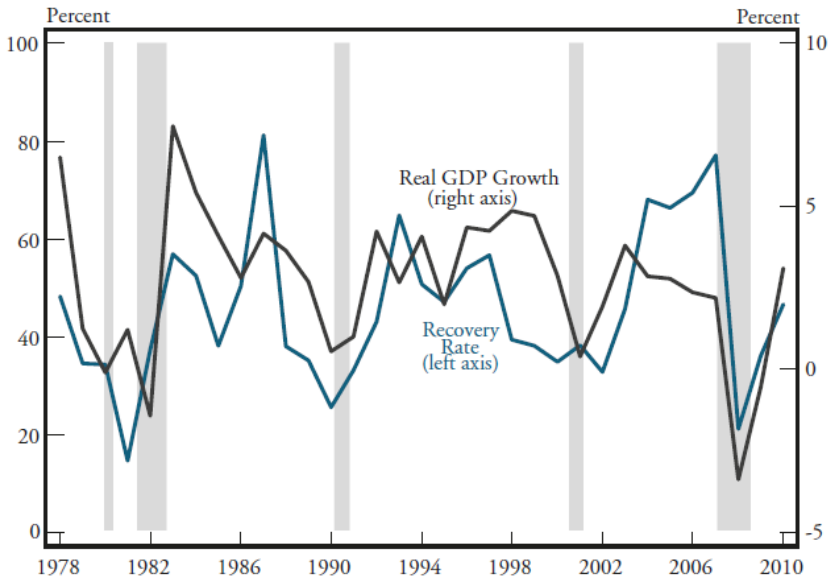


Figure 9: The recovery rate and the business cycle adopted from (Mora, 2012)

The reasons for the lower recovery rates during recessions or economic downturns is that only hedge funds and vulture investors are willing to invest in distress debt, and when there is a higher supply of defaulted debt in the market the capacity of these investors is limited and that leads to lower recovery rates.

Illiquidity for the defaulted firms' real assets can also affect recovery rates for the creditors, and key reason for this is industry distress. The distressed situation can force the firm to have a fire sale of the assets which will lead to dislocated price. This price is dislocated because the industry peers cannot bid the price up to the value that reflects the true value of the assets because the whole industry is in financially distress (Mora, 2012). The classic example is the sale of aeroplanes by financially distress airlines, where the prices of aeroplanes are highly related to airline industry.

4.1.8. Absolute Priority Rule (APR):

When the debtor firm is insolvent absolute priority rule (APR) is applied to resolved financial contracts. In its simple form it states that the debtor (equity holders) receives no value by disposing the assets of the firm until all of the creditors have been paid in full and also senior creditors' claim should be satisfied in full before junior creditors receive anything. Even though the APR rule seems very simple to implement but very hard to apply in practice for example (LoPucki & Whitford, 1990) argued that for a business with single owner and manager " equity frequently dominates the bargain to such an extent that the absolute priority rule is virtually stood on its head" this could be because during the restructuring process lenders have to reduce the value of their debt payment to give an incentive by creating equity stake for owner-manager because of his/her expertise to run the business, which might be rare, so manager-owner obtain leverage in renegotiation process, which can lead to APR violation, in a sense that creditors' claims are not paid in full and equity which has an most junior (residual) claim to the assets of the firm are paid.

There is no consensus among academician about the source of APR deviation, some attribute it to the bankruptcy code and believe that these code provides implicit support for APR violation and whether these violations have positive and negative consequences. (Longhofer, 1997) further argues that these deviations make two additional problems first they make default more likely, by increasing the interest rate that borrowers have to pay when they want to raise and secondly APR violations make credit rationing problem severe in a sense that lenders limits the supply of additional fund that borrowers need even though borrowers are willing to pay higher interest rate that will lead to market imperfection and equilibrium will not be achieved in the market.

4.1.9. Order of priority of claims in Norway[8]:

Distribution of funds of an insolvent firm in Norway is done as following:

Costs of proceedings have the highest priority and must be covered before any other debt. Second priority is for secured claims, which are secured on the debtor's assets. In case asset is mortgage for more than its value, the part that exceeds the assets value is considered as unsecured. Next in line are the employees' claims for wages, leading up to the period of six months. After these claims have been fulfilled the proceeds of funds are distributed by the following rule.

[8] This section is based on the report written by (Hansen, 2011) and (Brækus)

- Unpaid income tax;
- Employees tax deduction;
- Value added tax (VAT); and
- National insurance payment.
- Unsecured creditors
- Postponed debt i.e. claims for accrued interest and donation promises made after the insolvency proceedings.
- Shareholders.

According to the Bankruptcy Act of 1984 the debt negotiations between insolvent debtor and its creditors to reach an agreement on reducing the debtor's debt to a sustainable level in Norway can be reached by the following three stages.

1. Out-of-court voluntary arrangement *(frivillig gjeldsforhandling)* in this type of arrangement in which creditors covered by the proposal must approve the agreement. If the proposal does not receive required voting by the creditors and some creditors abstain from voting then the second voting is held and in this if more than 75% of creditors (by amount outstanding) have consented to the proposal, then the proposal is adopted.
2. Court-supervised voluntary arrangement *(offfentlig gjeldsforhandling)*
3. Court-supervised compulsory arrangement *(offentlig akkord)*

The first two stages are non-public, and the purpose of not making them public is that if these negotiations are made public, then debtor's assets will plunge in value and then it will be difficult to reach an agreement to rescue the debtor's business in some form. The debtor and creditors could not reach an agreement in first two stages then the transition to third stage must be made public.

5. Research Methodology

Research methodology or simply method refer to the techniques and procedures used to obtain and analyze data (Saunders, Lewis, & Thornhill, 2009). The choice of methodology forms the basis for evaluating the research, whether if it is conducted in a "scientific" manner or not. The main objective for the study is to calculate the present value of restructuring proposal and compare it with trading price of similar security to demonstrate that the creditors of distress firm got a better or worse deal. And to demonstrate that we used Lattice binomial

model to create interest rate on the lattice and then added spreads to the interest rate to computed the present value of bonds cash flows. In case of debt to equity swap we used nominal value of shares to calculate the value of share received as a result of restructuring. All the techniques and procedures used to evaluate the restructuring deal of distress firm will be described in detail below.

5.1. The Lattice model[9]

The complexity of bond valuation comes from the fact that cash flows of the bonds will depends on future interest rate. Practitioners and academician have come up with most elegant and complicated models to capture the uncertainty of future interest rate, but our choice of the model is lattice model in its simplest form and the we reduce to lattice to a binomial tree. In this thesis the focus is on the binomial model for interest rates and the models used to value fixed income securities with options imbedded in them, together with floating rate notes. The binomial model for the interest rate is a single factor model, the factor being the stationary variance and is in discreet time.

The model can be visually represented in Figure 10

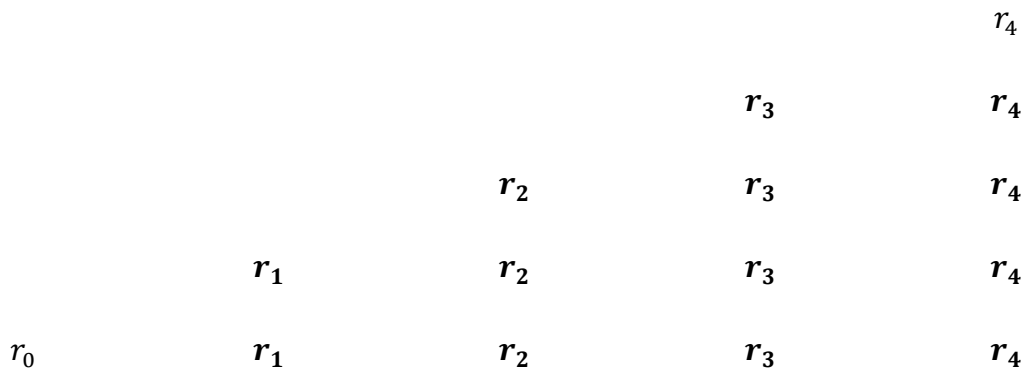


Figure 10: Single factor binominal model of interest rate

$r_{0\ldots n}$ = Represents short rates in each period. The model assumes that there are only two possible states that $\boldsymbol{r_0}$ can become the next period in the "tree". The period after that $\boldsymbol{r_1}$ can become three different rates. The model assumes that each so called state has a 50% probability to occur. The different states are called either down or up states so the tree can be presented as:

[9] Section 5.1is based on (FABOZZI, 2002)

				$\frac{r_4}{U,U,U,U}$
			$\frac{\boldsymbol{r_3}}{U,U,U}$	$\frac{\boldsymbol{r_4}}{U,U,U,D}$
		$\frac{\boldsymbol{r_2}}{U,U}$	$\frac{\boldsymbol{r_3}}{U,U,D}$	$\frac{\boldsymbol{r_4}}{U,U,D,D}$
	$\frac{\boldsymbol{r_1}}{Up(U)}$	$\frac{\boldsymbol{r_2}}{U,D}$	$\frac{\boldsymbol{r_3}}{U,D,D}$	$\frac{\boldsymbol{r_4}}{U,D,D,D}$
r_0	$\frac{\boldsymbol{r_1}}{Down(D)}$	$\frac{\boldsymbol{r_2}}{D,D}$	$\frac{\boldsymbol{r_3}}{D,D,D}$	$\frac{\boldsymbol{r_4}}{D,D,D,D}$

Figure 11: Different states of the single factor binominal tree

The difference from using the binomial model for interest rates as opposed to stocks is that first there are many models that are used to construct the binomial model, the one thing they have in common is that they all need to produce a value of an option less on-the-run issue.

This means that the interest rate tree (the binomial tree) must produce the same price as the market, when this is done the model is considered arbitrage free and the model can be used for valuations.

In the model each node has a relationship with the other nodes in its discreet time period. The relationship between the $\frac{\boldsymbol{r_1}}{Up(U)}$ and $\frac{\boldsymbol{r_1}}{Down(D)}$ is such as $r_{1,U} = r_{1,D} * e^{2\sigma\sqrt{t}}$ where σ is the stationary volatility, $\sqrt{t}$ is the square root of the time during the period between $\boldsymbol{r_0}$ and $\boldsymbol{r_1}$.

The relationship between$\frac{\boldsymbol{r_2}}{D,D}$, $\frac{\boldsymbol{r_2}}{U,D}$ and $\frac{\boldsymbol{r_2}}{U,D}$ are described as $r_{2,U,D} = r_{2,D,D} * e^{2\sigma\sqrt{t}}$, and $r_{2,U,U} = r_{2,D,D} * e^{4\sigma\sqrt{t}}$. So in essence the relationship can be described as each column short rate are related to the bottom rate in the structure as $r_{above} = r_{bottom} * e^{n\sigma\sqrt{t}}$ where "n" is increased by "2" by each step up in the column, and a lognormal random walk are assumed.

The next step is to set up a binomial tree with the value it measures

			V(HHHH)
		V(HHH)	V(HHHL)
	V(HH)	V(HHL)	V(HHLL)

	V(H)	V(HL)	V(HLL)	V(HLLL)
V	V(L)	V(LL)	V(LLL)	V(LLLL)

Figure 12: value measurement in binomial tree

Since the assumption is that the instrument pays a coupon that can be denote as "C". And there is also an assumption that the probability of the different states are equal, which means that in the column where we have V(H) and V(L) they have a probability of p=0.50 each of occurring. In the third column the probability of each node is p=(1/3) etc.

To measure the value back at node "V" one must calculate recursively from the last column such as:

$$V((HHH) = \frac{1}{2}\left[\frac{V(HHHH) + C}{(1 + r_{3,UUU})} + \frac{V(HHHL) + C}{(1 + r_{3,UUU})} \right]$$

This relationship goes for all the nodes in the model.

When the binomial tree is set up and the relationships are in place, the next step is to calibrate it to the term structure, or more precise the par-yield curve. The most important condition of the binomial model is that it has no-arbitrage. To make sure that the model is arbitrage free it is needed to calibrate the model for the short rates by the "value-binomial tree". To do that the thesis shows the process in a fictive way, where it is assumed the volatility, par yield and a short rate in the beginning of the process is known.

Volatility=0.30	B	C	D	E	F
12					=F16*exp(8*A11)
13				=E16*exp(4*A11)	=F16*exp(6*A11)
14			=D16*exp(4*A11)	=E16*exp(4*A11)	=F16*exp(4*A11)
15		=C16*exp(2*A11)	=D16*exp(2*A11)	=E16*exp(2*A11)	=F16*exp(4*A11)
16	0,01	0,01	0,01	0,01	0,01
17					
18					
19					104
20				=(0,5*(F19+F20))/(1+E13)	104
21			=(0,5*(E20+E21))/(1+D14)	=(0,5*(F20+F21))/(1+E14)	104
22		=(0,5*(D21+D22))/(1+C15)	=(0,5*(E21+E22))/(1+D15)	=(0,5*(F21+F22))/(1+E15)	104
23	100	101	102	103	104

Figure 13: Binominal model calibration 1

The first short rate in the period are assumed to be 1%, the volatility 30% and the time period are equal in all the steps in the tree. It is also assumed that the par-yield of the term-structure (which is a Zero coupon) produces the different pay-offs visible. For one period a bondholder

receives 1%, for two 2% etc. To calibrate the tree begin with "locking in" the par yield payoff at column "D" at 102.

0,3	B	C	D
12			
13			
14			0,0332
15		0,0182	0,0182
16	0,0100	0,0100	0,0100
17			
18			
19			
20			
21			102,0000
22		100,1747	102,0000
23	99,5865	100,9901	102,0000

Figure 14: Binominal model calibration 2

Then use goal-seek in Excel (or trial and error) and set the cell "B23" as the "target cell", induce the restriction that it will be 100, and that this is achieved by changing the cell "C16".

0,3	B	C	D
12			
13			
14			0,0332
15		0,0128	0,0182
16	0,0100	0,0070	0,0100
17			
18			
19			
20			
21			102,0000
22		100,7113	102,0000
23	100,0000	101,2887	102,0000

Figure 15: Binominal model calibration 3

The next step is to "lock in" the value of 103 in column E.

Figure **2.2.4**

0,3	B	C	D	E
12				
13				0,0332
14			0,0332	0,0332
15		0,0128	0,0182	0,0182
16	0,0100	0,0070	0,0100	0,0100
17				
18				
19				
20				103,0000
21			99,6902	103,0000
22		99,1547	101,1568	103,0000
23	99,0173	100,8602	101,9802	103,0000

Figure 16: Binominal model calibration 4

Again use the function of goal seek and set "B23" as target cell, with the restriction that it shall be 100, by changing "D16" this time.

0,3	B	C	D	E
12				
13				0,0332
14			0,0164	0,0332
15		0,0128	0,0090	0,0182
16	0,0100	0,0070	0,0049	0,0100
17				
18				
19				
20				103,0000
21			101,3391	103,0000
22		100,4254	102,0818	103,0000
23	100,0000	101,5746	102,4940	103,0000

Figure 17: Binominal model calibration 5

This process continues through-out the binomial trees until he whole tree is calibrated to the par-yield.(FABOZZI, 2002)

This binomial model will be used to value bonds in our sample.

5.2. Spreads[10]

When an investor decides if he or she are willing to invest in a non-treasury debt security they first look at the ”base interest rate” which is also referred to as the ”benchmark interest rate”. It is a government treasury rate i.e. the treasury yield. (FABOZZI & MANN, 2005)

A common base rate is the US governments which are seen as default free, but an investor can use another government yield curve, or benchmark curve that he or she feels comfortable with.

The base interest rate is the minimum requirement that an investor would accept when investing, however depending upon risk factors such as default risk and liquidity risks market participants describe the rate they use to price/trade the non-treasury securities with as a premium/spread to the base interest rate.

Pricing rate = Benchmark rate + Spread.

The default risk is the risk that the borrower might not be able to pay the coupon or principal on the bond during and at the end of the term.

The liquidity risk is the risk that the bondholder will sell the claim at below the true value due to the fact that there are not enough of buyers and sellers in the market for that particular security.

There is vast research on the literature of liquidity and determining the asset price. There are two type of liquidity i.e. trading liquidity and market liquidity. Trading liquidity is how easily an investor can trade the asset/security in the market. Aswath Damadoran explains it as cost of investor’s remorse, i.e. it is the cost of reversing an asset trade almost instantaneously after you make the trade.

The investors need for liquidity could be derived from the fact that he/she wants to change his/hers portfolio choices/weights, or it could be because of cash flow considerations.

The other type of liquidity is fund liquidity which is linked to market’s fund. Meaning how easily an investor can obtain funds. This type of liquidity becomes very important particularly during the crisis time.

[10] Section 5.2 is based on (FABOZZI & MANN, 2005)

Illiquidity is just the opposite of various frictions and impediments that hamper the trading of an asset or security or procurement of funds(Hibbert, Kirchner, Kretzschmar, Li, & McNeil, 2009).

The thesis is concerned with both types of illiquidity because once the firm is in distress then it will be hard for the bondholders to sell their securities in the market, since when there is many defaults there might not be enough funds available to buy distressed securities.

There is a larger debate among academicians for the actual existence of liquidity premium or not, however there has been much empirical research that found that the liquidity premium is no myth and it is real and measurable. One such research carried by (Dick-Nielsen, Feldhütter, & Lando, 2011) which investigated corporate bond liquidity before and after the subprime mortgage crisis found out that during the subprime mortgage crisis corporate bond spreads increased and market liquidity had and extra effect, which helped in widening the spread. They concluded that for CCC rated bonds/high yield bonds the spread for illiquidity are on average 420bp(basis points).(Hibbert, 2009)

Credit risk in default can be measured with the formula

Credit risk/Premium = Probability of default * Loss given default

Or

Credit risk/Premium = Probability of default * (1-Recovery rate)

So when determining which spread to use in a valuation of the cash flows from a bond, the investor needs to first decide on a fitting benchmark interest rate, which usually is a government yield curve. Then determine the credit risk from default, and the liquidity spread

Spread = Premium for default risk + liquidity premium

Then ad that spread to the appropriate benchmark rate to value the cash flows from the instrument that is being valued.

