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Economic Determinants of Legal Outcomes in Norwegian Public Compulsory Buyouts

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Economic Determinants of Legal Outcomes in Norwegian Public Compulsory Buyouts

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MSc in Finance

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ABSTRACT

In this thesis, we ask what the economic determinants are for whether minority shareholders choose to reject the offer in a public compulsory buyout, and for the outcome in court. We have collected and constructed a dataset, from the year 2000 to 2020, of all public compulsory buyouts on the Oslo Stock Exchange, and from all three tiers of court. There has been a decreasing time trend in this period. We find that the size of the company, the duration of a controlling owner, and the liquidity of the stock are the most important determinants of minority owners rejecting a buyout offer. The courts tend to favor the minority and disregard the last transaction price of the stock.

Acknowledgements

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1 Introduction

The questions we ask in this thesis are: *what determines whether a public compulsory buyout goes to court, what are the consequences of going to court, and can it be justified through financial theory?* To answer these questions, we will document all public compulsory buyouts of Norwegian companies between the year 2000 and 2020. We will report the size of the company, the duration of a controlling owner, what premium was offered to the minority shareholders, the liquidity of the stock, whether the case went to court, and, in case, what the outcome of the legal process was. Finally, we will derive the financial theory that justifies deviating from the market value in public compulsory buyouts.

1.1 Motivation

The topic is interesting, as public compulsory buyouts are an important part of the dynamics in financial markets. They are required to reduce inefficiencies and increase the value of companies. Buyouts may generate benefits to the firm, e.g., in terms of improved investment incentives, reduced agency costs, savings from listing and reporting costs to shareholders, or savings on potential legal costs from conflicts between majority and minority shareholders (Maug, 2006). Inefficient buyouts could reduce shareholder value maximization and hamper economic growth.

Public compulsory buyouts are a recurring event in the Norwegian market. A company that owns more than nine tenths of the voting shares, and an equivalent share of the votes at a general assembly, can perform a public compulsory buyout of the remaining shares, cf. "Norwegian Public Limited Liability Companies Act" (jf. Allmenaksjeloven ¶4-25 første ledd). The minority shareholders should be compensated by the offering price, cf. "The Securities Trading Act" (jf. Verdipapirhandelloven ¶6-22). In some cases, a special rea-

son ("særlig grunn") determines deviations from this law and uses a case law as a basis. The Norway Seafood case is frequently applied, which dictates that the minority owners should be compensated for their share of the "true value" ("virkelig verdi") of the company, cf. Rt. 2003 p. 713 (Norway Seafood ASA). We find it interesting that the courts seek to find the "true value" of an asset, while the "fair value" might be a more reasonable estimate to obtain.

1.2 "Fair Value"

The "fair value" of an asset is the price that would be received when traded on the market (Berg, 2009). However, this can be done on three precision levels. The highest precision level includes quoted prices in active markets for identical assets (FASB, 2006). The second level includes inputs other than quoted prices that are observable, such as quoted prices for similar assets. The final precision level are unobservable prices for the asset, such as assets without a market. In competitive, liquid financial markets, the value corresponding to the last equity transaction is considered the highest precision level and is our best estimate of the "fair value" of a company.

1.3 Structure

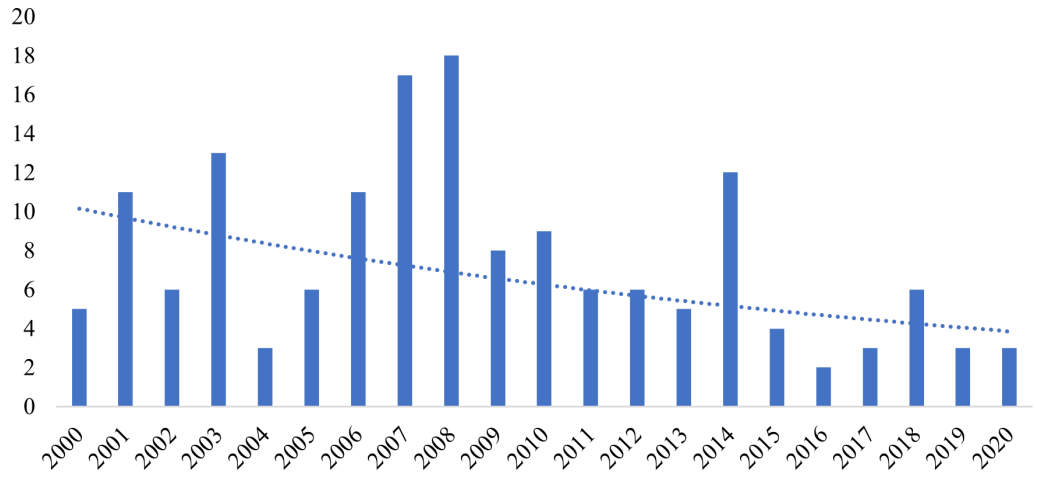
The paper is organized as follows: In Chapter 2, we present an overview of Norwegian public compulsory buyouts. In Chapter 3, we introduce a recent example of a Norwegian public compulsory buyout. In Chapter 4, we present financial theory related to public compulsory buyouts. In Chapter 5, we introduce our testable hypotheses. In Chapter 6, we provide the methodology used to derive the determinants of a Norwegian public compulsory buyout going to court. In Chapter 7, we presents our findings and discuss its implications for our research questions. In Chapter 8, we conclude our study.

2 Overview

In this study we have constructed a unique dataset containing all public compulsory buyouts of Norwegian listed companies from year the 2000 to 2020. The public compulsory buyouts are identified from Oslo Stock Exchange's (OSE) historical publications and the corresponding datapoints are manually plotted from the Bloomberg Terminal and (Oslobors, n.d.). When identifying public compulsory buyouts going to court, we have based our research on verdicts published on (Lovdata, n.d.). However, this only contains verdicts of significant public interest. To obtain a comprehensive list, we have communicated with all 59 District Courts in Norway. (See A.1.)

After collecting all datapoints for our sample of 157 cases, we found 10 to going court, giving a probability of 6.37% that minority shareholders reject the buyout offer. We found a decreasing time trend in the data (Figure 1). Public compulsory buyouts are 204% more frequent from 2001-2010, than from 2011-2020. (See A.2)

Figure 1: Frequency of Public Compulsory Buyouts



The figure shows the number of public compulsory buyouts each year in the period 2000-2020. The figure indicates a decreasing time trend throughout the period.

3 Background

The takeover of Hafslund AS by Oslo Energi Holding AS (OEH) is a recent example of a Norwegian public compulsory buyout going to court. Hafslund AS was initially a publicly traded company on the Oslo Stock Exchange. In August 2017, OEH acquired more than 90% of the shares in the company and were able to exercise a public compulsory buyout. The last closing price was NOK 88.50 per share. OEH offered a premium of 9.3% to buy out the remaining shares for NOK 96.75 each. This offer was rejected by the minority shareholders, as they argued it was lower than the "true value". The minority shareholders brought the issue to court and the District Court (Oslo Tingrett) ruled on the 11th of February 2019 in their favor, with a price per share of NOK 147.13. OEH appealed the verdict based on several economic arguments. Borgarting Court of Appeal (Borgarting Lagmannsrett) announced their verdict on the 26th of August 2020 with a share price of NOK 137.50, resulting in OEH paying NOK 1,000 million above their initial offer. Figure 2 and Table 1 provides an overview of the case statistics.

