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Does capital structure affect the valuations of banks?

Bachelor Thesis 15hp

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In this paper, we examine the capital structure and other factors affecting the valuation of U.S. banks. The study focuses on the largest publicly traded U.S banks in 2000-2019. To achieve the purpose, a quantitative method has been applied where a dataset has been analyzed through balanced panel data. We find that banks relationship between debt and equity differs from that of non-financial companies and our regression model shows that the capital structure has an impact on the valuation of banks in the stock market.

Keywords: capital structure, debt to equity-ratio

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1. INTRODUCTION

1.1 BACKGROUND

How capital structure affects companies profitability is a well investigated subject and have been frequently debated since 1958 when Franco Modigliani and Merton Miller published the "Modigliani-Miller Theorem". The theory's compatibility with reality was questioned by Kraus & Litzenberger (1973), who explained firm's financing based on pros and cons of costs associated with the risk of running bankrupt. Myers & Majluf (1984) challenged the theory as they argued that a firm's balance between debt and equity is determined by a financing hierarchy because of asymmetric information. Harding et al. (2013) investigated some of the parameters that are in conflict with the perfect capital markets assumed by MM such as tax benefits from adjusting capital structure in banks. Harding et al. (2013) found that there are optimal levels of the capital structures among the successful banks included in their study, contrary to the MM-theory. By contrast, Gropp & Heider (2009) found greater similarities between capital structure of banks and that of non-financial firms. Gropp & Heider (2009) concludes that banks have firm-specific capital structure targets, determined by other factors than standard corporate finance variables or regulation, as do non-financial firms.

Private banks are one of the most important institutions in a well-functioning economy. Society would simply be worse off without well-run banks. Yet the role and power of banks are discussed frequently as crises emerge and many banks remain profitable. Evaluating capitalization in banks is a difficult task but of great importance in order to illuminate problems due to their great potential burden to society. The fourth point in the introduction of the Basel Accords (BIS 2010) states:

> *One of the main reasons the economic and financial crisis, which began in 2007, became so severe was that the banking sectors of many countries had built up excessive on- and off-balance sheet leverage. [...] At the same time, many banks were holding insufficient liquidity buffers.*

The discussion about banks has led to much-debated regulations regarding the capital structure. The new regulations[1] include minimum requirements of reserves held by banks. Critics question how large the equity needs to be in order to have sufficient reserves and simultaneously run a profitable operation.

"This high capital level will decrease the ability of banks to lend"

said Scott E. Talbott of the Financial Services Roundtable, which represents the largest American banks.

The banking sector is intensely affected by technological innovation related to the battle of customer relations. McKinsey (2016) describe how banks develop real-time intervention without human interaction that will be required to help customers open accounts and take out loans. Banks experiment with self-learning algorithms and credit-card fraud detection which obviously are risky operations. These technological changes bear risks that makes the analysis of risks associated with capital structure in banks as relevant today as in the pre-financial crisis era (McKinsey, 2016). The most common theories are in conflict with each other where both financing through debt and equity are advocated to achieve optimal capital structure. These new challenges and theories raise the question whether banks should finance its operations through a high debt to equity-ratio or a high level of solidity.

This study intends to study the effect of banks' capital structure on the stock market's valuation of banks. Many studies have covered periods before 2008 and the great financial crisis, ergo we believe that analyzing data from recent years as well as pre financial crisis-data will contribute to existing research.

1.2 PROBLEM DEFINITION

Given the peculiar financial characteristics of banks where the capital structure is regulated by authorities, there has been reasons to conduct bank-specific studies to determine the effect of capital structure on stock market capitalization. Earlier studies have gained varied conclusions and the results have been discussed with support of contradictory theories.

[1] Basel 3

In this paper, we investigate how the debt to equity-ratio affects the valuation of US banks in the stock market during the period of 2000-2019. The subject has gained recognition since the financial crisis of 2007-2009 when low equity ratio[2] in banks were assumed to play a part in the magnitude of the crisis. As a response to the crisis, the Basel Committee on Banking Supervision (BCBS) developed a new international regulatory framework called Basel 3[3]. Basel 3 is a set of measurements that aims to strengthen the regulation and supervision of internationally active banks. The objective of Basel 3 is to tighten the capital requirements for banks in order to improve their ability to absorb economic shocks rising from financial disorder (BIS, n.d.). The standard imposes stricter ratios for banks regarding capital requirements, leverage ratio and liquidity requirements (BIS, 2014).