5.3. Probability of Default (PD), Loss Given Default (LGD) and Recovery Rate (RR)

Probability of default (PD) and Loss Given Default (LGD: which is simply one minus the recovery rate) are the two main variables that affect the credit risk of a financial asset. Significant focus has been devoted to the estimating the probability of default for the reason

that credit risk model are concerned with the systematic risk and traditionally it is assumed the Recovery Rate (RR) is dependent on individual factors such as collateral and seniority of claim.(Altman & Hotchkiss, 2006)

Early credit risk models were based on (Merton, 1974) in which risk of default is linked with the value of firm's assets. Basic intuition behind this model was that default occurs when the value of firm's assets are less then it liabilities (insolvency) and payoff of debt holder at the maturity is the minimum of face value of debt or market value of firm's assets. In Merton's theoretical framework PD and RR is inversely related. If for example, the firm's value increases, then its PD tends to decrease while expected RR at default increases, while on the other side if firm's debt increases it PD increases and expected RR decreases (Altman & Hotchkiss, 2006).

To make the matter for calculating RR simple, (Longstaff & Schwartz, 1995) argued that historical defaults rates and RR of different classes of debt of comparable firms are reliable estimate of RR. This research took the same approach when calculating the PD and RR, the research used Moody's average cumulative probabilities of default table (1970-2009) and calculated conditional default probabilities and used average historical RR of different classes of bonds as an input for LGD to get the spread for discounting

$$Spread = Probability\ of\ Default * Loss\ Given\ Default$$

$$Loss\ Given\ Default = (1 - Recovery\ Rate)$$

5.4. Default Probabilities and Hazard Rates:[11]

Different rating agencies produce such as Moody's, Fitch and Standard and Poor's produce corporate bond rating to illustrate credit worthiness of the bonds. These rating agencies also produce default probabilities, which means how likely it is that the bonds in different rating categories will default at the end of a particular period. For example from the table below we can see that a bond rated Caa-C has a probability of default of 17.723 percent during the first year and 29.384 during the second period. We can calculate the probability of default of that Caa-C rated bond will default during year two is as following, probability of default at the end of year two minus the probability of default at the end of year one (29.384%-17.723%= 11.661%). So the probability of default that a Caa-C rated bond will default during year 2 is

[11] Default probabilities table and hazard rate calculation is based on (Hull, 2012).

11.661 percent. This is called unconditional probability of default, meaning seeing from the time zero it is the probability that a Caa-C rated bond will default during year two.

In the thesis the authors have worked with conditional probability of default in valuing the restructuring deal. Conditional probability of default is the probability of default base on no earlier default. It is calculated as following. Now we know that unconditional probability of default for Caa-C rated bond during year two is 11.661 percent. We know that probability that a Caa-C rated bond will survive at the end of year one is (100%-17.723%= 82.277%). So the probability that a Caa-C rated bond defaulting during the second year conditioned on no early default would be (11.661% ÷ 82.277%= 14.172%). The conditional probability of default is also referred to as hazard rate or default intensities.

From the Table 1 it is evident that probability of default at the end of a year is an increasing function of time, meaning Aaa-A rated bond will be considered creditworthy initially but their creditworthiness will decline as time passes. For instance the probability of A rated bond defaulting in years 0-5. 5-10 and 10-15 are 0.105%, 0.392% and 0.43% respectively. But on the other hand for the below investment grade the probability of default is an decreasing function of time, meaning for the Caa-C rated bonds first two or three years are more critical and if they survive that period then chances are their financial health has improved. The probability of Caa-C rated bond defaulting in years 0-5. 5-10, 10-15 and 15-20 are 34.563%, 19.09%, 6.196% and 2.666% respectively.

Year	**1**	**2**	**3**	**4**	**5**	**7**	**10**	**15**	**20**
Aaa-AAA	0.000	0.012	0.012	0.037	0.105	0.245	0.497	0.927	1.102
Caa-C	17.723	29.384	38.682	46.094	52.286	59.771	71.376	77.545	80.211

Table 1: Average cumulative default rate (%) 1970-2009: Source Moody's printed in (Hull, 2012)

After calculating the conditional probability of default for Caa-C rated bond we used table in (Moody's, 2011) to get average recovery rate for the same type (seniority) of bond during that year and calculated Loss Given Default by the Following Formula.

$$\text{Loss Given Default} = (1 - \text{Recovery Rate})$$

For example, average recoveries for senior secured bonds for 2009 according to table used from (Moody's, 2011) is 62.5 % so the LGD will be (1-62.5%= 37.5%). Now we have PD

and LGD to calculate the spread to be used to discount the value to time zero from year 2 using the following formula.

$$\text{Spread} = \text{Probability of Default} * \text{Loss Given Default}$$

$$\text{Spread} = (14.172\% * 37.5\%) = 5.31\%$$

So to discount the values to time zero we added the (default) and liquidity spread to Norwegian zero curve (benchmark rate)

$$\text{Discount Rate} = \text{Norwegian Zero Curve} + \text{Default Spread} + \text{Liquiditiy spread}$$

5.5. Liquidity Spread

There is vast research on liquidity premium/discount in literature to determine asset price. There are two type of liquidity i.e. trading liquidity and market liquidity. Trading liquidity which is with how ease and investor can trade asset/security in the market. Aswath Damadoran explains it as cost of investor's remorse, i.e. it is the cost of reversing an asset trade almost instantaneously after you make the trade. Investor need for liquidity could be he/she want to change his portfolio choices or could be because of cash flow consideration. The other type of liquidity is market or fund liquidity which is linked to market's fund and with how much ease an investor can obtain fund this type of liquidity becomes very important particularly during the crisis time. Illiquidity is just the opposite of various frictions and impediments that hamper the trading of an asset or security or procurement of funds(Hibbert, et al., 2009). We are concerned with both types because once firm is in distress then then it will be hard for the bondholder to sell his/her securities in the market with the ease and since when there is lot of default maybe there is not enough fund available to buy distress securities.

(Dick-Nielsen, et al., 2011) concluded that for CCC rated bonds the liquidity premium increased by 420 basis points during the subprime mortgage. We used this liquidity premium in our calculation and added this to discount rate when we calculated the present value of the bonds cash flows.

5.6. Equity Valuation

It is difficult to explain what actually happens to firm value when the borrowers are in financial distress by accounting standards (GAAP). In standard accounting, the assets and liabilities sides always balances, but no accountant, finance professor or investor would ever

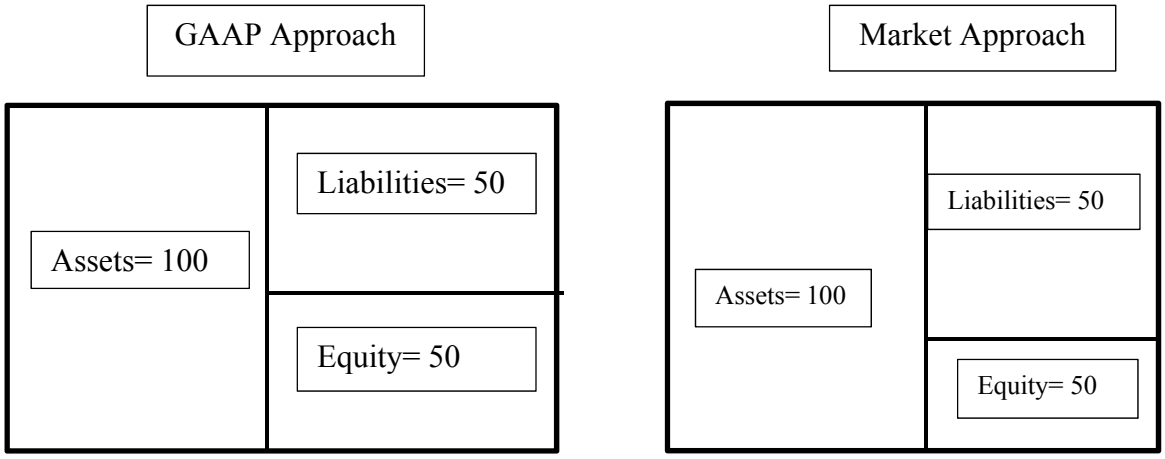
seriously argue that the accounting presentation of the firm by accounting standards represent economic reality (Moyer, 2005)

There are two approaches to present the size of the firm's assets, liabilities and equity. One is by the General Accepted Accounting Principles (GAAP) approach, in which the total assets of the company are equal to its total liabilities and equity. The other is the market approach which uses the trading values of the firm's securities (debt and equity) to determine the size of its liabilities and equity.

By determining the size of the liabilities and equity, the size of the assets will be determined, which is in contrast to the GAAP presentation of the firm, where equity value will adjust to balance the equation i.e. assets= liabilities+ equity. In the market approach it is assumed that the liabilities market value is equal to its principal amount as long as equity is positive. The strongest argument in favor of the market approach is derived from the Efficient Market Hypothesis (EMT) which states that "market is always correct" and that the stock price is the collective market valuation of the firm's equity by investors who have carefully analyzed all public information about the firm to arrive at this collective valuation. So the size of equity is known by this collective valuation and also the liabilities size, so the accounting equation becomes Equity= Assets-Liabilities. This way it becomes easier to find the value of the assets by the new equation.

These two approaches can be better understood by the following graphical presentation of the size of the boxes of assets, liabilities and equity. For example if the value of firm's assets is 100 and 50 is the debt then according to GAAP, equity value will be 50. The market approach explain the sizes as if the company has 50 shares outstanding and they are trading at 1 per share then the market value of equity would be 50, and the debt is in principal 50, and traded at the face value, so the value of the firm's assets will be 100.

Now this becomes problematic with the market approach during financial distress. Suppose that at the time of distress the firm's equity is trading at 2 so now the equity value will be 100 and debt or liabilities are still priced at 50, so the firm's assets will have a value of 150. Does this mean the firm's assets value increased? Not exactly that is why the market value of equity for a financially distressed firm becomes fairly meaningless (Moyer, 2005).

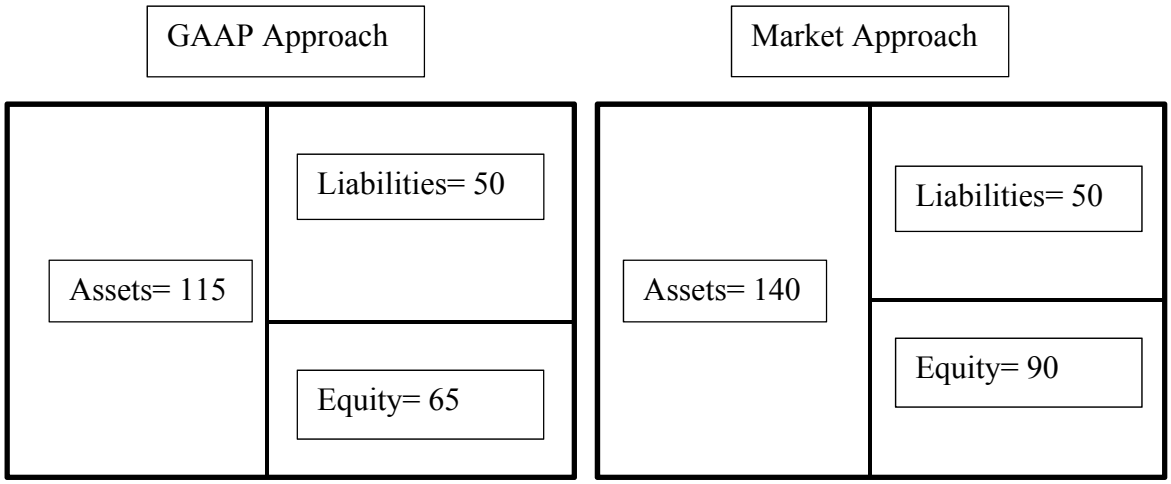


						Amount	Price	Value
Cash	20	Liabilities	50		Liabilities	50	100%	50
Tangible Assets	80	Equity	50		Equity	50	1	50
Total	100		100		Total			100

Table 2: Market vs. GAAP presentation of balance sheet 1

The description above is the case where market value equals GAAP value. Now consider that the firm wants to raise capital and the firm management believes that the market is fairly valuing its equity, and they issue 10 new shares at $1.5 per share. To simplify, assume that the market is optimistic about the future of the firm and chooses to value the firm's stocks higher than the book value. There could be many different reasons why market value of the firm's stocks are larger than the book value of the shares, however it is trivial to discuss that subject here, because the point here is to explain why the market valuation approach to value the firm's assets is not appropriate during financial distress.

According to GAAP this transaction will be depicted in the following way. The firm's asset value will increase by (10*1.5=15), and equity will be increase in by the same amount. On the market side however the equity value will increase to (60*1.5= 90) because now there are in total 60 shares outstanding and the value of each share is $1.5 so the equity value will be 90 and liabilities will still be the same at 50, so the firm's asset value will now be 140.

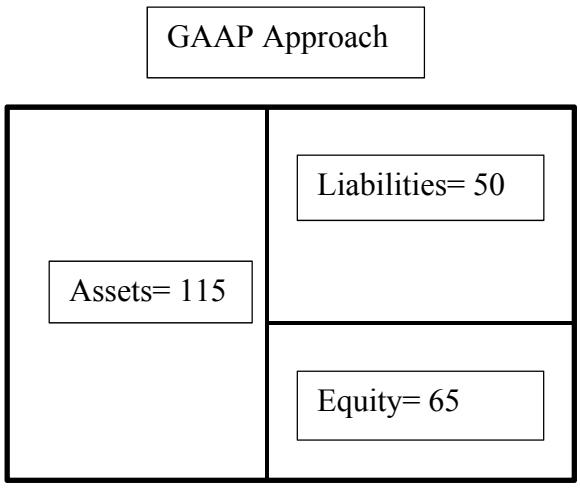


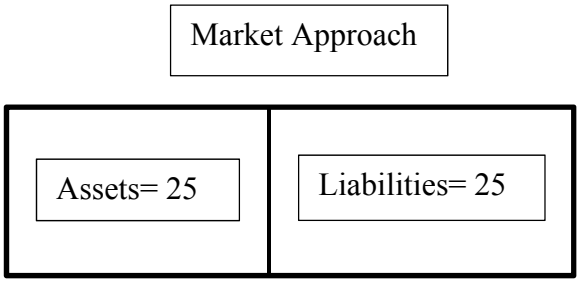
						Amount	Price	Value
Cash	35	Liabilities	50		Liabilities	50	100%	50
Tangible Assets	80	Equity	65		Equity	60	1.5	90
Total	110		110		Total			140

Table 3: Market vs. GAAP presentation of balance sheet 2

Assume that the market is not so optimistic about the firms' future and value each share at 15 cents and the debt now are trading at 50% of par value. What the market can give, it can take away, as we have seen in the case of "NASDAQ[12] Composite" during the dot-com bubble and financial crisis of 2007. During the dot-com bubble NASDAQ dropped from the peak of 5,132.52 to 1,108.49 during two and half year of the crisis started on 10 March 2000. During the 2007 financial crisis NASDAQ on the October 9th, 2007 closed at 2,800 and dropped to 2,300 by February the 6th, 2008. The description below shows that there will be no change to the value under the GAAP approach because the market values are irrelevant under that approach, however in the market approach, since the debt is trading at a significant discount the equity value will be ignored because of the fact that equity is junior to the debt claim, and the debt holders have to recover their values first, and after recovering their value, if there is some value left it would be given to the shareholders as the residual value.

[12] NASDAQ Composite consists of 3000 components and it is highly followed as an indicator of the performance of stocks.

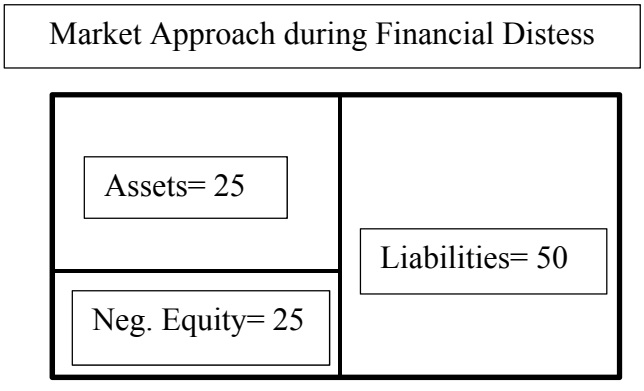




						Amount	Price	Value
Cash	35	Liabilities	50		Liabilities	50	50%	25
Tangible Assets	80	Equity	65		Equity	60	0	0
Total	110		110		Total			25

Table 4: Market vs. GAAP presentation of balance sheet 3

There is an interesting observation here; if the stocks are trading at 15 cents which is a positive value does it not mean that the firm's debt would be receiving 100% recoveries on their claims? Because equity should receive any only after the creditors' claims has been *"fully"* satisfied (since equity is junior in its claims). Having a positive value of equity can indicate full recoveries for the firms' creditors.



Assets	**25**	**Liabilities**	**50**
Net Equity	25	Equity	0
Total	50		50

Table 5: Market presentation of balance sheet in financial distress

This is the problem with the market approach in distress, since the firms' liabilities are more than the asset value of the firm. Because of this problem it is customary to use the nominal value of the shares to value financially distressed firms rather than resorting to the market value of the equity.

In a distressed situation the value of the assets are much more important, because they are going to dictate how much will be available to satisfy the creditors' claims, and if any residual value will be handed over to the equity holders.