Figure 2: Valuations (NOK/share)

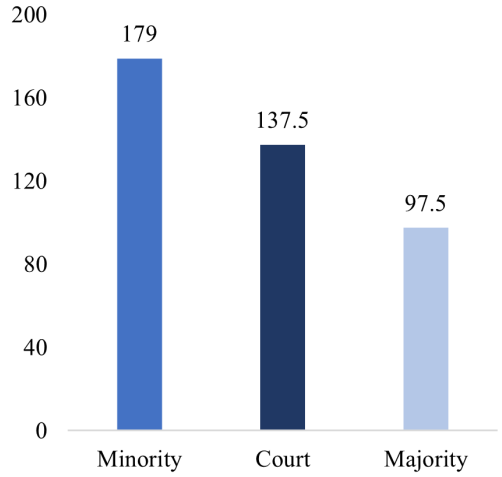


Table 1: Court Statistics

Legal Costs	NOK 12 (million)
Deprivation	3 (percent)
Court Proceeding	3.07 (years)
District Court	NOK 147.13
Court of Appeal	NOK 137.5
Value Increase	NOK 8 (billion)
Valuation	DCF

The figure shows the valuations in the courtroom by the Court, Minority shareholders and Majority shareholders. The table shows some of the most interesting characteristics about the Hafslund court proceeding. Legal Costs are the total amount of legal costs accrued in the case. Deprivation is the interest rate on the verdict premium given to minority shareholders for the court proceeding. Court Proceeding is the number of years the case was in court. District Court is the verdict price from the District Court. Court of Appeal is the verdict price from the Court of Appeal. Valuation is the valuation method chosen by the court, both District Court and Court of Appeal

Certain economic arguments presented in Borgarting Court of Appeal are of interest for future public compulsory buyouts. The first problem resides in valuing the company on a "stand-alone" basis, which involves disregarding the buyer's synergies. This should limit the valuations of multiples based on transactions. The valuation should also consider the principles of a "going-concern" and whether this can be coherent by splitting the company into singular valuation pieces. The litigation in the case is which valuation principle should be emphasized. Borgarting argues that the DCF method is the best fit, but that it needs to be controlled with a comparable method. The stock price is frequently used but is disregarded in this case. The disregard origins from the long-term consequences of large blockholders, in particular, their effect on the liquidity of the stock. It would be of interest to take a closer look at the governance complications from strong blockholders and derive the effects it can have on stock prices. The question then remains how the court can justify using their own DCF valuation, instead of the stock price. Borgarting Court of Appeal refers to the Norway Seafood case that states that the price should be what a third party, with complete and correct information about the company and its development, is willing to pay. How can one derive this price without access to the market?

The economic discussions presented in the case raises questions regarding the correct use of financial theory in the Norwegian legal system. Case law is frequently disregarding the market value of shares, in favor of their own DCF calculation. Their most important arguments are the duration of a controlling owner, the liquidity of the stock, and the lack of analyst coverage.

4 Theory

The purpose of this chapter is to derive the financial theory that justifies deviating from stock prices in public compulsory buyouts, and to document the economic framework for valuation methods. We split the chapter in two, where we will first focus on the stock price irrelevance proposition, then assess the valuation methods used by the courts.

4.1 Stock Price Irrelevance

The Norwegian legal system tends to disregard stock prices when valuing shares in public compulsory buyouts. They justify this on the premise of illiquidity, controlling owner duration, and lack of analyst coverage. We will now clarify how financial theory may legitimize deviating from market value.

4.1.1 Competitive Markets

The foundation for the competitive market assumption is that each buyer and seller are price takers; they are individually too small to have a significant effect on the market price (Varian, 2016). Price adjustments in competitive markets rely on the optimization principle and the equilibrium principle. Market players are rational and would want to maximize their utility in a competitive market. Consequently, the Invisible Hand will adjust prices towards the intersect between supply and demand. This premise of competitive markets is perhaps best represented in the stock market, where numerous independent investors choose to buy or sell stocks on publicly available information. By applying models for fundamental value, speculative investors will try to determine if stocks are mispriced. Rational investors would then seek to maximize their utility through buying stocks when they believe they are underpriced and selling if they believe they are overpriced. The market price can then be seen as the sum of all investor's valuation.

4.1.2 Agency Problem: Minority vs. Majority

A complication to competitive markets is asymmetric information; when the majority shareholder has more information than what is available to the market. Evidence suggests that blockholders have a strong incentive to withhold information from the market (Edmans, 2009). This becomes a problem when the interests of the controlling owner and the minority shareholders are not aligned. The key source of this problem is the gap between cash flow rights and voting rights. If the gap is large, an expected positive cash flow shock is not reflected in earnings. This is evidence that the controlling owner capture the additional cash flows (Bertrand, Mehta, & Mullainathan, 2002). As the controlling owners only receive dividends to their corresponding block, they have an enticement to expropriate benefits through tunneling. Tunneling is defined as the transfer of assets and profits out of firms for the benefit of their controlling owner (Johnson, La Porta, Lopez-de Silanes, & Shleifer, 2000). This phenomenon is observed in both emerging and developed markets. The agency problem between the minority shareholders and the majority shareholder tends to reduce the value of the firm over time. In public compulsory buyouts this might be a reality, when a controlling owner has been present over several years.

4.1.3 Control Premium

Controlling owners enjoys private benefits of control, such as overconsumption and overinvesting. Overconsumption refers to situations where the owner for instance hires incompetent family members or overuse the corporate jet. Overinvesting refers to situations where the owners invest in projects with social prestige or other value destroying projects. These benefits can be exploited through their voting power, as they do not need consent from minority shareholders. Empirical evidence suggests that trades of large-percentage blocks

of common stocks are typically priced at substantial premiums to the market price (Barclay & Holderness, 1989). Countries where capital markets are less developed, and ownership is more concentrated, have a higher private benefit of control. Lower private benefits are observed in countries with good law enforcement, a high diffusion level of the press, a high rate of tax compliance, and a high degree of product market competition (Barclay & Holderness, 1989). Evidence also suggests that illiquidity reduces the value of control (Albuquerque & Schroth, 2015). Good institutions and well-functioning markets tend to reduce the control premium and inherently the mentioned agency problem.

4.1.4 Analyst Coverage

Empirical evidence suggests that higher analyst coverage is a possible remedy for asymmetric information (Yu, 2008). With the objective to serve all shareholders, training in finance, and industry background knowledge, analysts are often seen as gatekeepers of corporate governance. They interact directly with management and oppose questions on all aspects of public company information. Perceived by managers as one of the most important groups affecting the share price of their company (Graham, Harvey, & Rajgopal, 2005), they are bound to have an impact on company valuation. However, analyst coverage has also been known to hamper innovation and exert too much pressure on managers to meet short-term goals (He & Tian, 2013). Overall, analyst coverage is a necessity for competitive markets.

4.2 Valuation Methodologies

In this section we assess the valuation methods used by the courts. As valuation often have unobservable inputs, using more than one method may reduce the uncertainy of those inputs. Optimally, an intrinsic valuation is complimented by at least one relative valuation. The choice of method(s) will depend

on the availability of information, the analyst's confidence in the information and in the appropriateness of the method(s) (Koller, Goedhart, & Wessels, 2015).

4.2.1 Discounted Cash Flow

The DCF is the only intrinsic valuation method, and is based on expected future cash flows and a discount rate. Of the available valuation tools, different versions of the DCF continues to deliver the best results and should be the primary valuation method used (Koller et al., 2015). However, it should be verified using a secondary method as it is overly sensitive to its assumptions. The first sensitivity problem is related to cash flow projections. Uncertainty increases exponentially in the forecasting period, and assumptions made in the beginning of the modelling period can amplify huge variances. The second sensitivity problem is the discount- and growth rate. Determining the weighted average cost of capital (WACC) is highly theoretical and is only feasible when the company maintains a constant debt-to-value ratio. If a company plans to increase its debt-to-value ratio, the current cost of capital will understate the expected tax shield and the adjusted present value (APV) method will be a better fit. The terminal value is often the largest single input in a DCF valuation and is conditional on the growth rate. Identifying this input is ambiguous and speculative. The DCF analysis should be used when the company has a stable cash flow, a relatively constant debt-to value ratio and a constant risk profile. If the company plans to change its capital structure during the forecasting period, an alternative DCF method would be suitable, referred to as the APV method.