TABLE 1: BASEL ACKORD - MINIMUM COMMON EQUITY CAPITAL RATIO

2013	2014	2015	2016	2017	2018	2019
3.5%	4.0%	4.5%	4.5%	4.5%	4.5%	4.5%

Implementation plan for capital requirement. Source: BIS (2014)

The Basel 3 accord have met a great deal of controversy among bankers

"Banks have warned that the new regulations could reduce profits, strain weaker institutions and raise the cost of borrowing." Ewing (2010)

In order to gain a deeper understanding of the relationship between debt and equity, this study further intends to analyze what causes banks to choose different types of capital structure. In order to do so, we believe that other variables than solely debt to equity-ratio must be considered. Our research will seek to test whether the relationship between debt and equity, liquidity and the size of a bank's total assets affect the valuation of banks. We believe that further research is needed that focus on a broader perspective when analyzing the effects of capital structure.

[2] A low equity ratio is when the equity makes up a small portion of a firms total funding.

[3] Third Basel accord or Basel Standard

1.3 AIM OF THE STUDY

The purpose of the study is to examine how capital structure affects the valuation of US banks during the period of 2000-2019. This paper will focus on the investor's perspective and their preferences on capital structure.

1.4 RESEARCH QUESTION

In this study, the following research questions will be answered:

- Does the debt to equity-ratio affect the valuation of a bank in the stock market?

Null hypothesis: The debt to equity-ratio does not affect the market value to book value [4] of a bank

Alternative hypothesis: The debt to equity-ratio does affect the market value to book value of a bank

1.5 DELIMITATIONS OF THE STUDY

This paper is focused on U.S. publicly traded banks in 2000-2019 since the period covers a variety of macroeconomic prerequisites and data is easy to access. The market value to book value is the variable used to investigate valuation because it's one of the most used variables for evaluating financial companies in practice. The control variables were also chosen based on the authors perception of what factors are common to take into account when evaluating companies in practice. The theories raised in this essay are the most widely accepted in finance regarding capital structure. However, new research has shed light on different aspects than that of the old theories and therefore attracted the authors interest.

1.6 THESIS STRUCTURE

In the next part, theories about capital structure and empirical research will be reviewed. Part three covers the method of how the regression model is constructed, what its variables are and

[4] Referred to as MV/BV later in this paper. Frequently referred to as the price to book-ratio, P/B.

the assumptions on which it is based. After the method follows the results from the regression in part four. The last two parts cover the authors analysis and conclusion drawn from the results.

2. THEORETICAL FRAMEWORK & PREVIOUS RESEARCH

2.1 THEORY

2.1.1 CAPITAL STRUCTURE

Capital structure is

"the combination of ways in which a company finances its business"

(Cambridge Dictionary, n.d.)

Hence, the capital structure can be deduced from the financing page on a balance sheet. Capital structure can be measured in many ways. This study will focus on the debt to equity-ratio. The debt to equity-ratio is simply a measure of the degree to which a company finance its operations through debt versus equity. The debt to equity-relationship can also be referred to as *leverage*. The leverage of a firm discloses the financial risk of the firm. That is, the risk of a firm's ability to maintain its financing in terms of current- and long-term liabilities. De Grauwe & Ji (2013) consider banks with high leverage to be more fragile than those with low leverage. A low levered company is considered less fragile and is hence better equipped for financial difficulties. In the case of banks, financial fragility associated with high leverage also comes in the form of liquidity issues in the case of a bank run[5] (Diamond & Rajan, 1999). Banks face regulations aimed at financial fragility[6] due to their systematic importance in society (De Grauwe & Ji, 2013). Regulations and banks peculiar financials are some of the main

[5] A bank run occurs when many depositors tries to withdraw money simultaneously.

[6] Financial fragility can also be considered to be the leverage of a firm.

reasons why banks capital structure differs from that of non-financial corporations.