Using the book values is a way to value the equity in a distressed situation, it may not be the perfect solution however it is a good approximation that should be utilized instead of using the market value of equity. Because from the example above, the market value of equity becomes fairly meaningless in a financial distressed situations according to Moyer. (Moyer, 2005)

6. Abnormal Return Measurement:

In the thesis a special measurement is used that we dubbed as "*abnormal return*"[13] for bondholder, the abnormal return is nothing more than the difference between trading price of security after default as percentage of amount outstanding of same seniority class of the bonds and the ultimate recovery as percentage of amount outstanding of the proposal. It is used in the thesis for measuring how much better/worse off the creditors are by accepting the restructuring proposal than if they sell their security on the market and get trading price base returns. It is presumably same as ultimate recovery, but since ultimate recovery is always positive, abnormal returns can take on negative values, indicating that creditors have received a worse proposal than they should have got through trading price recovery.

$$Abnormal\ Returns = \left(\frac{proposal\ value}{Outstanding\ amount}\right) - \left(\frac{Trading\ price\ of\ security\ at\ default}{Outstanding\ amount}\right)$$

The reason for choosing the abnormal return terminology is it can be negative and positive indicating if the bondholders got better off in case of positive value or worse off in case of negative value, as compared to trading price returns.

[13] We used the term "abnormal returns" differently than its traditional meaning in finance. To us it is the difference between ultimate returns (discounted value of cash flows plus equity value if any) of a security at default and its "expected" return. Expected returns as we considered are if at default bondholders sell their security on the market and get trading price returns.

7. Description of the sample

In Table 6 an overview of Stamdata database is presented. The table shows the amount outstanding in million Norwegian Kroners and Total number of tranche issued by industry type. It is clearly evident from the table that finance, public sector, energy and utility, oil and gas and shipping dominate in the Norwegian bond market both in volume and number.

Industry	Volume (mNok)	Number of Bonds	% of Total Volume	Average Tranche size (mNok)
Finance	619 052	2267	34%	273
Public Sector	561 034	787	30%	713
Bank	376 177	442	20%	851
Energy and Utility	77 645	222	4%	350
Oil and Gas	75 022	92	4%	815
Shipping	34 769	80	2%	435
Industry	27 033	78	1%	347
Property	20 309	53	1%	383
Service	14 052	45	1%	312
Transportation	10 134	40	1%	253
Food and Beverages	8 301	29	0%	286
Wholesale and Retail	7 810	24	0%	325
Fishery	3 440	12	0%	287
Media	3 135	9	0%	348
Telecom/IT	2 580	9	0%	287
Others	1 400	6	0%	233
Total	1 841 893	4195	100%	

Table 6: Issued amount (mNOK) during 2012 by industry type source: Stamdata database as of 08/09/2012

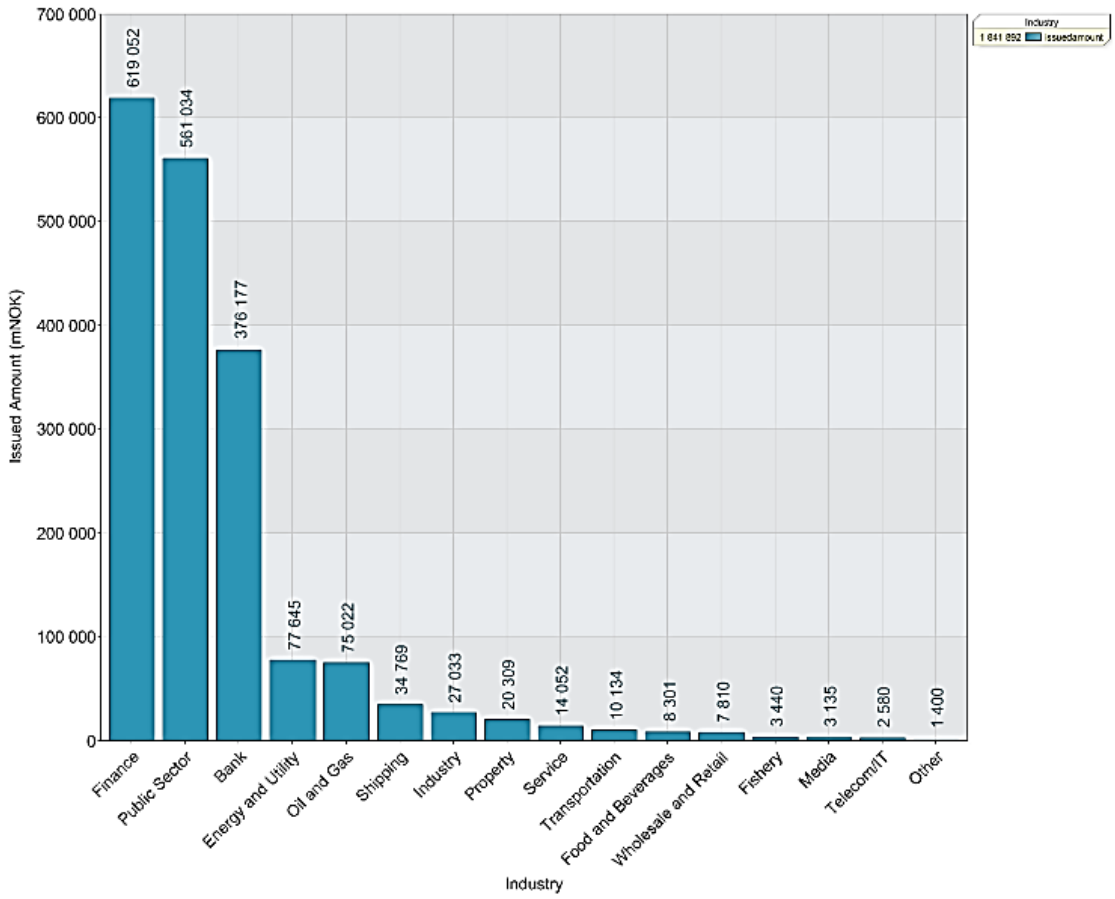


Figure 18: Bar chart of issued amount (mNOK) during 2012 by industry type source: Stamdata database as of 08/09/2012

Our final sample comprises of 97 bonds, we sorted the sample by looking at Stamdata database and selecting companies that went through restructuring, and then we further sort out the sample by looking into the companies who went through restructuring due to financial distress, while other companies were excluded from the sample.

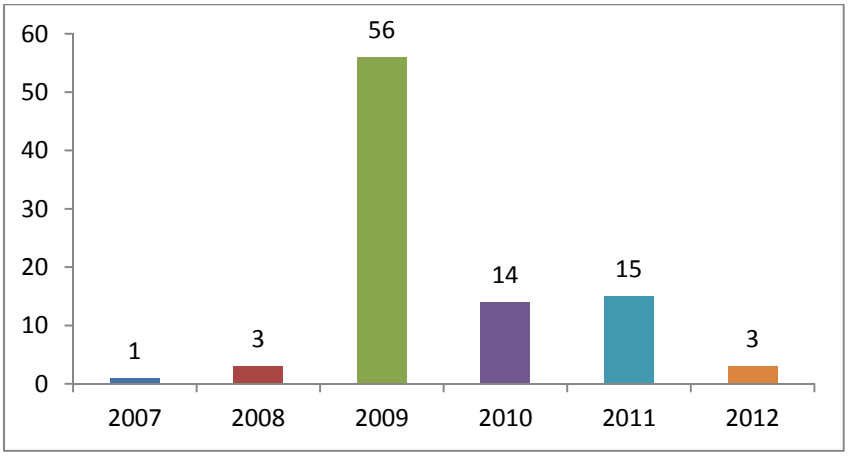


Figure 19: Restructuring during the year

Figure 19 illustrates restructuring during each year from 2007-2012 and clearly show that half of restructuring occurred during 2009, this could be from the fact that due to financial crisis that hit the world which led to economic downturn all around the world. Most of our sample is from 2009 to 2011 with only few restructuring proposed during the rest of the year included in the sample

Oil & Gas	Oil & Gas Services	Shipping	Mining	Others
Aladdin Oil & Gas ASA	Bergen Group ASA	Aker American Shipping ASA	Crew Gold Corp	Blom ASA
Artumas Group Inc/Wentworth Resources	Bergen Oilfield Services AS	Belships ASA	Wega Mining AS	Codfarmers ASA
Malaka Oil AB	Bluestone Offshore Pte Ltd	Eitzen Chemical ASA		Krillsea Group ASA
Nor Energy AS	Ceon ASA, Ceon AS1 & Ceon AS2	Eitzen Maritime Services ASA		Nattopharma ASA
Norse Energy Corp ASA	Marine Accurate Well ASA - MARACC	Nexus Floating Production Ltd		Peterson AS
Oren Oil/Saga Oil	Marine Subsea AS	Oceanlink Ltd		Tandberg Data-Storage ASA
Front Exploration AS (Discover Petroleum AS	Master Marine AS	Fairstar Heavy Transport NV		
Geysir Petroleum hf	Nordic Heavy lift ASA	Primorsk International LTd		
Proserv Group AS	Oceanteam Shipping ASA/Oceanteam Power&Umbilical ASA			
Interoil Exploration and Production ASA	Petrolia ASA			
	Reservoir Exploration Technology ASA			
	Rowan Drilling Norway AS- Skeie Drilling ASA			
	Sevan Marine ASA			
	Transeuro Energy Corp			
	Scan Geophysical ASA			
	Valhalla Oil and Gas AS			
Total: 10	16	8	2	6

Table 7: Sample classification by industry type

Table 7 sorts out the sample by five broader industry types. Companies included in Oil and gas industry type are the ones that are directly related to oil and gas production and exploration. We distinguish oil and gas production from oil and gas services, and oil and gas services includes the companies that provided services to oil and gas exploration. The Norwegian market is dominated by the oil and gas and shipping companies, so that is why almost 62% of the sample consist of oil and gas related companies that were involved in restructuring and 20% of the companies that were involved in restructuring were related to

shipping. Companies that are not related to oil & gas, oil and gas services, shipping and mining are grouped as others.

8. Sample Analysis:

8.1. Descriptive Analysis

Descriptive analysis of the sample has been done to analyze and presents the collective information about the abnormal return of the sample according to industry type, seniority of claim, and type of instrument used for distress exchange etc. the descriptive analysis is present in the form of table and graphs for the layman to understand how much abnormal returns are associated with different industry type, type of distress exchange instrument and seniority of claim. Although descriptive analysis only present significant features of the sample but it is a very effective tool to understand the trend in ultimate recovery associated with the types of bonds. A detailed regression analysis has also been done to analyze if the results obtain by descriptive analysis are significant or not.

The Table 8 below illustrates our sample by industry type and by amount outstanding for the time period covered by the study. 63 percent in number of total bonds and 73 percent of total amount outstanding consist of bonds issued by companies related to either oil and gas production or providing services to oil and gas industry.

Industry	Number of Bonds	Percentage of Total Bonds	Amount Outstanding (bnNOK)	Percentage of Total Outstanding
Oil & Gas	22	23%	4.15	13%
Oil & Gas Services	39	40%	19.10	60%
Shipping	15	15%	5.03	16%
Mining	6	6%	2.18	7%
Other	15	15%	1.55	5%
Total	97	100%	32.01	100%

Table 8: Sample description by industry and amount outstanding

For the purpose of regression analysis we also divided our sample into convertible bonds and "regular"[14] bonds and also in different type of interest rate structure i.e. fixed and floating rate. The table below illustrates that almost all of convertible bonds have fixed interest rate structure and only have one has a floating rate coupon rate, but "regular" bonds has 39 bonds which has floating rate interest rate structure and 30 bonds has fixed rate interest rate

[14] All types of bonds e.g. with and without embedded options except for convertible bonds

structure. It is also evident from the table below that there is even split between floating rate and fixed rate coupon rate in our sample, but fixed rate dominated our sample.

Interest Rate Structure	"Regular" Bonds	Convertible	Total number of Bonds	Percentage of Total Bonds
Floating Rate	39	1	40	41%
Fixed Rate	30	27	57	59%

Table 9: sample description by bond types

8.1.1. Descriptive Analysis of Sample's "Ultimate" Returns:

Figure 20 illustrates number of bonds in our sample that were involved in restructuring due to distress by their seniority claim. As well average recovery rate calculated by Moody's for the period 1987-2010. Almost 44% of our sample consists of senior secured bonds and 40 percent consist of senior unsecured bonds. The bar graph illustrates the average ultimate recoveries for different seniority of bonds; also it clearly shows that senior secured bonds in our sample obtained ultimate recovery of 65% of their face value and senior unsecured obtaining slightly higher recoveries of 68%. Ultimate recoveries calculated for senior secured and senior unsecured in our sample are *almost* identical to the trading price recoveries calculated by Moody's for the same seniority (Moody's, 2011). The number of the bonds in other categories is not large enough to make a sound judgment about average recoveries for those classes of bonds.

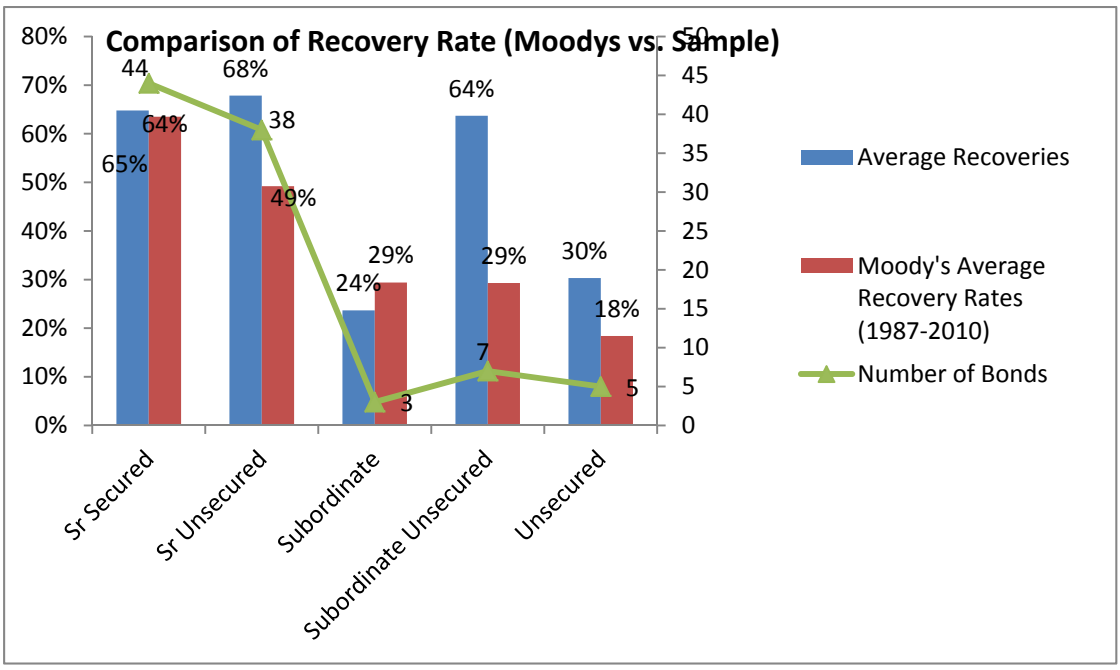


Figure 20: Number of bonds in restructuring according to their seniority claim and their ultimate recoveries compared to Moody's average recovery rate (1987-2010)

It is evidently clear from the graphs below (Figure 21) that ultimate recoveries for senior secured and senior unsecured bonds has increase since the onset of the financial crisis. An ultimate recovery for senior secured bonds from the modest 37 percent has risen to 69 percent in year 2011. Data for ultimate recoveries of senior secured bonds for 2007 and 2012 is deliberately excluded because of none or only one bond that got restructured in these years are present in our sample. Same can be said for senior unsecured bonds, whose ultimate recoveries has risen from modest of 23 percent in 2007 t0 92 percent in 2012.

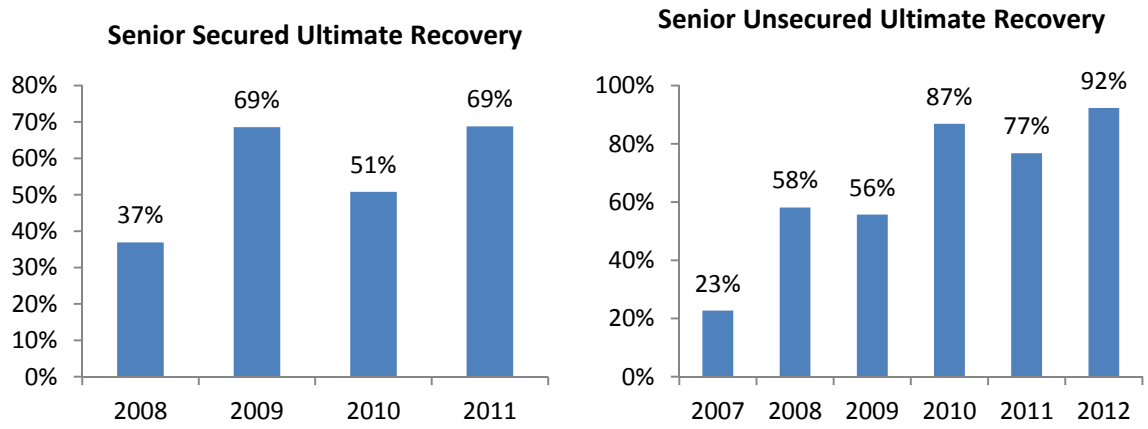


Figure 21: Ultimate recoveries of senior secured and senior unsecured bonds of the sample.

The graph below (Figure 22) illustrates ultimate recoveries of senior secured and senior unsecured bonds side by side. It is evidently clear that senior unsecured bonds have earned better ultimate recoveries then their counterpart i.e. senior secured for all year included in the sample, with the exception of year 2009 where senior secured ultimate recoveries were higher than the senior unsecured bonds.