4.2.2 Multiples

Multiples valuation is a relative valuation approach based on future earnings. The theory of multiples is derived from the law of one price; similar assets should sell for similar prices. Equating the multiples of comparable companies can be a convenient valuation method, when a certain peer group is available. Common practice is to select 8 to 15 peers and take the average of their multiples. However, getting a reasonable valuation requires careful judgements about which companies, and which multiples, are truly relevant for the valuation. The valuation method is technical and require highly skilled finance professionals to have consistent accurate results. In practice, multiples are often used in a specious way that leads to erroneous conclusions (Koller et al., 2015). Empirical studies suggest that using forward looking multiples in valuation results in a 15 percent pricing error (Liu, Nissim, & Thomas, 2002). When the multiples analysis is carefully and reasonably prepared, it not only serves as a useful check to the DCF, but also provides critical insights into what drives value in a given industry.

4.2.3 Substance

Substance valuation is a relative valuation method based on the market value of assets. This valuation method is appropriate when the target company has significant illiquid assets (e.g., real estate, shipping vessels etc.), and are worth more in liquidation than as a going concern. The drawback of the asset-based method is the disregard of a company's future earnings and the complexity of measuring intangible assets. Hence, the asset-based approach is generally considered to be the weakest valuation method from a conceptual standpoint (Pinto, Henry, Robinson, & Stowe, 2015). Asset valuation demands deep knowledge, experience, accuracy, and attention to detail.

5 Hypotheses

In this chapter we present our chosen predictors and their corresponding hypothesis. After scrutinizing the Hafslund case and identifying the relevant theory of public compulsory buyouts, we make six predictions determining whether a public compulsory buyout is going to court.

Hypothesis 1: There is a positive relationship between the size of the company and the probability of going to court.

The size of the company should be important in a public compulsory buyout, as it affects the risk/reward outcome of going to court. Legal actions are expensive, and there must be a significant gain for minority shareholders to risk carrying these costs. We hypothesize that the predictor variable is significantly different from zero. Formally, the hypothesis is:

$$H_0 : \beta_{Size} = 0 \quad vs. \quad H_1 : \beta_{Size} \neq 0$$

Hypothesis 2: There is a positive relationship between the controlling owner duration and the probability of going to court.

A controlling owner may expropriate the minority shareholders and should affect their decision of rejecting a public compulsory buyout offer. We hypothesize that the predictor variable is significantly different from zero. Formally, the hypothesis is:

$$H_0 : \beta_{Duration} = 0 \quad vs. \quad H_1 : \beta_{Duration} \neq 0$$

Hypothesis 3: The offer premium has a negative relationship with the probability of going to court.

The majority often pays an acquisition premium in takeovers and buyouts. Typically, paying a premium by the acquirer is associated with the desire to

close a deal and reduce the risk of legal actions. We hypothesize that the predictor variable is significantly different from zero. Formally, the hypothesis is:

$$H_0 : \beta_{OfferPremium} = 0 \quad vs. \quad H_1 : \beta_{OfferPremium} \neq 0$$

Hypothesis 4: The probability of going to court has a negative relationship with the liquidity of the stock.

High liquidity will ensure that all available information is incorporated in the stock price, while low liquidity may result in pricing delay or even wrong prices. We hypothesize that the predictor variable is significantly different from zero. Formally, the hypothesis is:

$$H_0 : \beta_{Liquidity} = 0 \quad vs. \quad H_1 : \beta_{Liquidity} \neq 0$$

Hypothesis 5: The probability of going to court increases with the lack of analyst coverage.

Higher analyst coverage is a possible remedy for asymmetric information and should reduce the agency problem between majority- and minority shareholders. We hypothesize that the predictor variable is significantly different from zero. Formally, the hypothesis is:

$$H_0 : \beta_{Coverage} = 0 \quad vs. \quad H_1 : \beta_{Coverage} \neq 0$$

Hypothesis 6: The probability of going to court increases with the last trading day premium.

The last trading day premium on the buyout offer should affect the probability of offer rejection as it implies that investors believe the stocks are worth more than the offer. We hypothesize that the predictor variable is significantly different from zero. Formally, the hypothesis is:

$$H_0 : \beta_{LastTradingDay} = 0 \quad vs. \quad H_1 : \beta_{LastTradingDay} \neq 0$$

6 Methodology

In this chapter we will outline the model used to derive the determinants of a public compulsory buyout going to court. We will describe the estimation technique used to compute the estimates of parameters in the model and critically assess any limitations with the approach.

6.1 Model Selection

The analysis is based on a limited dependent model, to consider the binary outcome of our dependent variable. Using a simpler Ordinary Least Squares (OLS) method, e.g., Linear Probability Model (LPM), would lead to possibilities of negative values or values exceeding one. The LPM would then truncate the results, defining all outcomes below zero as zero and all outcomes above one as one. This creates two problems. First, the model would create excess outcomes of zero and one. Secondly, it is not plausible to suggest a 0% or 100% probability of an event occurring. The LPM also suffers from violations of two assumptions regarding the error term: normality and homoscedasticity. (These are illustrated in A.3.) To overcome the restrictions of the LPM, we have chosen to run a probit model with heteroscedasticity robust standard errors, which is elaborated in A.4.

6.2 The Probit Model

The regression is based on a binary probit model with a dependent variable and five explanatory variables defined in A.5. When choosing the variables, we seek to find the determinants that are most likely to have an impact on the probability of going to court in a public compulsory buyout. Unfortunately,

we were unable to collect any data for the analyst coverage, and we discard our fifth hypothesis. The regression is thus run on a probit model following:

$$C_i = F(z_i), \qquad z_i = \beta_0 + \beta_1 S_i + \beta_2 D_i + \beta_3 OP_i + \beta_4 L_i + \beta_5 LTD_i + u_i \quad (1)$$

C is the binary outcome of court or no court. S represents the size of the firm. D is the duration of a controlling owner. L is the liquidity of the stock. OP is the offer premium. LTD is the last trading day premium on the buyout offer.

6.3 Limitations

The sample we used in our model is based on 157 observations. As the sample size is relatively small, one may miss the true characteristic of the population. However, a unique trait with our sample is that we have allegedly obtained the true underlying population in the specific time interval. Practitioners argue about the appropriate sample size to rely on maximum likelihood (ML) estimates and the resulting significance tests. ML estimation provides consistent, unbiased, and efficient parameters as the sample size approaches infinity (Long, 1997). In large samples, the ML estimator has suitable properties and becomes asymptotically unbiased (Wooldridge, 2010). The estimators are also asymptotically efficient in large samples (Casella & Berger, 2001). For small samples, the ML estimator of probit model coefficients does not work well, and they have substantial bias (Long, 1997). Empirical research suggests that ML is uncertain with samples smaller than 100, while samples larger than 500 seem adequate (Long, 1997).

7 Results

In this chapter we report the results from the regression, the consequences of going to court, and discuss if financial theory can justify disregarding the market price in Norwegian public compulsory buyouts.

7.1 Determinants of Offer Rejection

We have focused our regressions on the probit model specified in Chapter 6. The choice of model is elaborated in A.4. We have also run every variation of the following models as logit, but the probit continues to deliver the best Akaike's information criterion.

7.1.1 Preliminary Model

The model we specify seeks to find significance in any of the predictor variables. The variables we suspected to have an influence on court rejection are size, liquidity, owner duration, tender offer premium, buyout offer premium, and last trading day premium.

The first problem we encountered were how to measure liquidity. We have chosen two separate ways to determine the liquidity measure, where we will choose the model with the highest explanatory power. The first measure, Liquidity A, is the traded volume of shares in a quarter divided by the total amount of shares. The second measure, Liquidity B, is the traded volume of shares in a quarter divided by the free float. The liquidity measures will likely be correlated, and we will need to use them separately.

The second problem is the correlation between the tender offer premium and the buyout offer premium. These are in most cases equal, but at different

points in time. To solve this issue, we have separated the variables into two different regressions containing the same variables, but at different points in time. The size, owner duration and last trading day premium remains unaffected, but the liquidity measures uses the number of traded shares in the quarter prior to the respective offer.