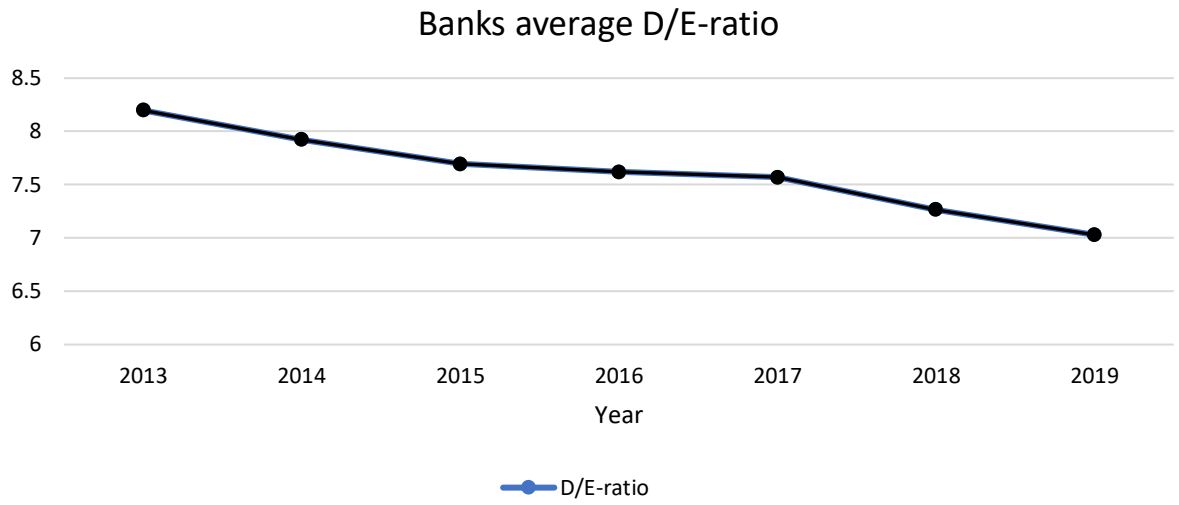

FIGURE 1: Average D/E-ratio among the 76 U.S. publicly traded banks included in this study. Source: Capital IQ.

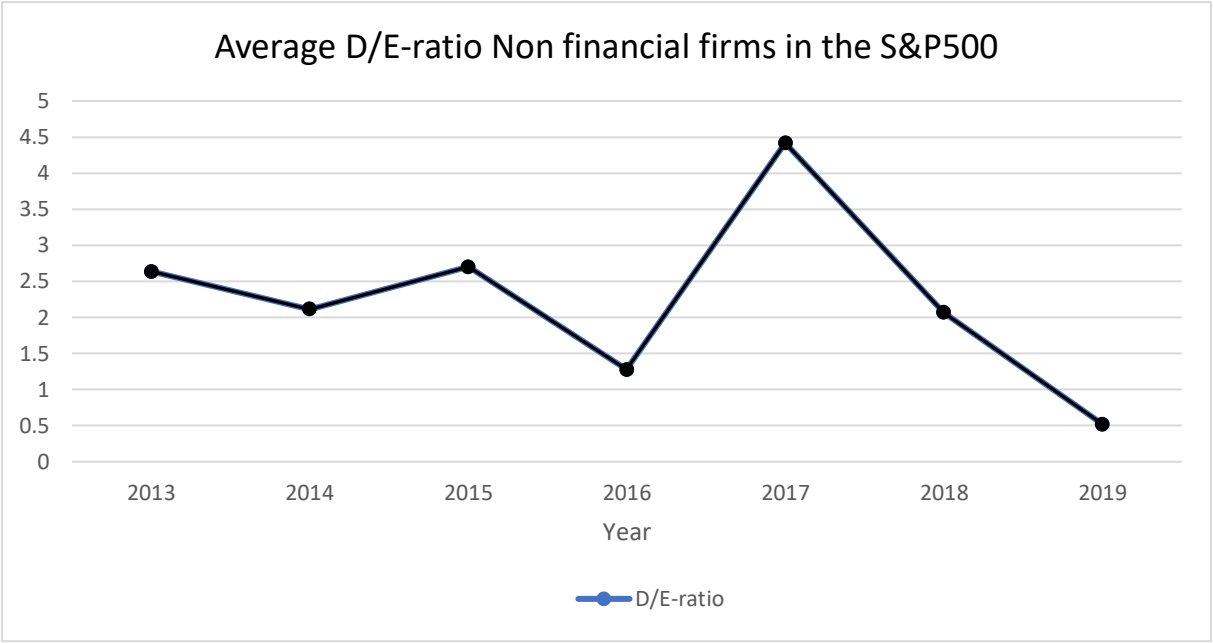

FIGURE 2: Average D/E-ratio among 434 non-financial firms included in S&P500. Source: Capital IQ

2.1.2 MODIGLIANI-MILLER THEOREM

Franco Modigliani and Merton Miller's theory on the irrelevance of capital structure

As modern financial theory developed during the 1950's, Franco Modigliani and Merton Miller elaborated one of the most established theories regarding capital structure. Modigliani & Miller (MM) stated that the total value of a firm is equal to the market value of its cash flows regardless of the capital structure of the firm, that is in a perfect capital market. A perfect capital market is a market where firms pay no taxes, has no transaction costs, no security issuance costs. Firms and investors can trade securities which prices are equal to the net present value of the cash flows and firms cannot make financing decisions that affect cash flows of its investments. Under the assumption of a perfect capital market, MM reasoned that a firm's total cash flow paid to its security holders is equal to the cash flow generated by the firm's assets. Hence, the market value of the securities and assets of the firm should be equal, according to the Law of One Price. MM's theory implies that the capital structure, the firm's way of financing its operations, is irrelevant when evaluating companies under the set of assumptions associated with perfect capital markets.