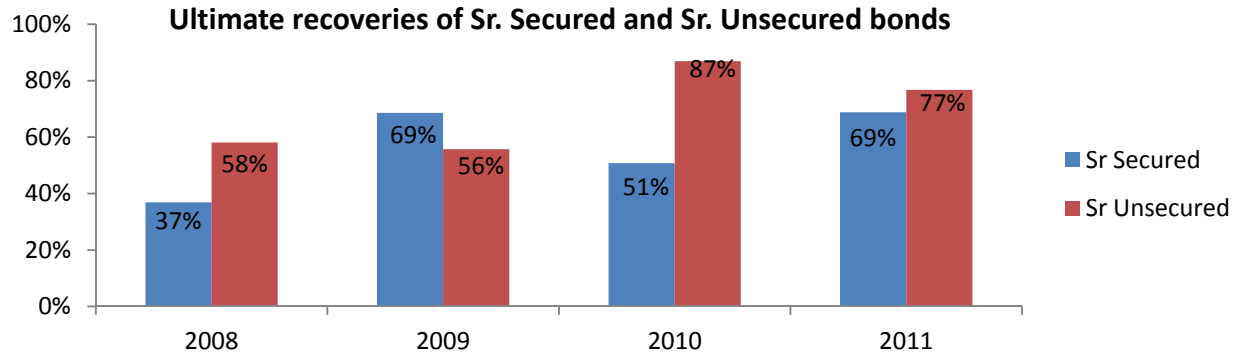


Figure 22: Comparison of ultimate recoveries of senior secured and senior unsecured bonds

From the pie chart below (Figure 23) it is evidently clear that almost of half of the restructuring for our sample has been done with debt exchange, 32 percent with debt-to-equity

swap and rest with a mixture of debt-to-equity and debt exchange. Debt exchange in the Norwegian bond restructuring is quite frequent then bankruptcy proceeding. This result coincide with (Moody's, 2011) which also has similar results, where debt exchange was only 11% of defaults for the period 1970-2007 and then it really took off because of number of reasons like unattractiveness of bankruptcy, lack of debtor in procession and exist financing. But between 2008 and 2010 the share of distress exchanges increased from 23 percent to 42 percent.

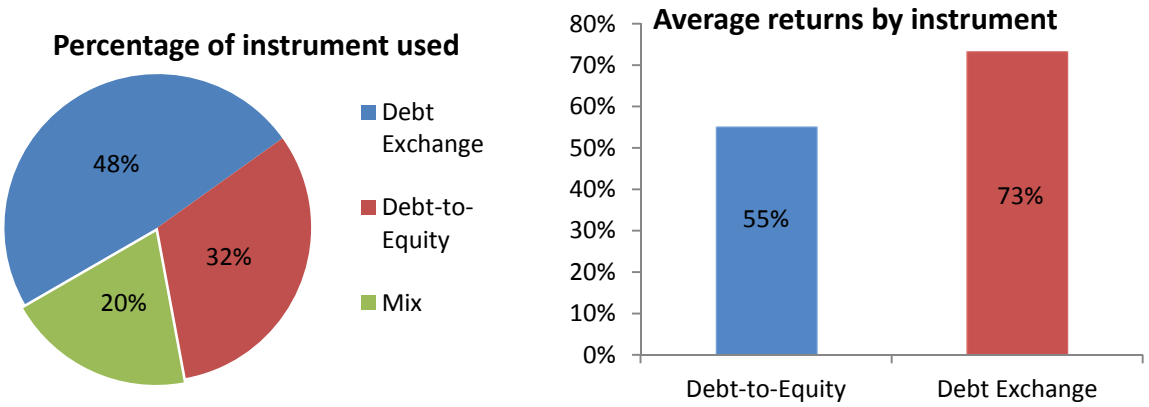


Figure 23: Distress Exchange by type and ultimate recoveries for debt-to-equity and debt exchange.

An average recovery for debt-to-equity swap is at 55 percent for our sample. This ultimate recovery has been calculated using nominal value of share and not market stock price. That could be a reason for lower ultimate recovery, but bondholders choosing for debt-to-equity swap have an unlimited upside if the distressed company turns around because of better liquidity situation and less debt in its capital structure. On the other hand debt exchange average ultimate recoveries were 73 percent which are 33 percent higher than debt-to-equity swap

The graph below (Figure 24) illustrates that average ultimate recoveries for the oil and gas sector (oil and gas production and exploration) has been quite high at 78% as compared to other industry type. The reason for this high ultimate recovery is that, 7 out of 22 bonds in oil and gas industry are senior secured, with an average ultimate recovery of 64 percent. Another reason for higher recoveries is that senior secured bonds have low probability of default which is a major input in calculating ultimate recoveries. Also this sample consists of 8 senior unsecured bonds, with an average ultimate recovery rate of 85 percent. Senior unsecured bonds have little high probability of default than senior secured but still significantly lower

than other type of bonds. All this factors have contributed to the higher recoveries for oil and gas sector.

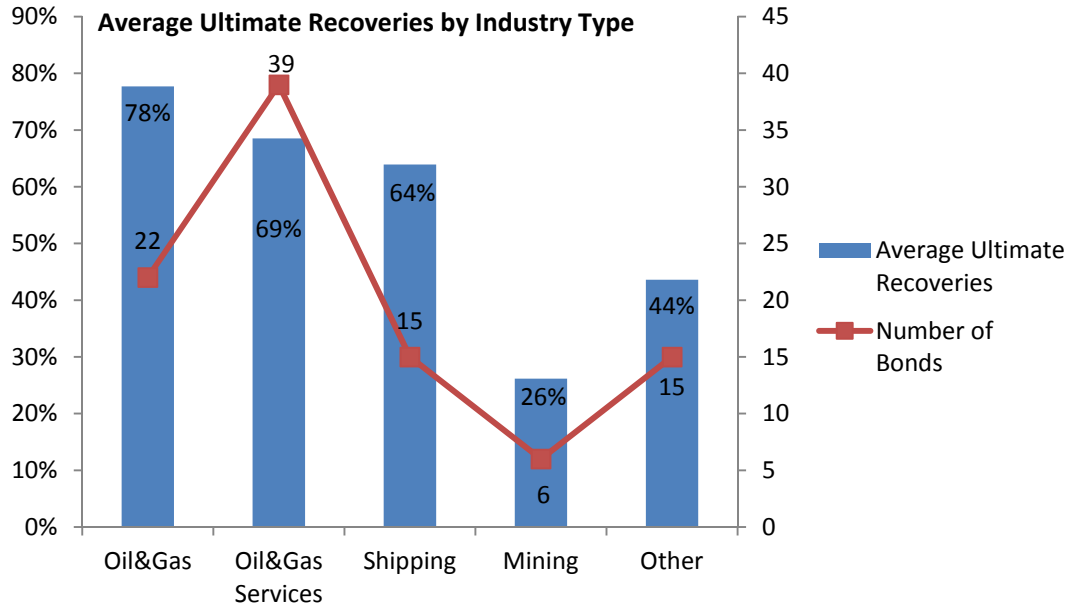


Figure 24: Average ultimate recoveries by industry type and number of bonds involved in restructuring.

The graphs below (Figure 25) illustrate average ultimate recoveries for different industry type along with number of senior secured and senior unsecured bonds. It is clearly evident the higher the number of secured bonds the higher the recovery rates in the industry, for example, oil and gas industry has 8 senior secured bonds and their average recovery rates is 60 percent. But in the case of mining and shipping industry which only has 2 senior secured bonds each it could not been said the same for them. Higher average ultimate recoveries for the oil and gas, oil and gas services and hipping could be attributed to higher number of senior secured bonds, which were involved in restructuring.

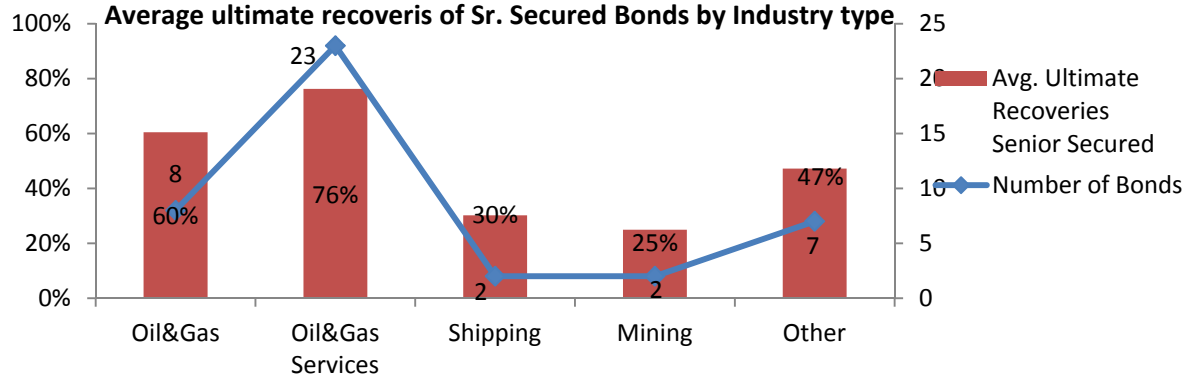


Figure 25: Average ultimate recoveries by industry type for senior secured bond along with number of bonds involved in restructuring

In the graph blow it is evident that higher the number of senior unsecured bonds involved in restruturing, higher the recoveries rate in the industry type will be. Oil and gas industy has 12 senior unsecured bonds and their ultimate recovery for senior unsecured bond is 90 percent, this is also one of the reason for higher ultimate recovery rate for the oil and gas services industry on the average. Same could be said for other type of industy in the sample.

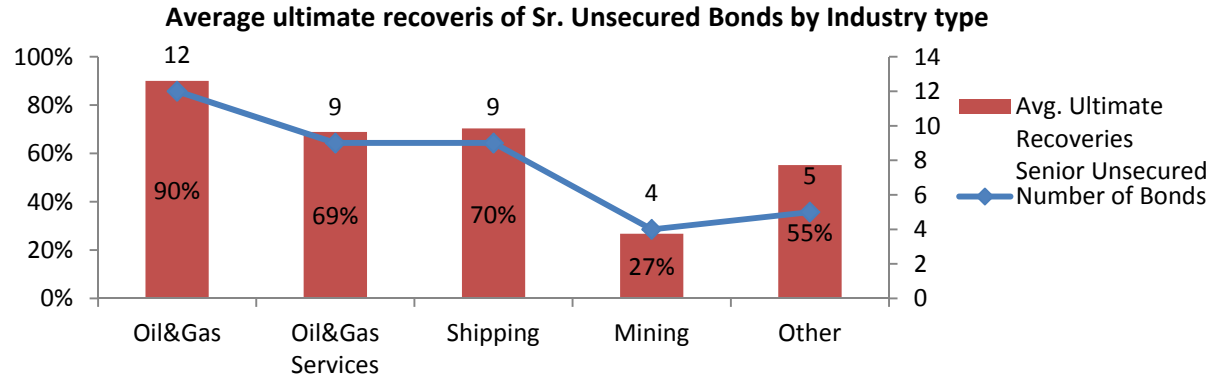


Figure 26: Average ultimate recoveries by industry type for senior unsecured bond along with number of bonds involved in restructuring

It is clearly evident from the above graphs that presence of senior secured and senior unsecured bonds in restructuring give higher ultimate recovery rate, the main reason for this is that, the probability of default for senior secured and senior unsecured is very low as compare to other types of bonds, which is a key input in calculating ultimate recoveries.

8.1.2. Descriptive Analysis of Sample's "Abnormal" Returns:

Figure 27 illustrates the abnormal returns for different types (seniority claim) of bonds; it is clearly evident that senior secured and senior unsecured bonds received high abnormal returns in our data sample.

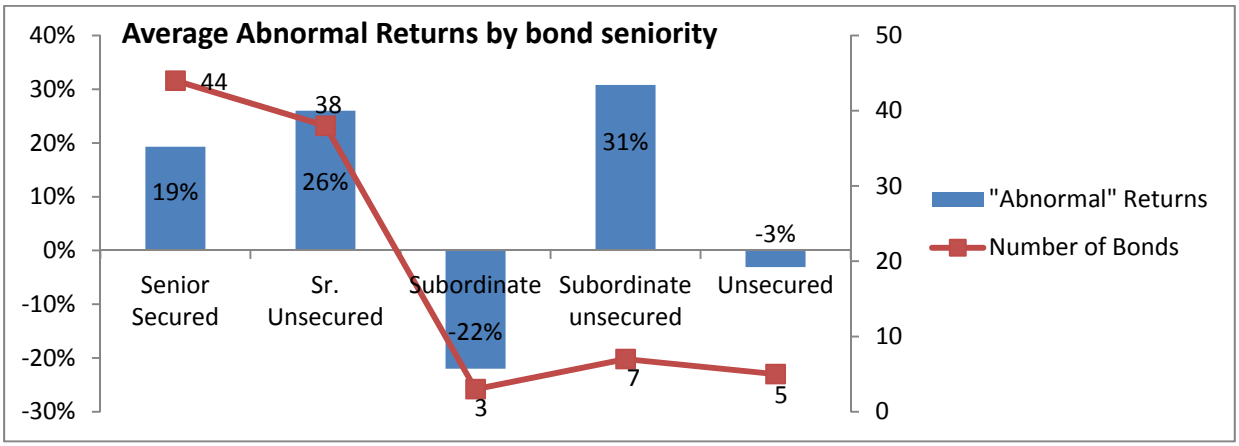


Figure 27: Average Abnormal Returns by Bond Seniority

The abnormal returns obtained by other type of bonds cannot be asserted with confidence because the number of bonds involved in the restructuring process was very low in number.

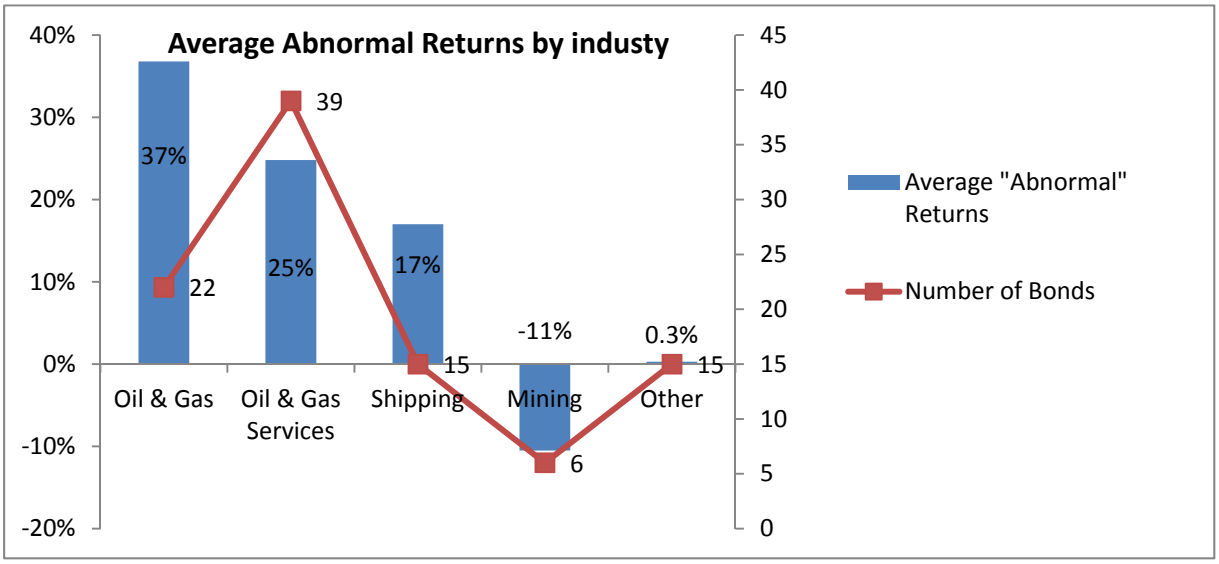


Figure 28: Average abnormal returns by industry type

Figure 28 depicts average abnormal returns associated with different type of industry. It is clearly evident that oil and gas, oil and gas services and shipping industries received higher abnormal returns. It is difficult to suggest that mining industry obtained negative abnormal returns in the restructuring process because only 6 bonds were in the sample. When an industry or bond received negative abnormal return, this means that they have accepted the deal in which they receive lower ultimate returns than getting trading price recovery.

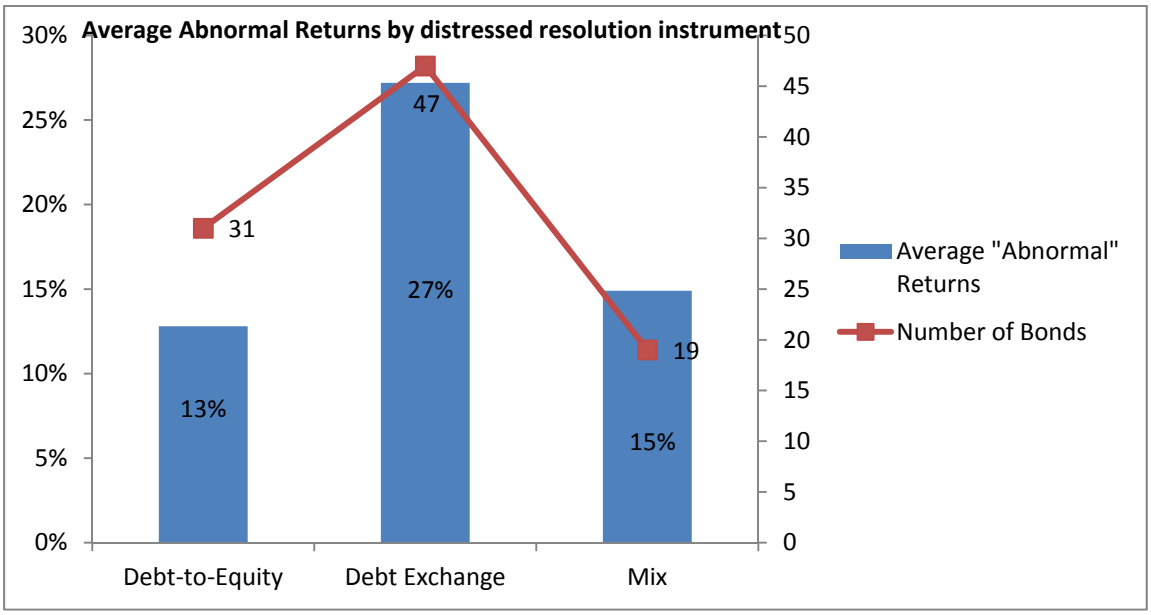


Figure 29: Average abnormal returns by distressed resolution instrument

Figure 29 display average abnormal returns by the type of distress resolution instrument, namely debt-to-equity swap, debt exchange and mix of both. The graph shows that creditors will have high (positive) abnormal returns if they are offered debt exchange during financial restructuring then debt to equity swap. Lower abnormal returns for debt-to-equity swap can be attributed to the valuation techniques used, where nominal value of shares is used to value the equity instead of trading price shares. The reason for using nominal value is that, most companies trading price were not available. As well distressed firm equity becomes a call option, but due to lack of data, it was valued suing nominal value than Black and Scholes option pricing model. The graph above suggests that creditors to receive higher value in restructuring than trading price recoveries should choose distressed resolution instruments in this order 1) debt exchange, 2) mix of debt-to-equity swap and debt exchange and 3) debt-to-equity swap.