We have thus chosen to run eight variations of the model. Model 1 contains the tender offer premium combined with the two different versions of the liquidity measure at two different points in time. Model 2 contains the buyout offer premium combined with the two different versions of the liquidity measure at two different points in time. All variables are elaborated in A.5

Table 2: Model 1: Tender Offer Premium & Liquidity Measure 1-4

	(1)	(2)	(3)	(4)
const	−6.037***	−6.004***	−6.710***	−7.757***
	(2.300)	(2.302)	(2.484)	(2.603)
SIZE	0.206*	0.204*	0.246**	0.302**
	(0.106)	(0.106)	(0.115)	(0.121)
DURATION	0.248**	0.249**	0.230**	0.182*
	(0.112)	(0.112)	(0.115)	(0.099)
LTD	−0.182	−0.190	−0.234	−0.463
	(0.776)	(0.771)	(0.729)	(0.580)
PREMIUM 1	−0.455	−0.473	−0.396	−0.463
	(0.475)	(0.473)	(0.511)	(0.521)
LIQUIDITY 1A	−0.027			
	(0.045)			
LIQUIDITY 1B		− 0.000		
		(0.004)		
LIQUIDITY 2A			−0.684	
			(0.487)	
LIQUIDITY 2B				−0.050**
				(0.021)
Pseudo-R^2	0.155	0.154	0.178	0.218
AIC	74.924	74.990	73.145	70.179

***,**,* indicates rejection at the 1%, 5% and 10% significance level. The numbers in parantheses () are the corresponding standard errors. SIZE represents the natural logarithm of the product of the total amount of shares and the final price. DURATION is the number of a years a majority shareholder has owned more than 50% of the shares. LTD is the last trading day price premium on the buyout offer. PREMIUM 1 is the tender offer premium on the highest stock price 6 months prior. LIQUIDITY 1A is the traded volume last quarter before the tender offer on the total amount of shares. LIQUIDITY 1B is the traded volume last quarter before the tender offer on the free float. LIQUIDITY 2A is the traded volume last quarter before the buyout offer on the total amount of shares. LIQUIDITY 2B is the traded volume last quarter before the tender offer on the free float. All variables can be seen in A.5. Pseudo-R^2 is McFadden's way of measuring Pseudo-R^2 and measures the relationship between the probit model (LLF) and a restricted model (LLF_0). AIC is Akaike's information criterion.

Table 2 shows that the size of the company, the duration of a controlling owner, and the liquidity of the stock are the only significant determinants.

Table 3: Model 2: Buyout Offer Premium & Liquidity Measure 1-4

	(1)	(2)	(3)	(4)
const	−6.041**	−6.005 **	−6.737***	−7.733***
	(2.348)	(2.354)	(2.491)	(2.668)
SIZE	0.205*	0.202*	0.246**	0.299**
	(0.109)	(0.109)	(0.116)	(0.125)
DURATION	0.247**	0.247**	0.230**	0.184**
	(0.107)	(0.106)	(0.111)	(0.093)
LTD	−0.169	−0.171	−0.231	−0.449
	(0.745)	(0.736)	(0.711)	(0.583)
PREMIUM 2	−0.093	−0.086	−0.096	−0.126
	(0.447)	(0.443)	(0.365)	(0.367)
LIQUIDITY 1A	−0.032			
	(0.054)			
LIQUIDITY 1B		− 0.001		
		(0.004)		
LIQUIDITY 2A			−0.688	
			(0.472)	
LIQUIDITY 2B				−0.050**
				(0.021)
Pseudo-R^2	0.152	0.151	0.177	0.215
AIC	75.136	75.222	73.279	70.408

***,**,* indicates rejection at the 1%, 5% and 10% significance level. The numbers in parantheses () are the corresponding standard errors. SIZE represents the natural logarithm of the product of the total amount of shares and the final price. DURATION is the number of a years a majority shareholder has owned more than 50% of the shares. LTD is the last trading day price premium on the buyout offer. PREMIUM 2 is the buyout offer premium on the highest stock price 6 months prior. LIQUIDITY 1A is the traded volume last quarter before the tender offer on the total amount of shares. LIQUIDITY 1B is the traded volume last quarter before the tender offer on the free float. LIQUIDITY 2A is the traded volume last quarter before the buyout offer on the total amount of shares. LIQUIDITY 2B is the traded volume last quarter before the tender offer on the free float. All variables can be seen in A.5. Pseudo-R^2 is McFadden's way of measuring Pseudo-R^2 and measures the relationship between the probit model (LLF) and a restricted model (LLF_0). AIC is Akaike's information criterion.

Table 3 also shows that the size of the company, the duration of a controlling owner, and the liquidity of the stock are the only significant determinants.

7.1.2 Final Model

We find that the model with the highest explanatory power is Model 1 (4), containing the tender offer premium and liquidity measure 2B. We proceed to remove insignificant variables from the regression, in an attempt to isolate the impact the significant variables have on the probability of offer rejection.

Table 4: Model 3: SIZE, DURATION and LIQUIDITY 2B

	Coefficient	Std. Error	z	p-value
const	−7.743	2.684	−2.885	0.004 ***
SIZE	0.299	0.126	2.377	0.018 **
DURATION	0.196	0.110	1.779	0.075 *
LIQUIDITY 2B	− 0.049	0.021	−2.332	0.020 **
Pseudo-R^2	0.213			
AIC	66.572			

***,**,* indicates rejection at the 1%, 5% and 10% significance level. SIZE represents the natural logarithm of the product of the total amount of shares and the final price. DURATION is the number of a years a majority shareholder has owned more than 50% of the shares. LIQUIDITY 2B is the traded volume last quarter before the tender offer on the free float. All variables can be seen in A.5. Pseudo-R^2 is McFadden's way of measuring Pseudo-R^2 and measures the relationship between the probit model (LLF) and a restricted model (LLF_0). AIC is Akaike's information criterion.

We find that the most important determinants of public compulsory buyouts going to court are the size of the firm, the duration of a controlling owner, and the liquidity of the stock (Table 4). However, Duration is only weakly significant. It is worth noting that the traded volume in the final quarter, divided by the free float, is the only significant liquidity measure. The quarter before the tender offer holds no significance.

We control for multicollinearity, as multiple variables in the model might be closely linked together. The linear relationship described in A.6 confirms that the predictor variables have a low correlation, and as we have a high explanatory power with high significance in predictor variables, we are

confident that the data contains little multicollinearity.

The $pseudo - R^2$ shows that the model explains some of the variance in the dependent variable. 0.213 $pseudo - R^2$ explains more than 21.3% of the variance in the dependent variable as the total sum of variance will be less than one. (This is further elaborated in A.7.)

7.1.3 Marginal Effects

We calculate the marginal effects to find the impact a single coefficient estimate has on the dependent variable. This is done through a calculation of the $F(z_i)$ from equation (A.2) presented in section A.3. To approach a value for z_i, we use the mean values of our predictor variables, then calculate z_i as in equation (A.6).

Table 5: Marginal Effects

	SIZE	DURATION	LIQUIDITY 2B
$F(z_i) \times \beta_i$	0.559%	0.367%	−0.091%

The table shows the increase in probability of going to court if one of the corresponding determinants increases by one unit. SIZE represents the natural logarithm of the product of the total amount of shares and the final price. DURATION is the number of a years a majority shareholder has owned more than 50% of the shares. LIQUIDITY 2B is the traded volume last quarter before the tender offer on the free float. All variables can be seen in A.5.

7.1.4 Economical Interpretation of Significant Determinants

In this section we interpret the regression results and the effect our predictor variables have on the dependent variable. The underlying test for hypothesis testing is elaborated in A.8.

7.1.4.1 SIZE

Increasing the size increases the probability of going to court.

We see that an increase of one unit in size, will increase the probability of going

to court by 0.559%. The effect of this variable can be visualized by comparing a NOK 1 million company to a NOK 1,000 million company, where the larger company will have a 3.86% higher chance of the minority rejecting a buyout offer.

7.1.4.2 DURATION

Increasing the owner duration increases the probability of going to court.
We observe that the estimate is weakly significant. One year increase in owner duration may increase the probability of going to court by 0.276%.