2.1.3 TRADE OFF THEORY

In an attempt to find the optimal capital structure, Kraus & Litzenberger (1973) elaborated the Trade Off-theory. The theory states that companies choose their financing between debt and equity by balancing the costs of running bankrupt against the benefits of the tax shield that debt financing causes. The theory assumes that if adjustment costs are negligible, then each firm's debt to equity-ratio would be at its optimum. However, Myers (1984) resonates in his study of the Trade-Off theory that differences between debt to equity relationships among companies might be caused by actual costs of adjusting the capital structure.

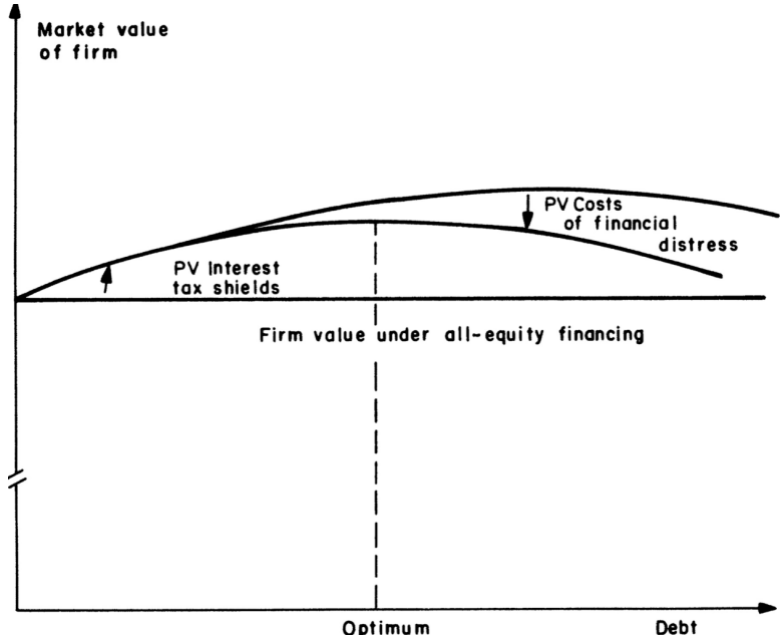

FIGURE 3: Illustration of the Trade-Off theory. The graph illustrates how the enterprise value reaches optimum at a certain level of debt. Source: Myers (1984)

2.1.4 PECKING ORDER THEORY

The pecking order theory states that companies follow a hierarchy where they prefer funding in the following way.

1. Internal funding
2. Debt
3. Equity

Myers (1964) introduced the idea where managers follow a preferred pecking order when they seek funding. The theory can be traced back to Gordon Donaldson's "Corporate debt capacity: A study of corporate debt policy and the determination of corporate debt capacity" in 1961.

To fully understand the pecking order the reader needs to be familiar with the ideas of *adverse selection* and *asymmetric information*. The costs associated with these problems will be crucial for understanding the later part. Akerlof (1970) illustrated the problem by using the market for used cars where only two types of cars exist, either the car is a lemon (a low-quality car) or a peach (a high-quality car). Akerlof assumed that the seller knew whether the car is a lemon or a peach, but the buyer did not have this information, this information gap is referred to as

asymmetric information. Assuming further that lemons sell at a lower price and peach at a higher price, but since the buyer do not know if the car is a lemon or a peach the price a buyer is willing to pay will be somewhere in between. In that case a lemon is priced higher than its true value and a peach is priced below its true value. This asymmetric information will generate incentives for sellers to only sell low-quality products (lemons) at a price above their true value and force the high-quality product (peach) out of the market. This phenomenon is known as adverse selection.

Myers (1964) argue that the fundamentals in the pecking order theory can partly be explained by adverse selection and asymmetric information costs. Myers & Majluf (1984) claim that asymmetric information cost is one of the reasons that a company choose debt over equity.

Myers & Majluf (1984) key points:

1. *Cost of relying on external financing.* The reason company's prefer internal funding over external is associated with administrative costs of external financing and underpricing of issued assets.

2. *The advantage of debt over equity issues.* When relying on equity funding managers may pass on investment with positive NPV because investors undervalue the firm. One could argue that managers should fund investment with debt when investors undervalue the firm and raise funding through equity when investors overvalue the company. The problem with this strategy is that eventually investors would know that the company only issue equity when the company is overvalued, and investors would not buy the equity.