8.1.3. Descriptive Analysis Conclusion:

From descriptive point of view of the sample data, it can been noticed that sample is mostly composed of senior secured and senior unsecured bonds so the descriptive analysis regarding these two bonds will shed better light on them other bonds which are very few in number. 73 percent of our sample consists of bonds that are related to oil and gas production and services firms, the reason for lot of bonds in this industry could be the financial crisis around the world which affected the industries all over the world and this can also confer that Norwegian economy is dominated by oil and gas related industry.

Other conclusion that could be drawn from descriptive analysis is that senior unsecured bonds acquired better returns then senior secured bonds and also returns for both type of bonds have increase since 2008. Another interesting observation from the analysis is that except for year 2008 senior unsecured on average obtain higher ultimate recoveries than senior secured bonds.

Another observation that coincide with (Moody's, 2011) is that the distress exchange (either debt exchange or debt to equity swap) is popular among Norwegian creditors instead filing for bankruptcy filing. Also debt exchanges have on average has obtained higher returns than debt to equity almost 18% more.

The most important observation from the sample comes from the fact that oil and gas production and exploration related companies obtained highest ultimate returns of 78%, this is because of two reasons, one most of the bonds in restructuring in our sample for the oil and

gas industry was senior secured bonds and other reason could be that these types of industries have large tangible assets so that could be the reason for higher returns for distressed bondholders.

Another interesting observation is that the higher the number of senior secured and senior unsecured bonds, the higher their ultimate recoveries irrespective of industry type. From the graphs and tables the picture of seniority, security and industry appears to be the most significant factors determining ultimate recovery during the restructuring process, with this descriptive analysis it cannot be concluded with certainty because detailed regression tests need to be done to see if these results are statistical significant.

The main conclusion that can be drawn from the descriptive analysis is distressed investors should hold bonds for oil and gas related industry and should opt for debt exchange during financial restructuring negotiations to receive higher return than trading price returns.

The next part of the analysis will examine the sample in more depth and with more efficient tools to see if a relationship and its magnitude can be determined.

8.2. Regression Analysis:

In this regression analysis we have tried to answer our research questions with the help of econometrics. The first question/hypothesis was that the bondholders should always receive positive "abnormal returns" from financial restructuring or in other words they only accept financial restructuring when their returns are higher as compared to if they sell their bond in the market. This was not the case as in 30% of our cases bondholders had negative abnormal return.

Another hypothesis is that during financial restructuring Absolute Priority Rule is upheld could not be refuted but there were a few outliners where we had deviations from APR, however on the larger scale we cannot say that APR was violated in our sample. Also the regression analysis did not provided that seniority of the bonds was a significant variable to estimate abnormal returns. But regression did find that industry and the type of proposal (debt exchange or debt to equity swap) given and executed were significant variables to estimate abnormal returns.

8.2.1. Test of Hypotheses

There were 97 bonds in our sample that went through financial restructurings, 25 of those bondholders received negative abnormal returns, which imply that in about 26% of the cases

the bondholders would have on average been better off if they would have sold their claim in the market. The reason for that could include that there is not enough distress investors in the market to buy their claim and also that there are not enough distress investing funds available in the market so bondholders accept the restructuring deal and agree to receive lower returns. Other reasons could be that bondholders are very experienced investors and backed up by the financial advisor and on their advice they might think that holding on to the restructuring deal they can maximize their return in the future, for example in the case of debt to equity swaps they might have valued the equity to be of much higher valued in the future so they accept the deal in the hope that a small loss now can turn into huge returns in the future. Also sometime Norsk Tillitsmann provided bondholders with their expert opinion about the restructuring whether it is a good deal or not and whether bondholders should evaluate the deal on to their own and by their advisors.

The range of abnormal returns varied a lot in our sample, the highest abnormal return was at 135% (in Rowan Drilling Norway) and the lowest was at -58.4% (in Krillsea Group ASA). The graph below (Figure 30) clearly indicates that abnormal returns for the distress bondholders vary a lot.

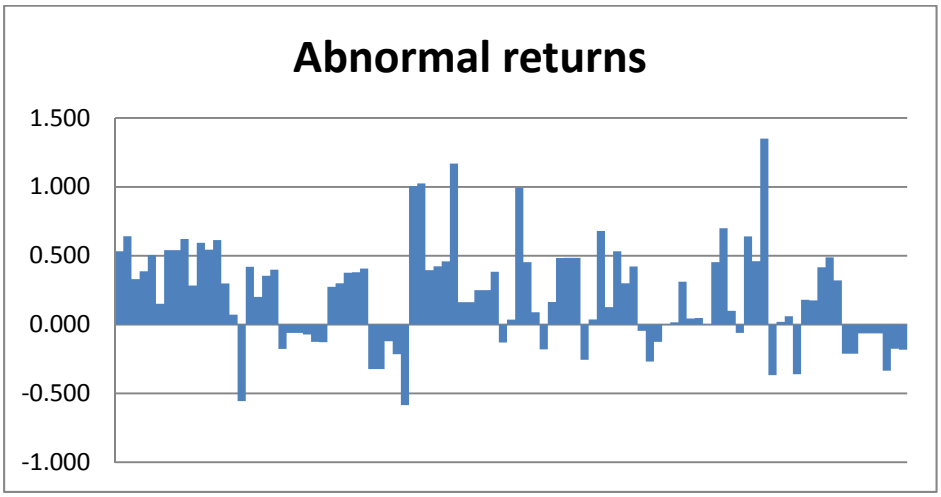


Figure 30: graph of sample abnormal returns

We also observed if there was any particular industry type that receives negative abnormal return but there was no industry that stood out in our sample which can be clearly seen from the table blow.

Industry Type	Number of Negative Abnormal Returns
Oil and Gas	4

Oil and Gas Services	5
Shipping	4
Mining	6
Others	6
Total	25

Table 10: negative abnormal returns by industry

We performed multiple linear regressions on two models to find out if abnormal returns are significantly affected by the type of restructuring instrument, type of bond, bond seniority, time in restructuring, time to maturity, industry type or ownership percentage after debt to equity swap. We started the regression analysis by deciding to use abnormal return as the dependent variables, and the following as the independent:

Independent Variable	Type	Reason	Significance
Fixed Coupon	Dummy	Interest structure	Not proven
Senior	Dummy	Priority oriented	Not proven
Secured	Dummy	Collateral	Not proven
Debt Exchange	Dummy	Type of restructuring	Yes
Debt to Equity Swaps	Dummy	Type of restructuring	Not proven
Ownership percentage after a D2E	Quantitative	Take-over	Not proven
Outstanding amount	Quantitative	Size	Not proven
Oil & Gas	Dummy	Industry	Yes
Oil & Gas Services	Dummy	Industry	Yes
Shipping	Dummy	Industry	Not proven
Mining	Dummy	Industry	Not proven
Other	Dummy	Industry	Not proven
Time to Maturity	Quantitative	Stress factor	Not proven
Gearing	Quantitative	Debt load	Not proven
Time in restructuring	Quantitative	Stress factor	Not proven

Table 11: list of independent variables used in regression

The regression analysis was performed in steps. In the first step we decided to test above listed independent variables whether they have a significant relationship to abnormal returns. For that purpose we used a multiple linear regression model with the above listed variables , we decided that variables that produced coefficients around 0.10 in p-values will be kept for further regression analysis and the ones with much higher p-values would be trimmed off.

Because higher p-value would mean that there is no significant relationship between the independent and dependent variables, or in more simple words the above listed independent

variables do not have any relationship with abnormal returns. The reason for not being very strict with the required significance level of 0.10 was that some independent variables may produce disturbance in the model and make significant variables seem insignificant. As an example, the variable for debt exchanges would have been discarded early if we hadn't provided the models with some slack in the trimming phase, because in the first and second regression tests where all independent variables were present, debt exchanges did not pass the 0.05 criterion. And if we hadn't used the rule of keeping the ones with p-values close to but not limited and discarded if somewhat higher than 0.10 a variable such as D2D would have been cut, and that would have been wrong since we can see that it in fact are relevant and significant, it was the "disturbance" from the other variables that in the beginning made it appear un-significant.

We also performed the regression tests by cutting the sample for the independent variable "gearing" to 71 observations. This was done because there was no information available to us regarding all companies gearing. That meant that we did use one sample of 97 observations that we called "without" gearing", and a sample with 71 observations where we had cut the companies we could not find out the gearing from. We then worked the sample and received two models one including gearing, and one without. We then trimmed the obviously insignificant independent variables from the model and repeated the process of trimming the independent variables up to three times, until we were satisfied that we had only significant independent variables in the models. We had our final models where we set the required p-value of 0.05 to consider the coefficients significant. Usually in research there are three levels of significance in the p-values used 0.01, 0.05 and 0.10. We decided that 0.05 would be acceptable as the required significance for a final model.

Independent Variables	Type	Required significance	p-value	Significant
Debt exchange (D2D)	*Dummy*	0.05	0.0051	Yes. Reject H0
Oil & Gas	*Dummy*	0.05	0.0001	Yes. Reject H0
Oil & Gas Services	*Dummy*	0.05	0.0015	Yes. Reject H0
H_0: No relationship				
H_1: Relationship				
Abnormal Return = **- 0.074 + 0.202***D2D **+ 0.378***Oil & Gas + **0.258***Oil & Gas Services + **e**				

Table 12: Multiple linear regression Abnormal Return (No Gearing)

Multiple linear regression Abnormal Return (gearing)				
Variables	**Type**	**Required significance**	**p-value**	**Significant**
Oil & Gas	*Dummy*	0.05	0.0004	Yes. Reject H0
Oil & Gas Services	*Dummy*	0.05	0.0453	Yes. Reject H0
H_0: No relationship				
H_1: Relationship				
Abnormal Return = **0.124 + 0.403***Oil & Gas + **0.183***Oil & Gas Services + **e**				

Table 13: Multiple linear regression Abnormal Return (with gearing)

Table 13 shows p-values of the final regression models. The two models displayed are of the abnormal returns. Both final models seems to first indicate that the industries "Oil & Gas, and Oil & Gas Services" both have a significant positive relationship that is positive with abnormal returns in restructurings. If the distressed bond is issued by an Oil & Gas industry firm then in financial restructuring the abnormal return seems to increase by almost 40%. The second noticeable point is that the type of restructuring performed is also important. This can however not be seen in the second model for abnormal return when gearing has been allowed in to the sample, and the sample have been reduced down to 71 observations. If the distressed bond during financial restructuring receives a debt exchange then bondholder's abnormal returns will increase by 20%. The final take away from the model is if a distressed bond is neither issued by Oil and Gas related industries nor receive a debt exchange in financial restructuring then it is better for the bondholders to sell off their bond in a market and receive trading price recoveries. That is easier said than done because it is conditioned on different factors as mentioned above, distress investing funds, market liquidity and future prospect of the restructuring deal perceived by bondholders based either or Norsk Tillitsmann or their financial advisors.

Regression Statistics for Abnormal returns (no gearing)	
R-Square	0.1924
Adj. R-Square	0.1664
P-Value of F	0.0002
Regression Statistics for Abnormal returns (with gearing)	
R-Square	0.1701
Adj. R-Square	0.1457
P-Value of F	0.0017

Table 14: Regression Statistics with and without gearing

The R^2 and adj-R^2 from the models gives us an explanatory power of the regression model, for the abnormal return we seems to only be able to explain about 20% and 17% of the variance.

But before any statistical inference can be done, and the model could possibly be used for any actual predictions, it needed to be tested that it is a good fitted model without bias.

8.2.2. Test of the model

The models we produced appear to have some explanatory power, and significant independent variables. However before any statistical inference can be made and the model would be suitable to test for prediction power and confidence intervals for the coefficients we performed some tests to see if the model meets the BLUE (Best Linear Unbiased Estimator) criteria and could be used for statistical inference. To be considered BLUE the model has to fulfill certain criteria: these criteria includes that the residuals cannot be heteroscedastic, auto-correlated or distributed "non-normally" around their mean and the model cannot be misspecified either.

We ran some tests to check for normality, homoscedasticity and model misspecification. In the tests, if the obtained statistic was larger than the critical values the "null-hypotheses" was rejected.

Normality, Homoscedasticity & Misspecification Abnormal Returns (no gearing)			
Test	**Critical value**	**Obtained**	**Accept/Reject H_0**
Jarque-Bera*	5.991	19.182	Reject
Brusch-Pagan**	7.815	1.822	Accept
Ramsey RESET***	3.097	0.182	Accept
*** Normality of residuals. H_0: Normality, H_1: Not normally distributed**			
**** Homoscedasticity, H_0: Homoscedastic, H_1: Heteroscedastic**			
***** Model misspecification H_0: No misspecification, H_1: Misspecified**			
Normality, Homoscedasticity & Misspecification Abnormal Returns (with gearing)			
Test	**Critical value**	**Obtained**	**Accept/Reject H_0**
Jarque-Bera*	5.991	12.083	Reject
Brusch-Pagan**	5.991	1.343	Accept
Ramsey RESET***	3.136	0.000	Accept
*** Normality of residuals. H_0: Normality, H_1: Not normally distributed**			
**** Homoscedasticity, H_0: Homoscedastic, H_1: Heteroscedastic**			

*** Model misspecification H_0: No misspecification, H_1: Misspecified

Table 15: Results to test if model fulfills BLUE (Best Linear Unbiased Estimator) criteria

The Jarque-Bera test confirms that the residuals are not normally distributed the disbursement around zero for the residuals can be seen below in the histograms of each model.

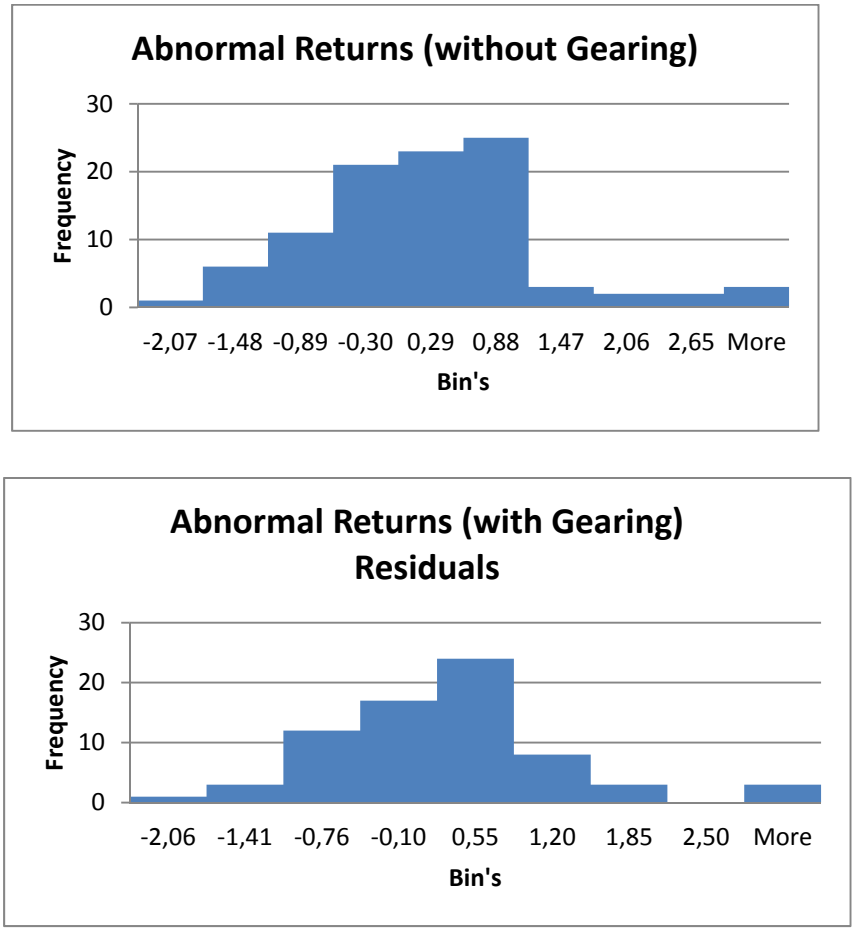


Figure 31: Histogram of standardized Residuals

If the residuals/error terms of the model are not considered normally distributed, the model cannot be used for statistical inference, so we cannot use our model for statistical inference.

The residuals could not be said to be heteroscedastic in any of the models according to the Brusch-Pagan test. The test are administered for its simplicity, where only an auxiliary regression is made and a LM-multiplier is calculated and compared to a critical value. If the model does not show itself homoscedastic in the residuals, then the error terms do not have the same dispersion and the model cannot be used for statistical inference.

None of the models appear in fact to be considered misspecified according to the RESET test which is important to attain the property of BLUE.

The last test we ran was the Durbin-Watson test to check for autocorrelation. There is a clear misconception regarding autocorrelation, that it is only apparent in time series data. This is not the case. In fact the reason for the misconception might be that it goes under another name in cross sectional data spatial correlation.[15] It is however almost the same thing.

In our data testing for autocorrelation/spatial correlation (since it is mostly cross sectional data) is just testing that one restructuring does not affect another restructuring. If it were, it would show up in our test and then there is a problem with the model.

Our sample (without gearing) consists of 97 observations while the other sample (with gearing) consists of 71, because we could not find any information regarding gearing of certain debtors. This made us use two different boundaries in regards to the decision rule for autocorrelation. From the table below we can determine that we appear to have autocorrelation in the model where we measure abnormal return with the independent variable "gearing" removed. It is very odd; it would imply that gearing was a variable that impacted abnormal returns of other restructurings; however this cannot be asserted with certainty because it can be something else involved in the sample. However when "gearing" is removed autocorrelation (positive) is present.