7.1.4.3 LIQUIDITY

Increasing the liquidity will decreases the probability of going to court.
We see that an increase of one in the liquidity measure will decrease the probability of going to court by 0.069%. This variable is not as intuitive as the previous variables. Liquidity measure 2B increases by one when the ratio of traded volume last quarter before the buyout offer doubles in comparison to the free float. If the free float is 10%, a traded volume equal to 100% of the total shares will decrease the probability of an offer rejection by 0.69%

7.2 Consequences of Going to Court

We find that the minority reject the buyout offer when they accuse liquidity to be low and the available public information to be limited. The courts side with the minority when they find a non-functioning market with insufficient liquidity. In our sample, the court has agreed with the minority eight times, giving a win probability for the minority of 80%. We do not have enough cases to run any meaningful regressions on the determinants of winning in court. However, we find that size of the company tends to be larger when the minority wins. Surprisingly, the liquidity tends to be lower in the cases when

the majority wins. (Table 6).

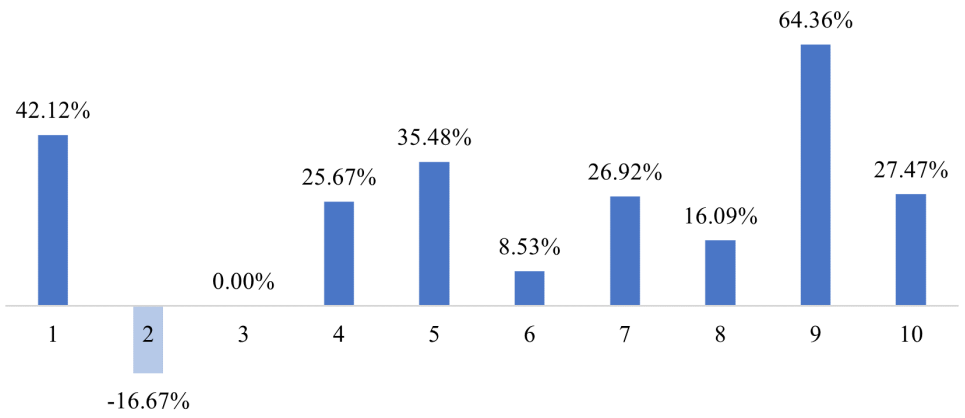
Table 6: Statistics of Different Legal Outcomes

	Minority Wins		Majority Wins
	Average	Median	Average
SIZE (in millions)	NOK 8,069	NOK 6,697	NOK 539
DURATION (in years)	2.97	0.77	0.50
LIQUIDITY 2B	3.10	2.44	0.66

The table shows the discrepancy in some of the statistics between the different legal outcomes. SIZE represents the natural logarithm of the product of the total amount of shares and the final price. DURATION is the number of a years a majority shareholder has owned more than 50% of the shares. LIQUIDITY 2B is the traded volume last quarter before the tender offer on the free float. All variables can be seen in A.5.

We find that the minority gets an average premium of 21.30% by going to court. In the 80% cases that the minority won, they had an average premium of 30.83% compared to the latest stock price. Figure 3 shows the litigation premium that was given in each verdict.

Figure 3: Litigation Premiums

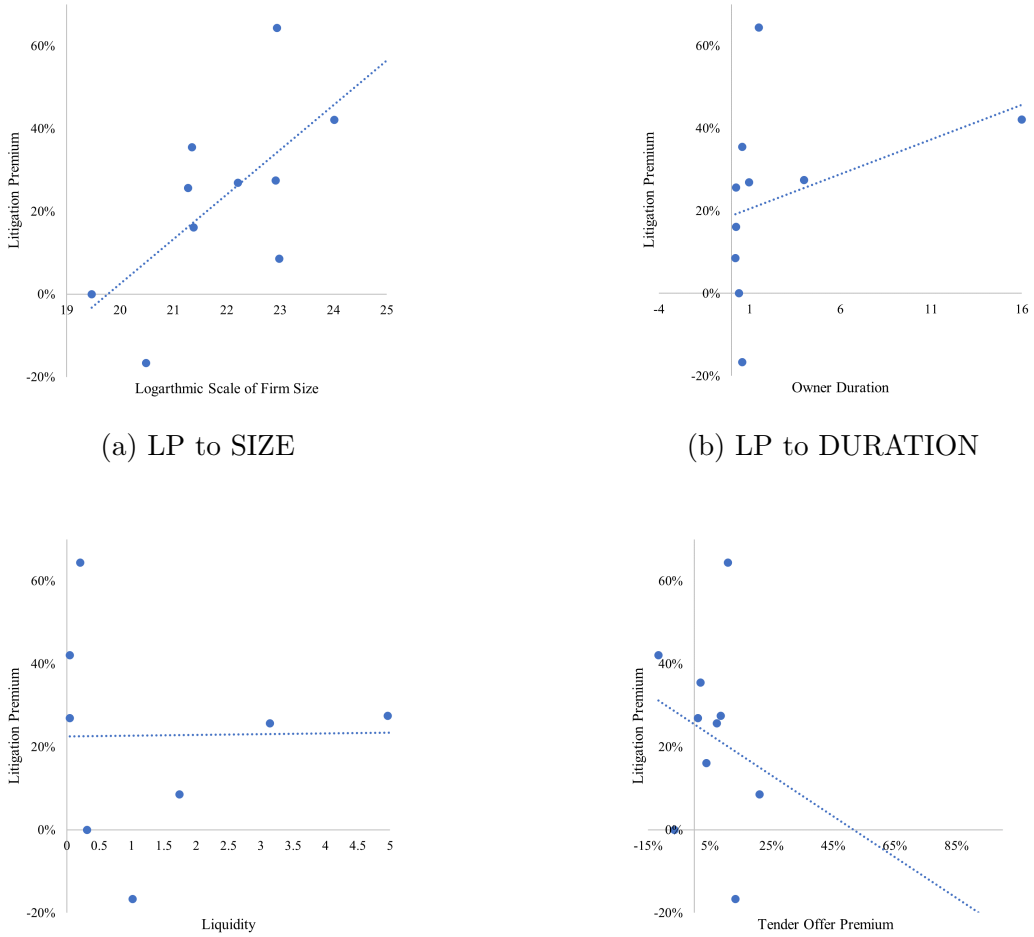


The figure shows the litigation premium that was given in each of the 10 cases. The two cases that the court sided with the majority are the cases with -16.67% and 0% premium. The other cases are all won in court by the minority.

We find that the litigation premium is not correlated with liquidity as can be seen from Figure 4. This is surprising as low liquidity may cause pricing delays or wrong prices. However, we observe that the litigation premium is positively

correlated with controlling owner duration. This finding suggest that the court rely on the theory behind the agency problem between the majority and minority. Having a controlling owner may expropriate the minority shareholders and the minority should be compensated for this. Lastly, we observe that the litigation premium is positively correlated with firm size and negatively correlated with the tender offer. Determining the explanatory variables of the litigation premium is challenging as we have a small sample of 10 cases and a regression model is not feasible.

Figure 4: Comparing Litigation Premium (LP) to Predictor Variables



(a) LP to SIZE

(b) LP to DURATION

(c) LP to LIQUIDITY 2B

(d) LP to PREMIUM 1

The figures show the correlation trend between the Litigation Premium and the three determinants of offer rejection in a public compulsory buyout. SIZE represents the natural logarithm of the product of the total amount of shares and the final price. DURATION is the number of a years a majority shareholder has owned more than 50% of the shares. LIQUIDITY 2B is the traded volume last quarter before the tender offer on the free float. All variables can be seen in A.5.