2.1.5 MARKET TIMING-THEORY

Further studies of factors that influence the choice of capital structure have led to the Market Timing-theory. The idea of the theory is that firm's decisions to issue equity depend on overall market performance (Deborah, McDonald, 1989, p.1). The theory predicts that firm's are reluctant to issue equity in times characterized by a bad macroeconomic environment, some firms issue equity in the middle stage and that equity issues are large during a booming economy.

2.1.6 SUMMARY OF THE THEORIES

TABLE 2: SUMMERY OF THEORY

Theory	Conclusions
Modigliani & Miller	Capital structure has no effect on value of a company.
Trade-off theory	Optimal capital structure is achieved when advantages of tax-reductions are compared to costs of financial fragility.
Pecking Order-theory	Optimal capital structure is achieved when determined by hierarchy based on information asymmetry.
Market Timing-theory	Firm's decisions to issue equity depend on overall market performance.

Table 2 summarizes the conclusions of the theories found in the theoretical framework.

2.2 EMPIRICAL STUDIES

2.2.1 MODIGLIANI-MILLER THEOREM

Empirical studies show that the theory is not always correct in neither financial firms nor nonfinancial firms. Gemmill (2001) found that "financial engineering", that is changing the capital structure on purpose, do increase the value of companies in his study on firms in the UK. Beltratti & Stulz (2009) investigated the performance of large international banks during the period of July 2007 to the end of December 2008 and found that banks with more Tier 1[7] capital and deposits performed better throughout the crisis than their peers. Since most banks face capital requirements by law, Gropp & Heider (2009) examined banks capital structure among 16 EU countries and the US. Gropp & Heider found a great variety of book capital ratios (book equity divided by total assets); thus Modigliani & Miller's theory could be disproved. Henceforth, Mehran & Thakor (2009) found that a banks value is positively correlated with solidity in their cross-sectional analysis of bank acquisitions.

[7] Tier 1 capital is a measure of a bank's financial strength.

Modigliani and Miller assumed perfect capital markets where no companies have to take problems associated with high levels of debt into account. Obviously, in reality there is no such thing as perfect capital markets. Research has hence gone forward and new theories of optimal compositions of capital structure have been developed.

2.2.2 TRADE OFF THEORY

Empirical tests have been proven to be in agreement with the Trade-Off theory (Graham & Leary, 2011). The authors argue that large companies which are stable have a higher optimum level of leverage than small companies have. The empirical evidence shows that the leverage is generally higher in large companies and is thus in line with traditional trade-off predictions. Ju et al. (2005) studies the determinants of a firm's capital structure and find factors such as the risk in an underlying asset important but the Trade-off theory as an accurate stance when finding the optimal capital structure.

2.2.3 PECKING ORDER THEORY

Elsas et al (2006) find some pecking order effect in their study on how large firms finance their major investments 1998-1999. The results of their study show that major investments are financed externally for most part and least through equity. However, they also find that most investments tend to be revised subsequent years. Contrary to the theory, Elsas et al (2006) further find that smaller companies tend to finance its operations through externally issued equity more than large ones.

Myers (1964) do not claim that the pecking order built on asymmetric information and adverse selection hold true for every investment decision in the world, rather it give one explanation why companies prefer internal funding over debt and debt over equity. The problem of applying the pecking order theory to banks is that banks are not exposed to information asymmetries the same ways as industrial companies. In fact, Gorton & Pennachi (1990) suggest that banks have their role because of the information asymmetry between lenders and borrowers. Further, banks assets and sources of funding differs substantially from those of non-financial firms and make the pecking order even more difficult to apply to banks (Diamond & Rajan, 1999).

2.2.4 MARKET TIMING-THEORY

Baker & Wurgler (2002) show a positive correlation between market performance and the frequency of equity issuance in their empirical studies of the matter. The evidence supports the

theory that share price has an impact on share issuance decisions (Baker & Wurgler, 2002). Baker & Wurgler (2002) found that firms have a tendency to acquire equity when valuations were high and the company's leverage was low, and vice versa. Thus, capital structure can be considered to have a causal relationship with the market situation.