Durbin-Watson Abnormal returns without Gearing 0.05 level of significance			
d	1.431		
n=97			
95 observations	~~1.602 ≤ 1.431 ≤ 1.732~~		
100 observations	~~1.631 ≤ 1.431 ≤ 1.736~~		
Decision rules			
Null hypothesis	**Decision**	**If**	**Our d**
No positive autocorrelation	Reject	0 < d < dL	**Yes**
No positive autocorrelation	No decision	dL ≤ d ≤ dU	**no**
No negative autocorrelation	Reject	4-dL < d < 4	**no**
No negative autocorrelation	No decision	4-dU ≤ d ≤ 4-dL	**no**
No positive or negative autocorrelation	Do not reject	dU < d < 4-dU	**no**
CONCLUSION: We appear to have positive autocorrelation			

Table 16: Durbin-Watson (sample without gearing)

Durbin-Watson Abnormal Returns with Gearing 0.05 level of significance	
d	1.702
n=71	
70 observations	~~1.554 ≤ 1.702 ≤ 1.672~~

[15] (Gujarati, 2006)

Decision rules			
Null hypothesis	**Decision**	**If**	**Our d**
No positive autocorrelation	Reject	$0 < d < dL$	**no**
No positive autocorrelation	No decision	$dL \leq d \leq dU$	**no**
No negative autocorrelation	Reject	$4-dL < d < 4$	**no**
No negative autocorrelation	No decision	$4-dU \leq d \leq 4-dL$	**no**
No positive or negative autocorrelation	Do not reject	$dU < d < 4-dU$	**Yes**
CONCLUSION: We appear to have no autocorrelation			

Table 17: Durbin-Watson (sample with gearing)

8.2.3. Violation of APR in our Data sample:

In our sample of bonds financial restructuring there is one financial restructuring that stands out with the clear violation of APR. That is Sevan Marine ASA, there were 5 bonds involved in the restructuring 4 out of 5 bonds were senior secured bonds and 5th one was senior unsecured bond.

ISIN	Seniority	Amount Outstanding	Payment in Cash	Fees	Share offer	Total proceed to bondholders
NO0010366966	Senior Secured	227.5 MUSD	165 MUSD	9 MUSD	NO	156 MUSD
NO0010582950	Senior Secured	111.75 MUSD	94.4 MUSD	4.5 MUSD	NO	89.96 MUSD
NO0010582968	Senior Secured	100 MUSD	84.5 MUSD	4.5 MUSD	NO	80.03MUSD
NO0010391642	Senior Secured	740 MNOK	525.7 MNOK	50.3 MNOK	NO	475.3 MNOK
NO0010593627	Senior Unsecured	700 MNOK	N/A	N/A	Yes	

Table 18: Sevan Marine ASA APR violation

According to the APR senior secured claims should have been satisfied in full before senior unsecured bonds would receive any proceeds. But it is clearly evident that seniors secured Sevan Marine ASA bonds were not satisfied fully during the restructuring process and still senior unsecured bondholders receives shares in the restructured Sevan Marine ASA.

In our sample we have a couple of other restructurings that can be loosely termed as violations of APR in the sense that senior bondholders did not receive full payment of their claim and junior bondholder's received some value. These APR violations are objectionable for the fact the way equity and bonds are valued. We used nominal share price rather than market price to value the equity because distressed firm's market share price is meaningless. To value bonds we used a Lattice model which is a single factor model and only takes into

account interest rate fluctuations in valuing the bonds cash flows and the probability of default table that we used to discount these cash flow to the date of the restructuring proposal was not for Norway or Nordic countries but it was a probability of default table for the world and also we assumed that the bonds issued by these firm that are in distress now are CCC rated because of the fact that we do not had actual rating for the bonds available. So for the way equity and bonds are valued and then compared to the face value of bonds to calculate recoveries will not tell the true recoveries for the bondholders so that is why we are terming these as loose APR deviations. From the table below it can be seen clearly that in most of the cases recoveries for the senior bondholders has been less than 100% and junior claimants receive some value post restructuring which could be seen as APR violation.

Borrower	ISIN	Seniority	Recoveries as % of Face Value
Interoil Exploration and Production ASA	NO0010363567	Senior secured	62.50%
	NO0010362809	Senior unsecured	51.21%
Master Marine AS	NO0010431315	Senior Secured	41.25%
	NO0010372469	Subordinate unsecured	32.24%
Nexus Floating Production Ltd	NO0010357387	Senior unsecured	82.38%
	NO0010375207	Subordinate	54.29%
Reservoir Exploration Technology ASA	NO0010368285	Senior unsecured	41.56%
	NO0010403546	Senior unsecured	41.88%
	NO0010503394	Senior unsecured	10.44%
	NO0010302201	Subordinate	7.05%
Rowan Drilling Norway AS- Skeie Drilling ASA	NO0010356009	Senior Secured	83.37%
	NO0010376247	Subordinate	9.62%
Marine Accurate Well ASA	NO0010355803	Senior unsecured	76.66%
	NO0010378763	Subordinate unsecured	49.95%

Table 19: Sample APR violation

It is assumed that when a firm defaults on its debt obligations, bondholders can take over the firm and divide the proceed among themselves based on APR rule, the same rule should apply when redistributing distressed firm value among different claimants when a distressed firm is restructured because of financial illiquidity, but in our sample data we have observed that when the distressed firm goes through restructuring its capital structure to bring the debt level to a more sustainable level and existing debt is converted to equity, instead of wiping out old equity holders some small portion of equity is given to them, usually 5% of equity value is given to old shareholders and 95% of the value is given to bondholders in debt to equity swap.

There could be any number of explanations for it, one is that debtor in possession has a lot of bargaining power in the negotiation and secondly costs are borne by the firm and in most cases in restructuring old equity holders has nothing to lose by holding out the negotiation process and cost related to the restructuring is borne by the firm, which drives down the firm value bondholders are going to receive after the restructuring, so they give some portion of the equity to old equity holders to maximize their gain after the restructuring process to preserve more value they can get against their claims.

Bond ISIN	Borrower	Ownership Interest (Post Restructuring)			
		Old Equity	**New Equity***	**Others****	**Total**
NO0010378227	Wega Mining	11.49%	33.19%	55.32%	100%
NO0010357676	Valhalla Oil and Gas AS	13.30%	53.23%	33.47%	100%
NO0010396211	Transeuro Energy Corp	49.73%	24.64%	25.62%	100%
Multiple ISINs	Transeuro Energy Corp	3.35%	96.65%	n/a	100%
NO0010593627	Sevan Marine ASA	30%	10%	60%	100%
Multiple ISINs	Rowan Drilling Norway AS-Skeie Drilling ASA	4.02%	39.64%	56.34%	100%
NO0010302201 NO0010503394	Reservoir Exploration Technology ASA	57%	43%	n/a	100%
NO0010373400	Proserve Group ASA	3.10%	86.90%	10%	100%
NO0010336308	Geysir Petroleum hf	5%	95%	n/a	100%
NO0010446503	Front Exploration AS (Discover Petroleum AS)	0.90%	78.84%	20.73%	100%
NO 0010400328 NO 0010366503 NO 0010545676	Aladdin Oil & Gas ASA	31.93%	68.00%	0.07%	100%
NO010324460 NO010346158 NO010398167	Artumas Group Inc/Wentworth Resources	2.37%	49.13%	n/a	100%

NO 0010538473	Blom ASA	86.95%	13.05%	n/a	100%
NO0010364250 N0010506728	Ceon ASA, Ceon AS1 & Ceon AS2	66.67%	33.33%	n/a	100%
NO0010398142	Codfarmers ASA	47.85%	20.24%	n/a	100%
NO0010243801 NO0010293939 NO0010495559 NO0010307309 NO0010307317	Crew Gold Corp	5.00%	91.80%	3.20%	100%
NO0010538127 NO0010538119	Eitzen Maritime Services ASA (1st)	69.35%	30.65%	n/a	100%
NO0010593510 NO0010593502	Eitzen Maritime Services ASA (2nd)	5.00%	95.00%	n/a	100%
N0010518103	Krillsea Group ASA	90.28%	9.72%	n/a	100%
NO0010368780 NO0010404676	Malaka Oil AB	58.30%	41.70%	n/a	100%
NO0010355803 NO0010378763 NO0010461585	Marine Accurate Well ASA - MARACC	1.37%	52.49%	n/a	100%
NO0010372469	Master Marine AS	12.15%	7.11%	80.74%	100%
NO0010523871	Nattopharma ASA	84.89%	15.11%	n/a	100%
NO0010373244	Oceanteam Shipping ASA/Oceanteam Power&Umbilical ASA	38.10%	61.90%	n/a	100%
NO0010450687	Oren Oil/Saga Oil	6.50%	71.30%	n/a	100%

Table 20: Post restructuring ownership structure for debt to equity swap

*Bonds converted to equity as a result of financial restructuring.
** New share issued beside debt to equity swap e.g. in private placement and to employees etc.

We know that equity has a residual claim on the assets of the firm so in financial restructuring they should only get value when all the claimants' value has been recovered but from the table above we can clearly see that old equity is not wiped out post restructuring but did retain some value. Even though in some cases they should have not received anything and should be completely wiped out but bondholders still gave them some stake into the restructure firm. There could be a couple of reasons for that one major reason is that management is acting in

the best interest of shareholders and during the restructuring negotiations they use their bargaining power to delay the outcome of the restructuring, and when they do that it is creditors who bear the cost of restructuring because as time passes, the cost of restructuring will increase, that will lead to decrease in firm value bondholders will receive, to overcome this hold out bondholders give some value of the restructured firm to the old equity holders. The other big reason could be if the old equity holder is a manager or owner of the distressed firm and have superior knowledge or skills which are hard to replace and he/she can help the distress firm post restructuring perform better, so give him/her an incentive to work, bondholders carve out some value of the restructured firm for old equity holder.

8.2.4. Time to maturity and Gearing

We decided to examine two additional variables "time to maturity" and "gearing" more in detail to find out if they have any significant impact on bondholder's abnormal returns. Actual time to maturity is calculated from the date of the restructuring proposal to bonds original settlement date. We have some negative time to maturity in our sample because the restructuring proposal was put forward after the settlement date of the bond when firm defaulted on its interest and principal amount. The graph below depicts the histogram of time to maturity of the distressed bond at the time of the restructuring proposal date and it can be clearly seen that there is no pattern of distribution and distress bonds had between six month to 3 or 4 year left to the actual maturity date.

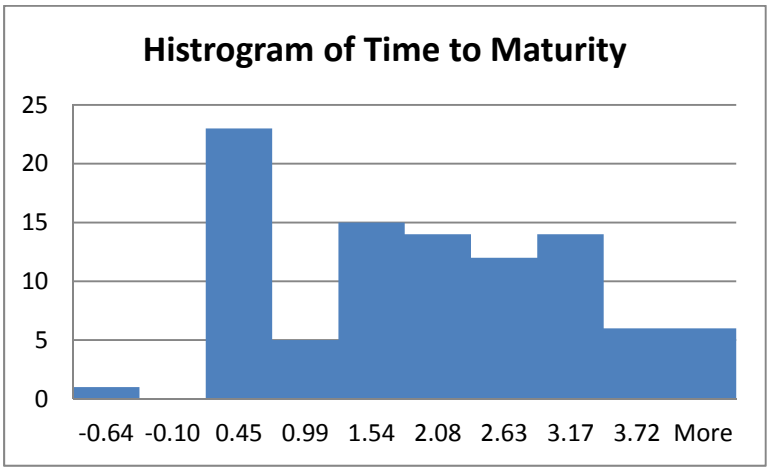


Figure 32: Histogram of Time to maturity of distress bonds in the sample

As in the statistical analysis no relationship (linear) could be seen, and the scatter plot below does not show any visually clear pattern regarding the ultimate recovery and the time left to original maturity at default. It seems from our sample that it does not have any real impact on bondholders return from financial restructuring.

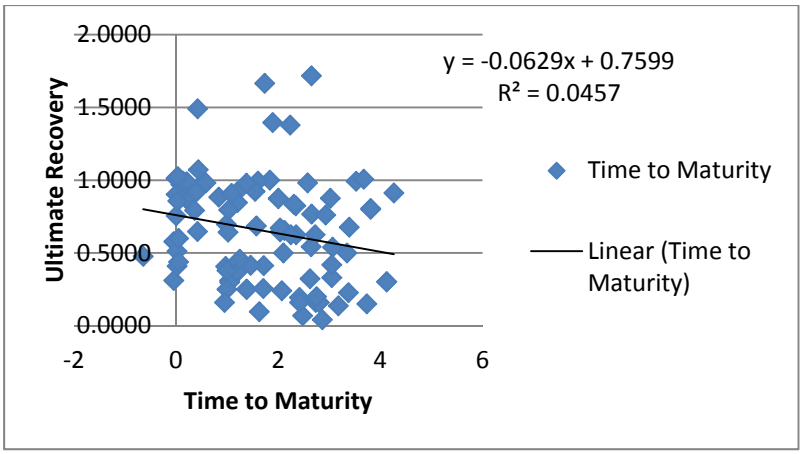


Figure 33: Regression result of time to maturity and abnormal returns

We also examined gearing (leverage- debt to equity ratio) of the firms involved in restructurings to see if gearing has any significant impact on bondholders' abnormal return. The histogram of the dispersion of the sample´s gearing shows that firms involved in restructuring have around a debt to equity ratio of 2 to 7 (i.e. debt constitutes around 66% to 88% of the capital structure) which is quite high. This could be expected since companies in trouble usually have high leverage and problems servicing the debt.

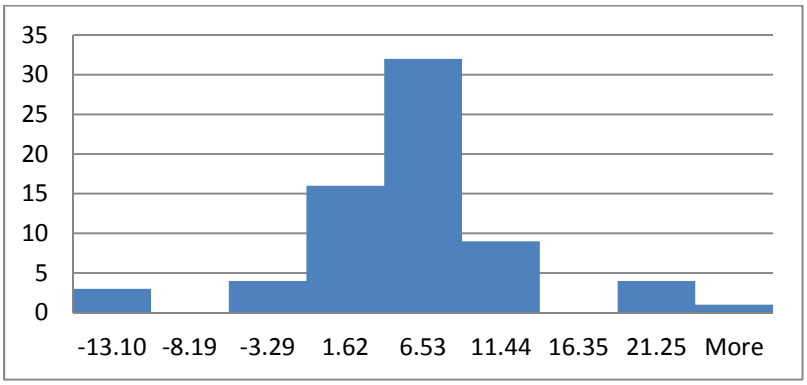


Figure 34: Histogram of Gearing (Leverage)

By examining the scatter plot below it can been observed that the p-value is very high, which means that there is no relationship between high gearing and bondholders' return in restructuring and also R^2 is around 2% which is very low

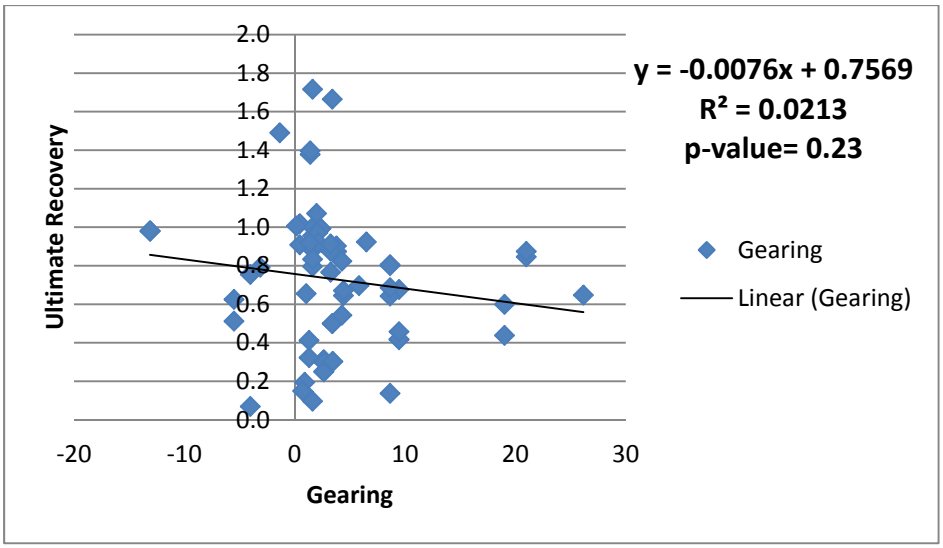


Figure 35: Regression results of gearing and abnormal returns

8.2.5. Time in restructuring

We also examined the effect of time spent in restructuring on the abnormal return for the distress firms' bondholder. We investigated this effect because the more time spend in restructuring will create more uncertainty regarding the future of the distress firm and its assets may even decline further in their value. By examining the histogram below we can observe that most of the proposals were given and accepted within half a year and the majority of them in one and a half month. There are some uncertainties regarding this, because maybe the distressed debtor were in private negotiations with their creditors which were not made public and since we have only been able to work with official announcements from NT that creates little uncertainty around the time spent in restructuring. We simply do not know if any discussions were initiated before NT published information.

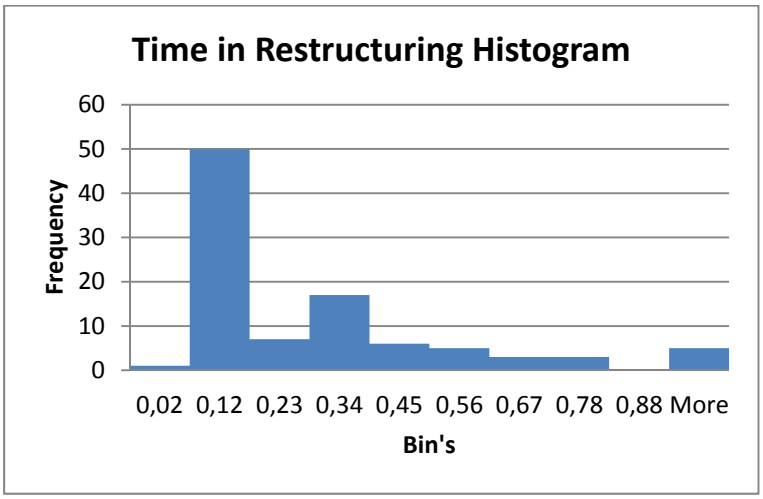


Figure 36: Histogram of time spent in restructuring.