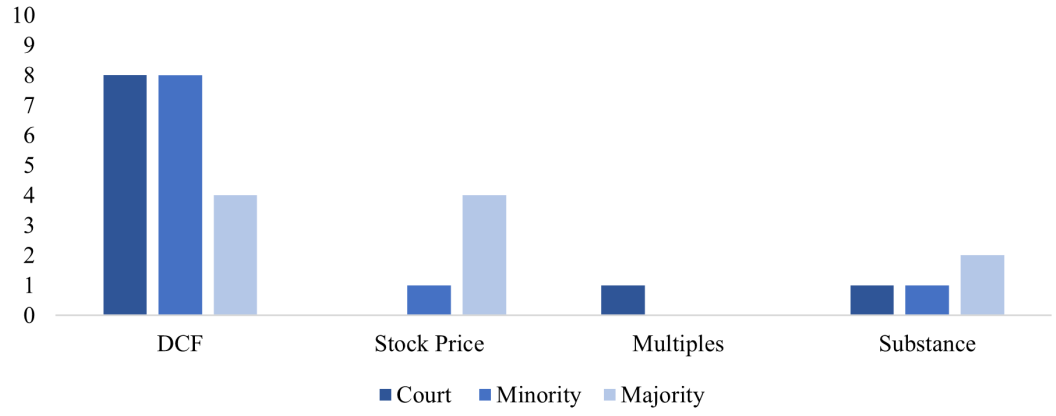
We find that the average legal cost in each case was NOK 3.6 million and was in nine out of ten cases paid by the majority. As going to court is tedious and

the minority's stocks are untradable, they are given a deprivation rate for the premium paid in the court proceedings. This rate was on average 1.62% above the Norwegian 10-year bond yield, and the court proceedings took 3.08 years on average.

7.3 Valuation Methods Used by the Courts

We find that the courts tend to disregard the last transaction price and instead compute their own fundamental valuation, with the objective of obtaining the "true value" ("virkelig verdi") of the company. Figure 5 shows the approaches to valuation presented by the minority and majority shareholders in court, and the approach to valuation finally chosen by the court. The data shows that the minority shareholders mostly rely on their own Discounted Cash Flow valuations, while the majority shareholders often rely on the last transaction price. In most cases, the courts have taken the same approach as argued by the minority shareholders and based their verdict on a Discounted Cash Flow model. By disregarding the last transaction price, the courts seem to implicitly assume that they are better capable of valuing a company than a competitive financial market.

Figure 5: Valuation



The figure shows the valuation methods presented in the courtroom by the minority shareholders, and the majority shareholders, respectively, and the valuation methods finally chosen by the court. The DCF is the Discounted Cash Flow method, based on future earnings and a discount rate. Stock Price represents the last transaction price. The Multiples method compares several earnings multiples with a peer group of comparable companies. The Substance method tries to value all assets in the company by deriving their market value.

The value of a company is indeed the discounted value of all expected future cash flows. The fundamental challenge of valuation is, however, that neither the sequence of future cash flows nor the sequence of future discount rates are observable. It may therefore be futile to believe there exists a "true value" of an asset, and even more futile to believe that such a price should be readily computable. Most economists, in contrast, rather operate with the concept of a "fair value" (Berg, 2009).

In this perspective, the courts' objective of obtaining the "true value" of a company may seem overly optimistic. In contrast, the last transaction price is the last price that there were some investors who were willing to sell at and some other investors who were willing to buy at.

In competitive markets, investors buy stocks they believe are underpriced and sell stocks they believe are overpriced. Since all assets have to be owned by someone, at the market price the number of stocks sold have to equal the number of stocks bought. If minority shareholders who have brought their case to court truly believe that their DCF provides a better estimate for the value of the company than the last market price, it is hard to understand why they did not buy more shares, and in that process, drove up the price to what they apparently have considered the "true value" (Table 7). However, we find little evidence of speculative trading prior to public compulsory buyouts. In most cases, the last trading day price is equal to, or lower than, the buyout offer.

Table 7: Valuation Comparison (in NOK/share)

Case	1	2	3	4	5	6	7	8	9	10
Court	137.5	5	15.5	34.6	210	160.6	16.5	14.5	166	116
Minority	179	40	36.7	100	325	180	40	14.5	–	160
Majority	96.75	6	15.5	27.5	155	148	13	12.49	105	91

The table shows the valuations done in the courtroom by the court, the minority shareholders and the majority shareholders. The court has used the multiples method for valuation in case 5 and the substance method in case 6. For all other cases the court has relied on the DCF method. The minority chose to not value the shares in case 9.

As we have emphasized, there may not exist a "true value" of a company, or, at least, it may be futile to believe it is possible to compute it. A "fair value" may be a more useful concept with better economic foundations. Even though the last transaction price should be the starting point to find a "fair value" for the minority shareholders, market failures that are possible to identify and measure may lead to a different result. Market failures related to public compulsory buyouts can e.g., be caused by weak minority protection or market illiquidity. Developed capital markets have strong minority protection (Barclay & Holderness, 1989) and abnormally low market liquidity is rare on a common stock exchange. To account for illiquidity and agency problems between the minority and majority, the market price may be adjusted.

8 Conclusion

The first part of our study examines the determinants of a public compulsory buyout going to court. After constructing a unique dataset of all public compulsory buyouts from the year 2000 to 2020, we find that 93.63% of the offers are accepted, and that they are independent of the tender offer premium. This result may be considered surprising as it would not have been unreasonable to believe that a higher tender offer premium would increase the acceptance rate. In contrast, we find that the size of the firm and the duration of a controlling owner has a positive relationship with offer rejection, while decreasing liquidity tends to also increase the probability of offer rejection.

In the second step of our study, we analyze the consequences of going to court in a public compulsory buyout. We find that minority shareholders are being favored in the court proceedings. The courts have sided with the minority eight out of ten times, resulting in an average premium of 21.30%. The average legal costs have been NOK 3.6 million and are in nine out of ten cases paid by the majority. The minority's deprivation rate is on average 1.62% above the risk-free rate, and the court proceedings have taken, on average, three years.

The final part of our study examines valuation methods used by the courts in public compulsory buyouts. We find that the courts tend to disregard the last transaction price and mostly rely on their own DCF valuations, with the intention of finding the "true value" of the company. The value of a company is indeed the discounted value of all expected future cashflows. The fundamental challenge of valuation is, however, that neither the sequence of future cash flows nor the sequence of future discount rates are observable. It

may therefore be futile to believe that such a price should be readily computable. Most economists, in contrasts, rather operate with the concept of a "fair value". The last transaction price might be considered a fair price, as it is the last price that there were some investors who were willing to sell at and some investors who were willing to buy at. This does not mean that this should be the final price in the verdict, but it should be the starting point. Market failures that are possible to identify and measure should be considered. To account for possible market failures, like weak minority protection or market illiquidity, the last transaction price may be adjusted.

8.1 Suggestions for Future Research

The dataset we have collected, and our analysis, may provide a starting point for future research on the economic determinants of public compulsory buyouts. There are multiple ways that new research could help shed light on Norwegian public compulsory buyouts. One interesting addition would be to find the analyst coverage for all Norwegian public compulsory buyouts. A second contribution would be to find the size of the largest minority shareholder in each buyout. A single minority shareholder needs to put in effort to reject the offer and go to court, which is costly. Increased dispersion between the minority shareholders may therefore decrease the probability of rejecting the offer. It may also be interesting to expand the sample size, either back to 1976 when public compulsory buyouts started occurring in Norway, or at a future point in time when more cases are available. A final contribution would be a thorough analysis of the competitive market in Norway to create a strong foundation for courtrooms to follow: *What are the opportunities of extracting private benefits? Are the liquidity criteria for public listings sufficient to reflect a fair price?*

REFERENCES

Albuquerque, R., & Schroth, E. (2015). The Value of Control and the Costs of Illiquidity. *The Journal of Finance*, *70*(4). doi:https://doi.org/10.1111/jofi.12207

Barclay, M. J., & Holderness, C. G. (1989). Private benefits from control of public corporations. *Journal of Financial Economics*, *25*(2). doi:10.1016/0304-405X(89)90088-3

Berg, A., S. (2009, May 14). *Virkelig verdi i regnskapet.* Retrieved from https://www.norges-bank.no/aktuelt/nyheter-og-hendelser/Signerte-publikasjoner/Penger-og-Kreditt/Penger-og-Kreditt-12009/Virkelig-verdi-i-regnskapet/

Bertrand, M., Mehta, P., & Mullainathan, S. (2002). Ferreting out Tunneling: An Application to Indian Business Groups*. *The Quarterly Journal of Economics*, *117*(1), 121–148. doi:10.1162/003355302753399463

Brooks, C. (2014). *Introductory Econometrics For Finance* (Third ed.). Cambridge Uuniversity Press. doi:https://doi.org/10.1017/CBO9781139540872

Casella, G., & Berger, R. L. (2001). *Statistical Inference* (2nd ed.). Cengage Learning.