2.2.5 PREVIOUS RESEARCH RESULTS

TABLE 3: SUMMERY OF EMPIRICAL STUDIES

Theory & Author	Conclusions
Modigliani & Miller	
Gemmill (2001)	Financial engineering increases the value of companies.
Mehran & Taylor (2009)	Bank value positively correlated with solidity.
Trade-off theory	
Graham & Leary (2011)	Leverage higher in large companies.
Ju et al. (2005)	Risk in underlying assets important to take into consideration but theory accurate stance.
Pecking Order-theory	
Elsas et al (2006)	Major investments are financed externally for most part and least through equity.
Gorton & Pennachi (1990)	Banks have their role because of the information asymmetry between lenders and borrowers.
Market Timing-theory	
Baker & Wurgler (2002)	Positive correlation between market performance and the frequency of equity issuance.

Table 3 summarizes the conclusions of the empirical research found in the theoretical framework.

3. METHODOLOGY & DATA

3.1 RESEARCH APPROACH

Research on capital structure has resulted in different results on a variety of aspects i.e. profitability and financial fragility. Previous studies have resulted in a wide range of empirical research which has been the starting point for this thesis purpose and problem discussion. A quantitative method is used in this study. Due to the authors delimitations and resources, the quantitative method is a great advantage as it provides the opportunity to process the comprehensive material effectively. Further, the quantitative method increases to possibility to generalize the results for the entire population.

3.2 LITERATURE STUDY

Scientific research articles, previous bachelor theses and finance related literature have been used. The e-library Social Science Research Network (SSRN) has been used to find scientific research based on keywords such as *capital structure, trade off-theory* and *determinants of bank capital structure.*

3.3 DATASET

The data for this thesis is collected from official Reports from Capital IQ to get data on balance sheet, profit & loss accounts etc. The banks included in the study are U.S. public, operating banks listed on the major U.S. indexes with a market capitalization of at least 1bn USD. The screening results in 99 banks. Data from 2000 until 2019 is used. The reason is that the capital structure in banks before and after the great financial crisis is very interesting to investigate how it has changed during this period of time. The great financial crisis shed light on how banks manage risks in ways never seen before and is hence important to include in this study.

TABLE 4: SUMMARY OF THE DATASET

Number of banks	Num. of banks after incomplete data excl.	Total number of observations	Replaced observations
99	76	1520	59

3.4 DEFINITION OF VARIABLES

Variables of the study has been collected from Capital IQ or calculated in Excel based on data from Capital IQ. Note that definitions of the variables mentioned in the discussed studies and that of the variables in this study since definitions might differ in different parts of the world.

3.4.1 MARKET VALUE TO BOOK VALUE – RATIO

The study tests how different aspects of capital structure affects valuations of banks. The market value to book value-ratio (MV/BV)[8] is one of the most used multiples when valuating banks in practice and will hence be our benchmark of how the stock market evaluates banks in terms of market capitalization. The market value to book value is preferred instead of the P/E-multiple due the unique characteristics of financial companies.

The price to book-ratio is simply calculated by dividing the market capitalization by the equity.

$$Price\ to\ book\ = \frac{MV}{BV} = \frac{Market\ capitalization}{Book\ value}$$

3.4.2 DEBT/EQUITY

Modigliani and Miller claimed that if all participants have the same information, no transaction cost exist, companies pay no taxes and all participants have equal borrowing costs, then debt to equity-ratio should be irrelevant for the valuation of a company. These assumptions are highly unlikely to hold true in the real world and contradictory research, such as the pecking order theory, claims that capital structure does affect the valuation of a company. To evaluate investors preferences regarding capital structure, our model will use the Debt/Equity ratio as an independent variable to test its effect on the market value to book value-ratio.

$$\frac{D}{E} = \frac{Debt}{Equity}$$

[8] Commonly referred to as price to book-ratio, P/B-ratio.

3.4.3 RETURN ON EQUITY

The return on the investment that investors can enjoy will most likely affect the price investors are willing to pay. To capture this effect on the valuation, we will include return on equity as a control variable.

$$RE = \frac{Earnings}{Equity}$$

3.4.4 LIQUIDITY RATIO

To include how default risk on short term liabilities affect investors preferences, the model include a liquidity ratio. In this model the liquidity ratio is defined as:

$$LR = \frac{Short\ term\ investment + cash}{Current\ liabilities}$$

3.4.5 TOTAL ASSETS

Economies of scale can be beneficial for banks influence in the market and their possibilities to take on investments. It will most likely affect the investors preferences towards the bank and by extension the valuation. To minimize the risk for omitted variable bias, our model includes total assets as an independent variable. Total assets are defined as the logarithm of total assets reported on the balance sheet expressed in million USD.