The regression analysis did not provide us with any information regarding the time spent in restructurings and the recovery. That is not to say it is not there, we have no significant indications about it however.

8.2.6. Multicollinearity[16]

We also needed to test our sample and model for multicollinearity, which is to say does one of our independent variables have a linear relationship with some of the other independent variables.

Testing for multicollinearity was done by auxiliary regression, in which we regressed each independent variable against the others in a multiple regression; we then obtained the R^2 from those regressions and performed F-tests. This was done because if there were no multicollinearity in the sample R^2 should statistically significantly be zero. So if we received significance of "F", there is a large chance that we have multicollinearity.

Abnormal Return model without Gearing, 0.05 significance-level			
Dependent Variable	**Value of R2**	**Value of F**	**Is F significant**
Debt exchange	0.06	3.23	Yes
Oil & Gas	0.24	15.17	Yes
Oil & Gas Services	0.22	13.54	Yes
Critical F	***3.09***		

Table 21: Result from the test of multicollinearity for sample without gearing

As we can see the final model for Abnormal return where we removed the independent variable "gearing" does suffer from multicollinearity.

Abnormal Return model with Gearing, 0.05 significance-level			
Dependent Variable	**Value of R2**	**Value of F**	**Is F significant**
Oil & Gas	0.19	16.82	Yes
Oil & Gas Services	0.19	16.82	Yes
Critical F	***3.98***		

Table 22: Result from the test of multicollinearity for sample with gearing

[16] This section is based on (Gujarati, 2006)

And when gearing is included in our sample the model suffers from multicollinearity as well.

In fact this is a recurring theme for our variables as can be seen below.

Sample without Gearing			
Dependent Variable	**Value of R2**	**Value of F**	**Is F significant**
FIXED/FRN-Dummy	0.39	4.12	Yes
Senior/Subordinated	0.28	2.57	Yes
Secured/Unsecured	0.25	2.19	Yes
Debt exchange	0.33	3.23	Yes
Debt to Equity	0.54	7.69	Yes
Combination dummy for ownership after restructuring	0.42	4.79	Yes
Outstanding in mNOK	0.15	1.13	No
Oil & Gas	0.85	37.16	Yes
Oil & Gas Services	0.88	49.09	Yes
Shipping	0.81	28.43	Yes
Mining	0.67	13.02	Yes
Other	0.78	22.63	Yes
Time-to-maturity	0.29	2.70	Yes
Time in Restructuring	0.32	3.09	Yes
Critical F	**1.84**		

Table 23: Regression results from multicollinearity for sample (without gearing)

Sample with Gearing			
Dependent Variable	**Value of R2**	**Value of F**	**Is F significant**
FIXED/FRN-Dummy	0.396	2.62	Yes
Senior/Subordinated	0321	1.89	Yes
Secured/Unsecured	0.237	1.24	No
Debt exchange	0.459	3.39	Yes
Debt to equity	0575	5.40	Yes
Combination dummy for ownership after restructuring	0.564	5.18	Yes

Outstanding in mNOK	0.19	0.94	No
Oil & Gas	0.92	52.04	Yes
Oil & Gas Services	0.95	77.19	Yes
Shipping	0.92	51.37	Yes
Mining	0.85	23.12	Yes
Other	0.83	20.69	Yes
"gearing"	0.29	1.70	No
Time-to-maturity	0.42	3.00	Yes
Time in Restructuring	0.29	1.69	No
Critical F	1.87		

Table 24: Regression results from multicollinearity for sample (with gearing)

Most of our independent variables have some kind of relationship with the others independent variables. Multicollinearity of our independent variables further reduces the use of our model for statistical inference.

8.2.7. Conclusion of Regression Analysis:

The first hypothesis regarding bondholders always accept the restructuring deal when their recoveries are higher than the trading price recoveries and if not they will not accept the restructuring deal. This hypothesis is rejected for the fact that bondholders have accepted restructuring where their recoveries from the restructuring were lower than the trading price recoveries.

The second hypothesis that when bondholders accept restructuring proposals then it should not depend on what type of instrument (debt exchange or debt to equity swap) has been used is partly rejected for the fact that our regression results proves that debt exchange has significant impact on the bondholders abnormal returns. Or in other words there is a relationship between debt exchange and higher abnormal return.

The econometric analysis could not provide us with any conclusive evidence for hypotheses three about seniority. So from the statistical analysis it seems that there is a relationship between two industries and the type of restructuring that are performed. The models are however not fit for inference and we cannot make any quantitative projections that can be tested.

The final regression model does prove the relationship between returns bondholders get in financial restructurings and independent variables (such as type of instrument and industry used) but we could not use our models for any predictions because it did not pass the BLUE criteria. However the model did provide us with the "proof" that debt exchanges were in fact superior to debt to equity swaps in regards to recoveries and abnormal returns during financial restructuring, but it is not clear to what extent.

Another important question is, does seniority matter? Seniority managed to pass the first trimming of the regression model, and then in later regression models it was discarded as insignificant due to high p-values. We could not find any proof of a relationship between seniority of the bond and abnormal returns, which is not to say there is none because theory tells us that senior bondholders receive full value of their claim before junior claimants receives any proceeds (APR). In a way this is an answer to the question of APR deviations. If Seniority of bonds would have been proven a significant independent variable in the model, APR-violations would not show up too often in our sample. But we could not find any conclusive evidence in our sample that seniority of bonds is a significant factor in determining bondholders' returns in financial restructuring.

The model gave us two other variables that seemed to be related to abnormal returns, and that was industry type (Oil & Gas and Oil & Gas Services). Those two industries appear to increase the abnormal return and recoveries if distressed bonds were issued by these industries and have a positive impact on bondholders' returns from restructuring. But it should be kept in the mind that our models did not pass the criterion, so that this conclusion should not be used for statistical inference.

9. Limitations and recommendation for future research:

The limitations in the analysis comes from the small sample which we could not increase in a time efficient way. Scouring through every bond in the Norwegian market over a longer time was not simply an option for us because of time constraint. So we tried to get the related data from Norsk Tillitsmann website, looking for the companies that went through restructuring because of financial distress.

The fact that comparison between the ultimate recoveries in the debt to equity exchanges using nominal values decrease the value of the restructuring proposal but this was done because of the reason described in the section on equity valuation and also because of the fact

that we wanted to be consistent across the dataset and trading price for all the companies were not available on DataStream and Oslo børs. Also if the restructuring had warrants, these were not included in the calculation of ultimate recoveries simply because some of the warrants issues were too complicated and not enough information were available to value them. If further research could be carried out these limitations could be addressed in a more appropriate manner.

The analysis of debt to equity was limited from the fact that some of the borrowers in the sample were really hard to find information regarding concentration of shareholders. Some had later gone in to bankruptcy or got bought up and the homepages where we could search for annual reports and get the figures from were not available.

Another limitation for the research was that Reuters DataStream did not have information regarding bonds that were below investment grade in Scandinavia to use for a better yield curve that could be transformed and more accurately given us better discount factors in the Lattice models.

The model choice for valuing the restructuring proposal was Lattice model, there are other models available to find the "fair" value which was not included in the research, and again if this could be looked into by someone doing further research on this matter they can employ different methods of choice for valuing the deals.

The liquidity spread that has been added to the spread is for the U.S. corporate bonds, so in that sense it may not have correctly represented the liquidity spread for the sample of Norwegian bonds, a better effort could be devoted to find the appropriate liquidity spread that will be more representative of the Norwegian bond market for different classes of securities.

The major limitation for this analysis is, it is only representative of Norwegian bond market, and conclusion drawn from the analysis could not be generalized for different other bond markets. It would be interesting to conduct further research into the matter to investigate if the Norwegian bond market is same as other bond markets or there is something inherently different.

For further research on a similar subject and in a similar fashion, we recommend to involve financial institution that deal with similar issues on regular basis and have them as partners in the project. The data that we had was limited in scope and if provided with more data through

the collaborating financial institutions, it can provide for a better understanding of the issue and conclusion can be even more authentic.

It is the authors' firm belief that someone with the possibility of obtaining even more data that they can sort through and find a larger sample, they might be able to find a relationship. The implication of this thesis is not a firm reaffirming of theory, however it is a small piece of the puzzle to look for evidence confirming the hypotheses regarding debt (from the creditor and distressed investors point of view).

If it is possible to get around the privacy laws regarding bondholders which could be used for researching the possibility of finding a relationship between ultimate recoveries and the amount of the bonds that were held by a single investor. We do believe that it could shed more light on the phenomena of distressed restructuring, due to the fact that a large block-holder of a borrowers bonds has an immense power to steer a restructuring, he/she can just refuse to accept a proposal.

10. Final conclusion

The thesis has not been able to decisively either confirm or reject what the theories regarding recoveries stated about the relationship between collateral, seniority ownership structure industry type etc. and ultimate recoveries. But there were some evidence in this study from the descriptive and the econometric analysis that the relationship mentioned above are producing higher recoveries than others.

In relation to the theories regarding seniority and collateral of the bond there seems to be no confirmation, but this does not mean that theory is flawed it is just that the sample that the thesis used was that an overwhelming part of the bonds were seniors. It is hard for the authors to draw any meaningful conclusion with the data at hand.

Even though the analysis in this research has not been able to produce a statistical significant relationship between any variable in the data set to the explanation of ultimate recovery in the Norwegian bond market but still it finds plausible relationship between the variables indeed, no hard evidence none the less.

From the regression and descriptive analysis it is evident that the most important variables that increase the likelihood of distress firm's creditors to obtain higher ultimate recoveries than trading price recoveries are, the borrower in the restructuring should be oil and gas

related and the restructuring should also be a debt exchange, this result is in confirmatory with (Moody's, 2011).

The conclusion for the research is that there appears to be no merit for the theory's statements regarding seniority and collateral in relation to ultimate recoveries and abnormal returns in Norwegian bond restructuring for our sample, even though descriptive analysis pointed out that fact.

There are strong indications however that industry and type of proposal given are factors that seem relevant, however nothing conclusive can be said regarding the exact relationship, there might very well be other variables beyond the scope of this research that can explain the variance in more detail.

There seems to be a negative relationship between a clear ownership and ultimate recoveries as well, it might just be that a dispersed ownership indicates a certain level of sophistication in financial restructuring negotiations; however this is not something that can be proved or unproved in any way in this thesis because of privacy law surrounding the ownership information of who and how much an individual investors holds distressed securities.

We also examined if bondholders recoveries are affected by the gearing (leverage) of the distressed firm and also by the time to maturity (settlement date) of the bonds. In the regression analysis we did not find these to be significant affecting bondholders' returns but we did notice that almost all of the firms had 66% to 80% debt in their capital structure. And we believed that high leverage is the reason for them to be in distress.

In our sample of bonds financial restructuring there is one financial restructuring that stands out with the clear violation of APR. That is Sevan Marine ASA, there were 5 bonds involved in restructuring 4 out of 5 bonds were senior secured bonds and 5th one was senior unsecured bond. According to the APR senior secured claims should have been satisfied in full before senior unsecured bond would receive any proceeds. But it is clearly evident that seniors secured Sevan Marine ASA bonds were not satisfied fully during the restructuring process and still senior unsecured bondholders receive shares in restructured Sevan Marine ASA. We also found out some loose violation of APR in our data sample, these are the violation when debt is exchanged for equity, and new equity did not receive 100% of their recoveries and still old equity holders got some value during restructuring. Usually post restructuring 5% of equity value is given to old shareholders and 95% of the value is given to bondholders in debt

to equity swap. There could be number of explanations for it, one is that debtor in possession has a lot of bargaining power in the negotiation and secondly costs are borne by the firm and in most cases in restructuring old equity holders has nothing to lose by holding out the negotiation process and cost related to the restructuring is borne by the firm, which drives down the firm value bondholders are going to receive after the restructuring, so they give something portion of the equity to old equity holders to maximize their gain after the restructuring process to preserve more value they can get against their claims.

From a creditor's or investor's point of view in the Norwegian bond market the best choice seems to be to positions oneself in the Oil & Gas industry and hope for debt exchanges in restructurings.

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12. Appendices

12.1. The Term-structure

12.1.1. Term-structure of interest rates

The term structure or the yield curve is the depiction of the relationship between the yield on bonds of similar credit quality but different maturity (FABOZZI & MANN, 2005). The term structure described in this part is the treasury yield curve. The treasury yield curve is the yield curve that represents the Norwegian bonds and bills issued and actively traded in the secondary market.

The yield curve is calculated either by using polynomial regressions (Benninga, 2008) or by bootstrapping (FABOZZI & MANN, 2005). The focus of this thesis is not to model the term structure so the reader is advised to research the subject more by reading the sources provided if interest arises on how the term structure are calculated and estimated. It is however worth to note that usually there are three distinct yield curves academia and practitioners referrers to:

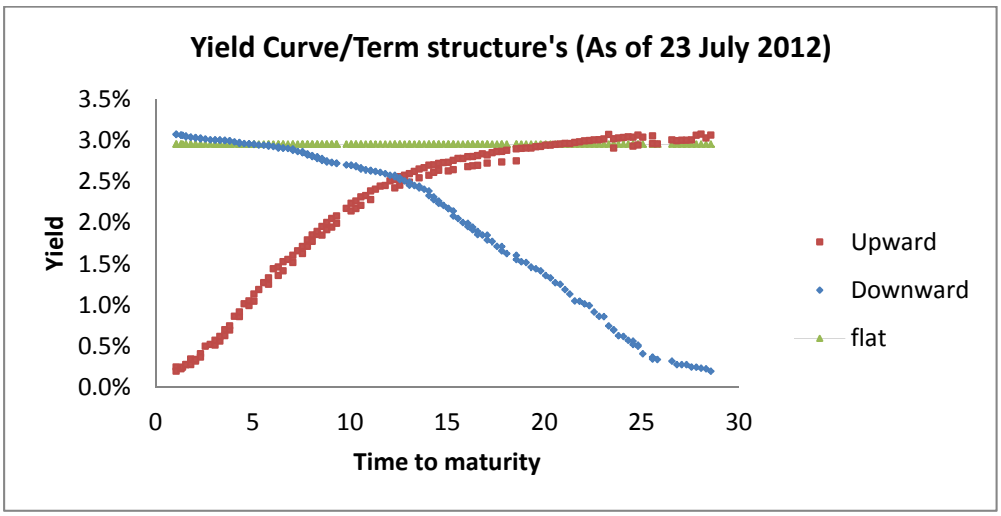

Figure 37: The most common yield curve (data taken from Yahoo finance)

They are the “normal upward sloping”, the “downward sloping” and the “flat” term structures.

There are yet another called a “humped” yield curve, below is a illustration from Norway.

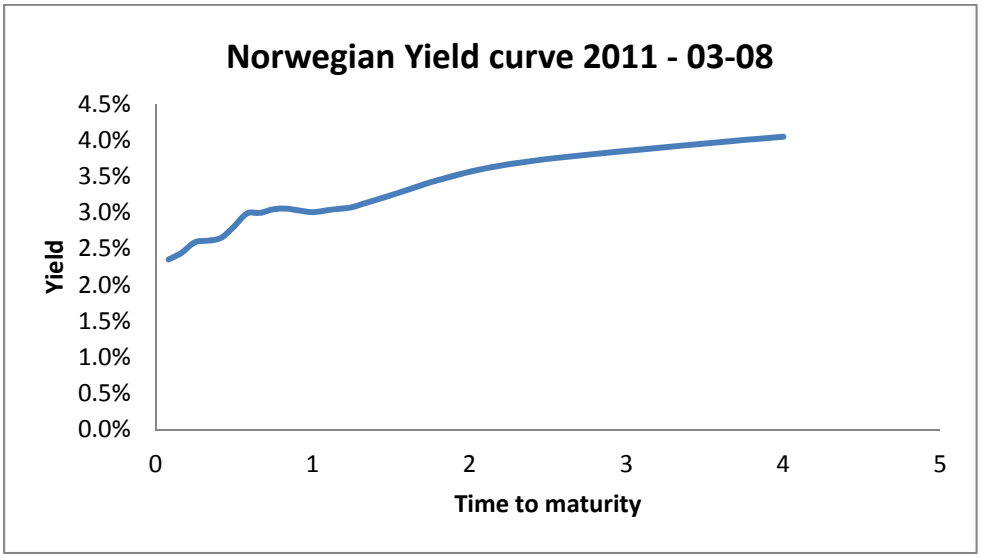

Figure 38: Norwegian yield curve (humped) (data taken from DataStream)

The term structure is used for many applications in finance and economics, one application is to calculate forward rates (FABOZZI & MANN, 2005). Another and more relevant for this thesis is to price the cash flows from bonds and ultimately estimate the price an investor should consider when purchasing the bond.

12.2. Interbank offered rates

12.2.1. LIBOR

London Inter-Bank Offered Rate is a benchmark rate for which rate a leading bank can obtain unsecured funding for a given period.

It was created in the 1980s when London position as an international financial center grew. UK banks asked the BBA (British Banker Association) to develop a method to calculate an interest to use in syndicated loans. That rate was called BBAIRS (British Banker Association Interest Rate Settlement). It later became renamed BBALIBOR i.e. LIBOR.(BBA, 2012)

To define LIBOR the BBA asks every contributor:

“At what rate could you borrow funds, were you to do so by asking for and then accepting inter-bank offers in a reasonable market size just prior to 11am?”