Chen, G., & Tsurumi, H. (2010). Probit and Logit Model Selection. *Communications in Statistics - Theory and Methods*, *40*(1). doi:10.1080/03610920903377799

Edmans, A. (2009). Blockholder Trading, Market Efficiency, and Managerial Myopia. *The Journal of Finance*, *64*(6), 2481–2513. doi:https://doi.org/10.1111/j.1540-6261.2009.01508.x

FASB. (2006, september). *FAS 157 (as amended).* Retrieved from https://www.fasb.org/cs/BlobServer?blobkey=id&blobnocache=true&blobwhere=1175823288587&blobheader=application%2Fpdf&blobheadername2=Content-Length&blobheadername1=Content-Disposition&blobheadervalue2=476852&blobheadervalue1=filename%3Daop_fas157.pdf&blobcol=urldata&blobtable=MungoBlobs

Graham, J. R., Harvey, C. R., & Rajgopal, S. (2005). The economic implications of corporate financial reporting. *Journal of Accounting and Economics*, *40*(1). doi:10.1016/j.jacceco.2005.01.002

He, J. J., & Tian, X. (2013). The dark side of analyst coverage: The case of innovation. *Journal of Financial Economics*, *109*(3). doi:10.1016/j.jfineco.2013.04.001

Johnson, S., La Porta, R., Lopez-de Silanes, F., & Shleifer, A. (2000). Tunneling. *American economic review*, *90*(2). doi:10.1257/aer.90.2.22

Kennedy, P. A. (2003). *A Guide To Econometrics* (5th ed.). Malden, MA: Blackwell.

Koller, T., Goedhart, M., & Wessels, D. (2015). *Valuation* (6th ed.). McKinsey & Company.

Liu, J., Nissim, D., & Thomas, J. (2002). Equity Valuation Using Multiples. *Journal of Accounting Research*, *40*(1). doi:https://doi.org/10.1111/1475-679X.00042

Long, J. S. (1997). *Regression Models for Categorical and Limited Dependent Variables*. SAGE Publications Inc.

Lovdata. (n.d.). *Lovdata.* Retrieved from `https://lovdata.no/pro`

Maug, E. (2006). Efficiency and fairness in minority freezeouts: Takeovers, overbidding, and the freeze-in problem. *International Review of Law and Economics*, *26*(3), 355–379. doi:10.1016/j.irle.2006.11.006

Oslobors. (n.d.). *Newsweb.* Retrieved from `https://newsweb.oslobors.no/`

Pinto, J., Henry, E., Robinson, T., & Stowe, J. (2015). *Asset Based Approach to Private Company Valuation* (3rd ed.). CFA Institute.

Varian, H. R. (2016). *Intermediate Microeconomics with Calculus: A Modern Approach* (Ninth International Student ed.). W.W. Norton & Company.

Veall, M. R., & Zimmermann, K. F. (1994). Evaluating Pseudo-R2's for binary probit models. *Quality and Quantity*, *28*(2). doi:10.1007/BF01102759

Wooldridge, J. M. (2010). *Econometric Analysis of Cross Section and Panel Data* (Second ed.). MIT Press.

Yu, F. F. (2008). Analyst coverage and earnings management. *Journal of Financial Economics*, *88*(2). doi:10.1016/j.jfineco.2007.05.008

A Appendix

A.1 Data Collection

There is no comprehensive public register concerning public compulsory buyouts. The documentation of public compulsory buyouts is made on historical publications from the Oslo Stock Exchange (OSE). Through tedious research and communications with a representative from the OSE, we should presumably have all public compulsory buyouts in the period from year 2000-2020. Prior to this period, the publications are not stored electronically, and we were unable to obtain these in paper. When constructing the dataset, we have relied on the Bloomberg Terminal which stores in-depth data on most Norwegian companies from the 2000s. Prior to this it would be challenging to retrieve all datapoints required for the regression. However, we still lost 16 cases due to missing information. The first datapoints we obtained where the last tender offer (voluntary or mandatory), what price were offered, the highest stock price 6 months prior to the offer, the traded volume last quarter before the offer and the majority share at the time of the offer. These same datapoints were also obtained for the buyout offer. We collected datapoints for the duration of a majority shareholder owning more than 50% of the shares in the company, the total outstanding shares, and the last trading day price. Our final stock price is the buyout price unless it went to court, in which case it is the verdict price.

There is no comprehensive list regarding public compulsory buyouts going to court. Our available search engines are limited, which makes it challenging to identify cases. We have based our research on verdicts published on (Lovdata, n.d.), although it merely displays verdicts that are of significant interest to the public. However, a representative from (Lovdata, n.d.) have ensured us that all cases from the Court of Appeal are available in their database. In

order to obtain a comprehensive list, we forwarded a request to all 59 District Courts. Most of them were able to help and conducted a thorough search in their database. However, some of them required the case number to find these cases. After tedious research through news articles back to year 2000, we were able to acquire two more cases through case numbers. For the identified cases that went to court we have collected additional datapoints, to derive the conclusive consequences of going to court.

A.2 Detailed Descriptive Statistics

In a public compulsory buyout, the minority shareholders are offered an average tender offer premium of 10.18%. The premium for the cases that did not go to court has an average of 10.48%, while the cases that did go to court has an average of 5.00%. This indicates that minority shareholders demand higher premiums to accept the offer. In a public compulsory buyout, the average owner duration is 0.53 years. The owner duration for the cases that did not go to court has an average of 0.39 years, while the cases that did go to court has an average of 2.47 years. This indicates that a long controlling owner should increase the probability of rejecting the offer. In a public compulsory buyout, the average firm size is NOK 2 864 million. The firm size for the cases that did not go to court has an average of NOK 2 631 million, while the cases that did go to court has an average of NOK 6 241 million. This indicates that minority shareholders are more likely to accept the offer in a smaller firm. The liquidity measure is the traded volume last quarter before the buyout offer on the free float. In a public compulsory buyout, the average liquidity ratio of the target firms' stock is 13.47. The liquidity ratio for the cases that did not go to court has an average of 14.20, while the cases that did go to court has an average of 2.61. This indicates that the minority shareholders demand higher liquidity to accept the offer.

Table 8: Descriptive Statistics Summary

	PREMIUM 1	DURATION	SIZE (in million)	LIQUIDITY 2B
Overall	10.18%	0.53	NOK 2 864	13.47
No Court	10.48%	0.39	NOK 2 631	14.20
Court	5.00%	2.47	NOK 6 241	2.61

The table shows descriptive statistics for all the cases, the cases that did not go to court, and the cases that went to court. All numbers are the averages for their respective category, Overall, No Court, and Court. PREMIUM 1 is the tender offer premium on the highest stock price 6 months prior. DURATION is the amount of years a majority shareholder has owned more than 50% of the shares. SIZE is the firm size in million NOK. LIQUIDITY 2B is the traded volume last quarter before the buyout offer on the free float.