3.4.6 SUMMARY OF VARIABLES

TABLE 5: VARIABLES IN THE REGRESSION MODEL

Variable	Abbreviation in the model
Market value to book value of equity	MVBV
Debt to equity-ratio	DE
Return on Equity	RE
Total Assets	ln(TA)
Liquidity ratio	LR

3.5 DATA

3.5.1 HANDLING EXTREMES

A few extreme values can have a big impact on the results of the study which gives the appearance of a different image than what is fair to the entire sample. Extreme values are replaced by minimum and maximum values of a particular variable. The minimum and maximum values are defined as the median value for a variable, plus/minus two standard deviations for that particular variable. There were 59 adjustments in the dataset. Extreme values are evaluated by the authors based on what's considered extreme for the individual bank. Some examples of extreme values in the dataset occurred around 2008 and the financial crisis. Restructurings took place in some of the banks, which led to unusual levels of capital structure variables.

3.5.2 FIXED EFFECTS AND RANDOM EFFECTS

When running a regression analysis on panel data you obtain repeated observations of the same variable over different time periods. For each observation you will have unobserved time-invariant heterogeneities across entities (Hank et al.). The model needs to consider how to treat these unobserved effects to obtain a prominent value for the coefficient of the observed independent variable. Two common ways are used to control the unobserved heterogeneity, either the model assumes fixed effect or random effect. The deviation between the two is how they treat the intercept of the unobserved heterogeneity. Fixed effect predicts different intercepts for each individual while random effect assumes these intercepts to be randomly

distributed. Whether the intercept is treated as fixed or randomly distributed is crucial to achieve an efficient result and it depends on the characteristics of the observations (Verbeek, 2004, p.351). Fixed effect assumes correlation between the independent variable and the individual effect, while the random effect assumes these events to be uncorrelated. To test if the assumption for fixed or random effect predict the most efficient results a Hausman test have been performed (Hausman 1978).

The panel data regression for the Hausman test (1).

$$Y_{it} = \beta_0 + \beta_1 x_{it} + \alpha_i + u_{it} \tag{1}$$

i = Individual characteristics

t = time

α = unobserved factor

If the unobserved factor (α) I uncorrelated with the independent variable (x) then both random effect and fixed effect are consistent. If α is correlated with x, then solely fixed effect is consistent. Hausman test the null hypothesis that random effect should be used.

$$H_0: \text{Cov}(\alpha_i, x_{it}) = 0$$

$$H_A: \text{Cov}(\alpha_i, x_{it}) \neq 0$$

The test statistic for the Hausman test is computed according to equation (2) and is chi-squared distributed with one degree of freedom.

$$W = \frac{(\beta_{FE} - \beta_{RE})^2}{Var(\beta_{FE}) - Var(\beta_{RF})} \tag{2}$$

If the null hypothesis is true, both fixed effect and random effect will be consistent and the difference between $(\beta_{FE} - \beta_{RE})^2$ will be a small, generating aa small nominator. Further, if the null hypothesis is true the variance for β_{FE} will be greater than the variance for β_{RF}, generating a positive number for the denominator and the W-statistic will be close to 0.

The characteristics of the chi-squared probability distribution with one degree of freedom is that most of the observations will be around 0. Thus, if the W-statistic is close to 0 we can´t reject the null hypothesis. We have performed a Hausman test, which showed statistical significations for rejecting the null hypothesis and that we should use fixed effect in our model.[9]

3.6 PANEL DATA ANALYSIS

A regression analysis can be implemented through panel-, cross-sectional- or time series data. This study will make use of a panel data in the regression model since it has a number of advantages relative to the others in this kind of study. Lohse, Bellman, Johnson (2000) argues that panel data is superior to cross sectional data since it is more accurate. The writers further accentuate the advantages of being able to collect more data in the panel data analysis than that of the others since existing background information need not be repeated each period. Baltagi (2005) mentions the great importance of controlling for individual heterogeneity. Panel data analysis takes the individual heterogeneity into account, which both cross-sectional and time series data do not and hence result in a biased result.

The panel data in this study will be balanced, which means that the number of observations is the same for every bank in this study. Previous studies of similar design and purpose have also used panel data (Gatsi, 2012). All statistical analyzes will be carried out with the help of Stata.

3.7 REGRESSION ASSUMPTIONS

3.7.1 NORMAL DISTRIBUTION

The regression model requires that the error term ε is normally distributed in order to find evidence whether is a linear relationship between our dependent and independent variables (Jaggia & Kelly, 2013). A Jarque-Bera test was performed to investigate the normality of the study's data which showed non-normality for all variables.[10] Given the size of our data set the

[9] See results in Table 8 on p.23.