So what is clear is that LIBOR is not necessarily based on transactions that actually occurred in the market. But rather on the perceived lowest rates each contributor estimates they can receive in an inter-bank loan. (BBA, 2012)The rates are quoted as annualized interest rates, which is a market convention. The rate is used as a benchmark for short term interest rates globally, it´s used in derivatives and loan documentation such as Floating Rate Notes (FRNs).(BBA, 2012)

LIBOR is quoted for ten currencies (GBP, USD, JPY, CHF, CAD, AUD, EUR, DKK, SEK & NZD). There are a range of 6 to 18 contributors and they are chosen twice a year by the Foreign Exchange and Money Markets Committee (FX&MM Committee) by the activities of the banks/contributors on the FX and SWAP markets. (BBA, 2012)

The designated agent who calculates LIBOR is Thomson Reuters (TR), they do it by the guide lines from FX&MM Committee, and each morning between 11:00 and 11:10 an individual responsible at the bank at the cash desk inputs their contribution to the people at Thomson Reuters by an application that is linked to the LIBOR setting team at TR.(BBA, 2012)

The rates are calculated by a trimmed arithmetic mean. That means that when TR has received the contributor's rates they rank them from lowest to highest and then exclude the 25% highest and the 25% lowest of the rates received. After calculation TR distributes the quote for the LIBOR rates themselves and by licensed data providers. The maturities involved are "spot", 1w, 2w, 1m, 2m, 3m, 4m, 5m, 6m, 7m, 8m, 9m, 10m, 11m & 12m. (BBA, 2012)

12.2.2. NIBOR

Norway Inter Bank Offer Rate, the NIBOR is a reference rate that reflects the unsecured lending between banks in Norway in Norwegian Kroner (NOK).(Norway, 2011)

As with LIBOR there are contributors/member banks that submit the rate to an individual bank in the FX and money market in Norway they estimate that they could borrow at for the maturities mentioned above in the LIBOR. The reporting is done by TR as well. (Norway, 2011)

NIBOR as with LIBOR is an arithmetic average that has been trimmed. If there are more than seven banks that have published the two lowest and two highest interest rates are omitted, if there are five, six or seven banks, then the highest and lowest rates are omitted, and if there

are fewer banks all rates are used.(Norway, 2011) NIBOR are published every market day, normally at 12:00 or at 10:00 at days with shorter market hours. (Norway, 2011).

12.3. Bonds and their variation[17]

12.3.1. Treasury Securities

Treasury securities are debt instruments issued by the state/government. They are usually considered risk free and commonly used to price and hedge other fixed income securities. There are three basic types of government bonds, the "bills, notes & bonds" in this thesis the term "bonds" will almost always be used interchangeably. The treasury bills are issued at a discount to face value and the investors return is the difference of the discount and the face value. The usual length on maturity on these bills is one year or less

Treasury notes are securities issued with longer maturities than one year, but not more than ten years, and they pay a fixed coupon. They are redeemed at face value/par and are sold at par usually, so the return to the investor is the coupons he or she receives during the term.

Treasury bonds are securities that have a term that is longer than ten years and pay a coupon, they are redeemed at par and sold at par, so the return the investor receives is the coupons during the term.

Naturally if the investor does not buy the securities at the issuing/auction they may pay more or less than par and have another return than just coupons. The primary market for government securities is leading banks that buy the securities on auctions; private investors can also invest in the securities in the primary auction.

In Norway the primary dealers for Norwegian government debt is DNB, Danske Bank, Nordea, SEB and Handelsbanken. The Norwegian securities for government debt are primarily treasury bills and treasury notes, although the notes are called bonds. The interest rates for treasury debt are quoted per annum.

12.3.2. Corporate Bonds

A corporate bond is in its essence an instrument of debt where the issuer pays a specified percentage on the bonds face value on pre-determined dates, and repays the principal at maturity together with the accrued interest. This debt instrument would be called a fixed coupon option less bond. The bondholders have a legal claim of the assets of the issuer in

[17] Section 12.1 is based on (FABOZZI & MANN, 2005)

default that are senior to common stock and preferred shares, and if a default occurs they will be first in line (depending on seniority) to the value in recovery be it liquidation or a restructuring.

The fixed coupon bondholder will get the interest at set dates that can be in annual, semi-annual or any other determined period according to the indentures. Indentures are the contracts that govern the bonds claim on the issuer and actions the borrower can take.

It is common that a trustee are brought in as a third party how are experienced in the "legalese" in the indentures, and who monitors that the issuer are not in any breach of the contract. In Norway the trustee is Norsk Tillitsmann (NT) which was established 1993 by leading banks and financial institutions to fill the need for monitoring that the bond indentures were followed by the issuers. (Tillitsmann, 2012)

The maturity of the bond is the date on which the issuer have fulfilled its obligations to the bondholders and repaid the principal and accrued interest according to the agreed upon price. Depending on the indentures the loan may be redeemed earlier fully or partially before the full maturity has been reached, one special case is called "sinking funds". Sinking funds is a term used to describe when the issuer has agreed upon in the indentures to redeem/repay parts of the loan during the term of the loan. The term fund comes from the fact that earlier the issuer saved money in a fund for maturity, now it is referred to the fact that they repay parts of the loan during the term in cash.

The interest on a bond may be paid annually which is when the issuer pays the interest after a year has passed from the last payment. Semi-annually payment means that the interest is paid each six months in arrears. There are also quarterly payments and something called floating rates.

Besides the floating rate interest the interest is usually fixed, or it might be a step-up, which means the fixed coupon are increased (or lowered, step-down) after a period.

A corporate bond can be secured or unsecured; if it is unsecured the correct terminology is that the bond is a debenture. However in the thesis they are referred to as bonds.

12.3.3. Bond collateral

Mortgage bonds are bonds that are secured in the indentures by the borrower's properties, which means that in the case of a default or bankruptcy the bondholders can legally take

control of the properties and sell them to recover their claim. In the indentures it is called that the bond holders have “first lien” on the property. This means that they have the legal right to sell the property to satisfy the unpaid claim.

A first lien secured mortgage bond usually has a lower coupon than an unsecured debenture because of that legal right. However, usually bondholders use that lien to leverage the claim in a restructuring instead of taking control and selling it.

When a borrower does not have the amount of property that they can secure the bond with a first lien mortgage they can secure the claim with what is called a “collateral trust bond”, that is when the borrower is a holding/parent company to subsidiaries the issuer secures the claim in the shares of the subsidiaries. It does not have to be limited to shares it can be any other collateral such as bonds the holding company owns, or notes. The issuer can secure bonds on other things such as charter vessels and drilling rigs etc.

The unsecured bond does not have to be the worst alternative. The fact that they are unsecured does not mean they are not without any claim on the borrowers assets. They have a claim of all the assets of the borrower and depending on the seniority of the debenture they have a legal right before other creditors that are unsecured in a bankruptcy. They can also be protected in the sense that in the indentures there may be written in “negative-pledges” which means that if the borrower issues more debt, the first unsecured claim are given the same rights as the newly issued bonds and be secured on the same way.

If a bond is subordinated it means that they rank after secured and unsecured bonds and other claims ahead in the priority in a bankruptcy, these are usually more expensive for the issuer since they need to pay higher interest on them.

There are also something called guaranteed bonds, these are bonds that are issued by one entity in a group of companies but are guaranteed by another company in the group.

12.3.4. Embedded options

If a corporate bond has an embedded option that gives the issuer the right to buy back parts or the whole claim before the maturity they are referred to as callable bonds. The call option might be on a set of specific dates, ore during the entire term of the bond. They are usually cheaper since they are possible to retire earlier if interest rate goes down. There are two types of call provisions, the “fixed price call provision” and the “make whole call provision”. The fixed call provisions are usually set to a specific schedule with different call prices according

to a schedule in the indentures. At first the call price is substantially above par and declines during the schedule during the term.

The make whole call provision is a bit more complicated. The call price is calculated as the present value of the remaining cash flows subject to a floor price equal to par value. The cash flows are discounted by the yield on a treasury security with the same maturity and an added premium called make whole call premium.

A corporate bond with an embedded put option is a bond that gives the bondholder the right to sell the security back to the borrower at par value on designated dates. So if the interest rates rise shortly after the issue date, the bondholders can reinvest at the higher rates. There are "hard puts" and "soft puts", a hard put means that the bond must be redeemed in cash, whereas soft puts the bond may be redeemed for shares or other debt instruments or combinations of them, soft puts can be found in convertible bonds.

A corporate bond that is convertible is a bond that has the right to convert the claim in to common stock of the borrower. The indentures specify the ratio and the price of the conversion. The ratio is adjusted proportionally to splits and dividends in the stock. The right to convert can be set to only a limited time ore during the whole term of the bond. They are usually callable, so the borrower can force the bondholders to convert the claim.

12.3.5. Floating Rate Note

There are corporate bonds that do not have a fixed coupon but are dependent on a reference rate and a margin

Coupon rate = reference rate +/- margin

Instead, they are referred to as floating rate notes, or simply floaters.

They were first introduced in the 1970s and are now in nearly every field of the market such as government, municipalities, corporate and other structured product such as mortgage and asset backed obligations (ABO & MBOs). The most common reference rates for floaters is interbank offering rates such as LIBOR and NIBOR, treasury yields and other rates such as CD rates.

If the floater has a limit of how high the reference rate may go that is stipulated in the indentures it is said that they have a "cap", and if they have e limit on how low the reference

rate may go they are said to have a "floor". If they have caps and floors, the floaters is said to have a "collar".(Fabozzi, 2005) Floaters can also have put or call options embedded in them.

12.3.6. High Yield

High Yield bonds are bonds considered to not qualify as investment grade by the investors or rating agencies, they can be referred to as*" junk bonds"* also. That does not mean that they have to be on the edge of bankruptcy, many are close to be investment grade. They do however carry more risk than the investment grade corporate bonds.

12.3.7. Hybrid Capital [18]

There is another type of instrument that can be found in the capital structure. It is known as hybrid capital. In essence it is a bond without a fixed maturity.

The hybrid capital has a fixed coupon, a fixed principal and is above equity in bankruptcy (however it is below other bonds in APR). The instrument usually has embedded call options. The option is deferred several years ahead before it can be used; this period is known as the "protection period". The option helps the issuer to be able to issue "risk capital" that actually is quite similar to bonds in practice. The pricing of hybrid capital is done by valuing a bundle of options.

12.3.8. Warrants

Warrants are issued by the borrowing company and can be attached to bonds. A warrant is a right to buy a number of shares in the company, and the life of a warrant are usually long (some even perpetual).They can be seen as call options issued by the borrower and they issue new shares when exercised.

12.4. Bond Valuation[19]

To value a bond, the investor values the cash flows from that bond. The theoretical values are calculated by discounting the cash flows by a relevant discount rate. (Hull, 2012). To that discount rate a spread may be added to reflect the risk of default and the liquidity of the bond.

12.4.1. Bond without embedded options

To price a fixed coupon bond without any options attached to it and with known cash flows, and known intervals between the cash flows is mainly a matter of discounting the cash flows

[18] This section is based on (Mjøs & Persson, 2010)
[19] Section 12.4 is based on (FABOZZI & MANN, 2005)

from the bond to a present value by a discount rate that the investor deems applicable. The coupons can be paid in different intervals, the most usual being semi-annual and quarterly, but of course also annually. The bond can mature at either par or above "par", this is information that can be gathered from the bond indentures.

The discount rate used can be a required yield the investor wants to use to discount the cash flows with, that means that the buyer of the bond, or potential buyer of the bond are pricing the cash flows from the coupon and the maturity par or above at a single discount rate usually called just the yield.

The yield the buyer requires is often determined by the investor by comparing yields on comparable bonds in the market place. In this case comparable means that the bonds should have the same maturity, credit quality and also be without embedded options.

The pricing formula is:

$$Bond\ Price = \frac{CF_1}{(1+y)} + \frac{CF_2}{(1+y)^2} + \cdots + \frac{CF_n + Maturity\ price}{(1+y)^n}$$

Where "CF" stands for cash flow, maturity price is the agreed upon price the issuer pays the bondholder on the face value like 100%(par) or 103%(above par), the "y" represents the yield, the single discount rate that the investor needs or decides is the required rate he or she needs.

There is however arguments to as to why the investor should discount each cash flow with a different discount rate. The investor should view the cash flows as zero coupon bonds and the whole bond as a package of Zero Coupon bonds. The investor then makes use of a term structure that fits the needs of him or her to value the cash flows from the coupons, and the price at maturity. In that case the "y" in the formula above is not the same for every cash flow. Instead it is derived from the term-structure (and in those cases the term-structure is a government yield curve an appropriate spread is added).

12.4.2. Bond with embedded options

When pricing a fixed coupon bond that has options such as a call provisions or put provisions attached to them, the investor needs to use different techniques.

If the option is a call-option to call it at a specific date during the term of the bond, a ordinary valuation such as the above(bonds without embedded options) with the discounting by a term-structure is the first step, the next being a reduction of that price by the option value. To value

the option the investor uses an option pricing method such as Black-Scholes and then reduces the value of the option less bond with the value of the call-option.

The reduction meaning that the issuer has the right to call and redeem the debt when interest rates moves in a favorable way to them, and they can raise new debt at cheaper interest rates, and the bondholders will have to reinvest the money at a lower rate.

The opposite is true for a "puttable" bond, and then the option value is added to the bond, since bondholders can force the issuer to redeem the debt earlier and reinvest the money at for the investor more favorable terms.

If the option to call the debt is not in what is called a European fashion (set dates) the investor needs to use the binomial model to value the bond (or Monte Carlo techniques for example).

The technique is to use the binomial tree. When setting up the "value-nodes" if it is a call option imbedded the value at a node is

$$V_t = Min[Call\ Price, PV(Future\ Cash\ Flows)]$$

And if it is a put option embedded

$$V_t = Max[Put\ Price, PV(Future\ Cash\ Flows)]$$

This is from the investor's point of view.

The binomial tree will look like this

		V= Value at maturity
	V1=Min[Call, V+c1]/(1+r1)	V= Value at maturity
V0=Min[Call, V0+c0]/(1+r0)	V1=Min[Call, V+c1]/(1+r1)	V= Value at maturity

Table 25: Binomial Tree

Where "value at maturity" is the value if the bond is not called and it´s coupon at that date (t=2), V1 stands for the value at that node, and call for call price, c1 the coupon at t=1, r1 is the short rate that is used for discount. V0 is the value at t=0, c0 is the coupon at t=0, r0 is the short rate used for discount at that date.

The short rate used here can either be a short rate that is constructed through either the calibrated term-structure that is appropriate to the bonds credit rating etc., or a short rate taken

from calibrating the par yield of a government zero-curve and an added spread that is appropriate. The instrument with an embedded put option is very similar; the difference is that instead of the "min-function" the "max-function" mentioned above is used in the nodes.

12.4.3. Floating Rate Notes (FRNs)

To price a FRN ordinary discounting of cash flows cannot be used, since the coupons are dependent on a reference rate. The coupons are adjusted at every node due to this fact.(FABOZZI, 2002) The technique is similar to the fixed coupon bond with an embedded option. The investor needs to use binomial trees and work recursive to finally get the value. First a binomial tree for the short rate are needed, after that a valuation tree.

				N(HHHH)
			N(HHH)	N(HHHL)
		N(HH)	N(HHL)	N(HHLL)
	N(H)	N(HL)	N(HLL)	N(HLLL)
N	N(L)	N(LL)	N(LLL)	N(LLLL)

Table 26: Binomial Tree of short rate

To value the FRN at "N" the initial node, the investor starts at the end. To make an example a binomial tree is constructed with the reference rate first which are assumed to be based on semi-annual movements. The reference rate tree is also assumed to be calibrated.

Short rate - Reference Rate			
			2,16%
		1,58%	1,47%
	0,37%	1,08%	1,00%
1,17%	0,36%	0,73%	0,68%

Figure 39: Reference rate binomial tree

Then assume a margin of 5%p.a (2,5% semi-annual)

Coupons			
			4,66%
		4,08%	3,97%
	2,87%	3,58%	3,50%
3,67%	2,86%	3,23%	3,18%

Figure 40: coupon rate binomial tree

Now, assume that in this case the investor believes the instrument is not riskier than the reference rate and he or she is willing to discount the instruments cash flows with the binomial tree of the short rate, also assume that the FRN matures at 100% of par. Then to value this FRN start after 1.5 years and see that after two years the investor have four possible values at maturity, which is all the same in the beginning since the FRN adjusts for each node to par.

Value			
			100,0%
		X	**100,0%**
	X	**X**	**100,0%**
X	**X**	**X**	**100,0%**

From the theory of the binomial model for interest rates it is known that p=0.50 (probability for each node to happen). The first thing to do is to use the formula

$$X = \frac{1}{2}\left[\frac{100 + 0.0408}{1.0158} + \frac{100 + 0.0408}{1.0158}\right]$$

For the yellow marked cell in figure below

Value			
			100,0%
		X	**100,0%**
	X	**X**	**100,0%**
X	**X**	**X**	**100,0%**

The result then is:

Value			
			100,0%
		102,5%	100,0%
	X	X	100,0%
X	X	X	100,0%

The technique is then used for all the cells back to the initial node, and the value for the FRN will be as in figure below

Value			
			100,0%
		102,5%	100,0%
	104,9%	102,5%	100,0%
107,4%	105,0%	102,5%	100,0%

12.4.4. Zero coupon bonds

Above it was showed how to value a fixed coupon based bond. To price a coupon-less i.e. zero coupon bond the same technique to value a coupon bond is utilized, in the sense that the investor values future cash flows.

In a zero-coupon bond however there are no other cash flows than on maturity. The investor discounts the maturity value by either a required yield or the term-structure of a zero curve to calculate the price.

12.4.5. Convertible bonds

A convertible bond may have many features. The convertible bond is a bond that gives a coupon up to maturity and then is redeemed at par as a “regular” bond with the exception that the investor may convert the bond in to shares. The shares do not need to be in the issuer, but most are. This makes the convertible a package of a “regular” bond and an option on the shares of the issuer.

Convertible = Bond + Option

The pricing is then a two-step exercise, first value the bond as if it were not a convertible, then add the value of the option to that, and the sum are the convertible’s value.