A.3 Linear Probability Model Violations

The LPM suffers from violations of two assumptions regarding the error term. This can be illustrated by the following LPM:

$$P_i = p(y_i = 1) = \beta_1 + \beta_2 x_{2i} + \beta_3 x_{3i} + u_i, \quad i = 1, ..., N \tag{A.2}$$

In equation (A.2), the binary outcome of y_i only has two belonging values for the error term for fixed values of explanatory variables:

$$y_i = 1 \quad \rightarrow \quad u_i = 1 - \beta_1 - \beta_2 x_{2i} - \beta_3 x_{3i} \tag{A.3}$$

$$y_i = 0 \quad \rightarrow \quad u_i = -\beta_1 - \beta_2 x_{2i} - \beta_3 x_{3i} \tag{A.4}$$

We see that the error term cannot be normally distributed. As the error term will change consistently with the explanatory variables, the error term will also be heteroscedastic. Heteroscedasticity robust standard errors are therefore required in all limited dependent variable models. (Brooks, 2014)

A.4 The Probit Model

To overcome the restrictions of the LPM, the probit and logit models binds the fitted values between zero and one through a modification of the regression. The two limited dependent models will give similar characterizations of the data because the densities are very similar. The only instance where the models may give non-negligibility different results occurs when the split of the dependent variable between zero and one is unbalanced (Brooks, 2014). If this is the case, the deviance information criterion (DIC) or Akaike's information criterion (AIC) will determine the correct model (Chen & Tsurumi, 2010). We observe in our sample that there is an unbalanced split of the dependent variable, as going to court only occurs 6.37% of the time. Hence, we are choosing the model with the lowest information criteria. The probit regression model has the lowest AIC and is used to evaluate the determinants of a public compulsory buyout going to trial. The probit model utilizes the cumulative normal distribution (CDF) through this function:

$$F(z_i) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{z_i} e^{-\frac{z_i^2}{2}} dz \tag{A.5}$$

Which can be rewritten as a function of Φ (CDF):

$$F(z_i) = Pr(y = 1|x_1, x_2, ..., x_i) = \Phi(z_i) = \Phi(\beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + ... + \beta_j x_{ji}) \tag{A.6}$$

The model is not linear and need to be estimated through maximum likelihood (ML). The parameter estimates cannot be interpreted as in the OLS, but rather through marginal effects. The simplest way to find the marginal effects is through utilizing the average values for the parameter observations as follows:

$$z_i = \beta_0 + \beta_1 \bar{x_1} + \beta_2 \bar{x_2} + ... + \beta_i \bar{x_i} + u_i \tag{A.7}$$

When z is found, we can use this to find the effect in probability a single coefficient has on the dependent variable through the CDF function as shown in equation (A.5), where $\beta_i \times F(z_i)$ is the marginal effect x_i has on y_i. This can also be found using a z score table and looking up the closest z value corresponding to the chosen level of significance (α) and degrees of freedom.

A.5 Defining Variables

COURT (C)	=	Binary outcome of court or no court
SIZE (S)	=	LN (Total shares * final price) (final price is the verdict price or the buyout offer if the case did not go court)
DURATION (D)	=	Number of years an owner has owned more than 50%
LTD	=	Last trading day price premium on the buyout offer
PREMIUM 1	=	Tender offer price premium on the highest stock price 6 months prior
PREMIUM 2	=	Buyout offer price premium on the highest stock price 6 months prior
LIQUIDITY 1A	=	Traded volume last quarter before the tender offer on the total amount of shares
LIQUIDITY 1B	=	Traded volume last quarter before the tender offer on the free float
LIQUIDITY 2A	=	Traded volume last quarter before the buyout offer on the total amount of shares
LIQUIDITY 2B	=	Traded volume last quarter before the buyout offer on the free float

A.6 Linear Relationship

Assessing the linear relationship between our variables provides a helpful foundation to the design of our model. The correlation matrix indicates the size and direction of the linear relationship between each predictor variable and the response variable, but also the relationship between the predictor variables. We do not want to include predicator variables that are highly correlated among themselves, as this can cause problems of multicollinearity.

Table 9: Correlation Matrix

	C	S	D	P1	L2B	LTD
Court	1	0.1782	0.3400	−0.0569	−0.0837	−0.0147
S	0.1782	1	0.1456	−0.0540	0.2036	0.1758
D	0.3400	0.1456	1	−0.0633	−0.0820	−0.0456
P1	−0.0569	−0.0540	−0.0633	1	0.0001	−0.1729
L2B	−0.0837	0.2036	−0.0820	0.0001	1	−0.0046
LTD	−0.0147	0.1758	−0.0456	−0.1729	−0.0046	1

COURT (C) is the binary outcome of court or no court. SIZE (S) represents the natural logarithm of the product of the total amount of shares times the final price. DURATION (D) is the number of a years a majority shareholder has owned more than 50% of the shares. LIQUIDITY 2B (L2B) is the traded volume last quarter before the tender offer on the free float. PREMIUM 1 is the tender offer premium on the highest stock price 6 months prior. LTD is the last trading day premium on the buyout offer. All variables can be seen in A.5.

We see that court has a positive relationship with firm size and controlling owner duration, and a negative relationship with offer premium and liquidity. This is in line with our hypotheses and provides a good foundation for our regression. However, offer premium and liquidity is weakly correlated with court, and might not contribute as much to our model of prediction. Liquidity and firm size hold the highest correlation between our predictor variables. They are correlated by 20.36%, which should not be a problem.

A.7 Goodness of fit

The standard goodness of fit measures such as the R^2 and $\bar{R}^2$ are not appropriate when estimating using ML. The purpose of ML is to maximize the value of the log-likelihood function (LLF), not to minimize the residual sum of squares (RSS). The results will also be misleading as the true values only takes on a binary outcome while the fitted model can take on any values. Two common approaches to measure the goodness of fit, for a limited dependent model, is the percent of correct predictions and the $pseudo - R^2$. The percent of correct predictions is simply defined as 100 times the number of observations predicted divided by the total number of observations. However, with an unbalanced sample this method is not ideal (Kennedy, 2003). This can be illustrated through our own sample, with 6% of cases going to court. A simple predictor would state all samples as 0 and get 94% correct predictions. One of the most common definitions of the $pseudo - R^2$ is $McFadden's - R^2 (R^2_{MF})$:

$$Pseudo - R^2_{MF} = 1 - \frac{LLF}{LLF_0} \tag{A.8}$$

The equation measures the relationship between the probit model (LLF) and a restricted model (LLF_0), where all slope parameters are set to zero. This measure is closely related to the chi-square statistic which makes it easier to test hypotheses regarding the predictor variables (Veall & Zimmermann, 1994). As the function is bound between zero and one, the LLF/LLF_0 will always be negative and the maximum value of the $pseudo - R^2$ can never be one. The equation does not estimate the proportion of variation such as the traditional R^2 and fails to have a clear intuitive interpretation. However, a conversion rate of 1.68 to a traditional R^2 has been suggested for a sample size of 200 (Veall & Zimmermann, 1994).

A.8 Hypotheses testing

In this section we will give a detailed description of how we perform our hypotheses tests, which is applicable for all our chosen hypotheses.

Stating the null hypothesis

We made six predictions about public compulsory buyoust going to court. We are using a two-sided hypothesis test (a 'not equal to' alternative hypothesis), as our variables are not restricted in any direction and might be negatively or positively related to our dependent variable. The hypothesis is formulated in the following way:

$$H_0 : \beta_i = 0 \quad vs. \quad H_1 : \beta_i \neq 0 \tag{A.9}$$

Identifying the appropriate test statistic and its probability distribution under the null hypothesis

The test statistic is used for deciding whether we reject or fail to reject our null hypothesis. Each test statistic for the corresponding coefficient estimate is calculated from our sample. Our test statistic is associated with the standard normal distribution. The test statistic is calculated as follows:

$$Test\ statistic = \frac{sample\ statistic - value\ of\ the\ parameter\ under\ H_0}{standard\ error\ of\ the\ sample\ statistic} \tag{A.10}$$

Specifying the significance level

We are choosing a significance level of $\alpha = 0.05$ 'strong evidence', in all our hypotheses tests. Choosing the significance level of our test is determined by the desired standard of proof against which we measure the evidence contained in the test statistic. The level of significance is identical to the

probability of a Type I error; hence our test is conservative.

Stating the decision rule with the p-value approach

We fail to reject our null hypotheses if the p-values are higher than our significance level $\alpha = 0.05$. The p-value is the smallest level of significance at which our given null hypothesizes can be rejected. All p-values are calculated using the test statistic of our estimates. Overall, smaller p-values mean greater confidence in the significance of the results.