[10] See Appendix 2

non-normality will not cause any concern. According to the central limit theorem, if a sufficiently large sample set of independent observations is drawn from a population, the sample mean will converge towards normal distribution. To test the central limit theorem, we plotted the residuals in a histogram and the result validated the assumption for normality.[11]

3.7.2 AUTOCORRELATION

The regular assumption of independent errors in panel data sets is often violated in time series data. As such, the violation must be taken into account when analyzing the data (Gow et al., 2009). All of the regressors have been tested for autocorrelation by a Durbin-Watson test test. The test shows positive autocorrelation for all four models.[12]

3.7.3 HETEROSCEDASTICITY

When observing repeated observations of the same units over time, each observation is not independent of one an another, and this possibly cause heteroscedasticity over the time-series and make the OLS estimates inefficient. Heteroscedasticity is a violation of the assumptions for a linear regression model since it violates the Gauss-Markov theorem that the OLS estimator has the lowest variance of all other unbiased estimators. While heteroscedasticity does not cause the coefficient estimates to be biased, it affects the standard deviation which can generate problems for hypothesis testing. Wrongfully estimated standard deviations will affect the p-values and the validity of the test. To test for heteroscedasticity, we use the Breusch-Pagan test. The Breusch-Pagan tests if there is a relationship between the error term and the independent variables. The population parameters are not observed and must be estimated from the sample.

Auxiliary regression equation takes the following form

$$\varepsilon^2 = \delta_0 + \delta_1 X_1 + \delta_2 X_2 + \ldots \delta_t X_t \quad (3)$$

ε^2 = Squared error term from the sample

δ_0 = Estimated Intercept

δ_1 = Estimated coefficient for independent variable 1

[11] See Appendix 3

[12] See Appendix 4

δ_2 = Estimated coefficient for independent variable 2

δ_t = Estimated coefficient for independent variable t

N = Sample size

LM = Lagrange multiplier

p = Degrees of freedom

The Lagrange multiplier (LM) yields the test statistic for the test and is obtained by multiplying the R^2 from equation (1) with the sample size. LM measures how much of the variation in the error term that can be explained by the independent variables.

$$LM = NR^2$$

The test statistic is distributed in the probability distribution Chi-squared with p degrees of freedom under the null hypothesis of homoscedasticity.

$$H_0: \delta_1 = \delta_2 \ldots = \delta_t = 0$$
$$H_A: \ \delta_i \neq 0$$

If the null hypothesis is rejected, then the OLS regressor is not the best linear unbiased estimator. Under those circumstances, panel data will be more suitable for the data set. To test for heteroscedasticity and whether to use pooled OLS estimates or panel data for this study the writers have performed a Breusch-Pagan test. The Breusch-Pagan test strongly suggested the use of panel data.[13]

3.8 THE REGRESSION MODEL

The regression model is divided in four separate models. The data is collected from publicly traded U.S. banks. Four different regressions were made where one control variable was added to the model in each to clarify the causal relationship from the debt to equity-ratio. All regressions have been run on the 76 banks included in our dataset. The regressions are constructed in accordance with the model described in 3.6. In our regression model, α represents the constant, β represents the coefficient and ε represents the error term.

[13] See results in Table 8 on p.23.

Model 1: $MVBV_{it} = \alpha + ß_1 Debt/Equity_{it} + \varepsilon_{it}$

Model 2: $MVBV_{it} = \alpha + ß_1 Debt/Equity_{it} + ß_2 RE_{it} + \varepsilon_{it}$

Model 3: $MVBV_{it} = \alpha + ß_1 Debt/Equity_{it} + ß_2 RE_{it} + ß_3 ln(Total\ Assets)_{it} + \varepsilon_{it}$

Model 4: $MVBV_{it} = \alpha + ß_1 Debt/Equity_{it} + ß_2\ RE_{it} + ß_3 ln(Total\ Assets)_{it} + ß_4 Liquidity_{it} + \varepsilon_{it}$

3.9 METHODOLOGY CRITICS

A number of aspects need to be considered to determine the quality and the level of credibility in the data selection and choice of variables. Bell & Nilsson (2006) argues that source criticism, trustworthiness and validity is crucial when choosing methodology and finding reliable information. Trustworthiness of the data is simply how reliable the data in the study is. Validity is a measure of the extent to which one is actually investigating what is intended to be investigated.

The primary source of financial information to this study is Capital IQ. The trustworthiness of the data and observing it objectively is crucial to build the report on a credible basis. Capital IQ is provided by Standard & Poor's credit rating agency, which is one of the most well-known organizations in finance. Random values have been checked in some of the banks financial reports to ensure that the values in the dataset collected from Capital IQ is correct. The extreme values in the dataset have been carefully processed in Excel to maintain the trustworthiness of the work. However, one should be aware that adjustments have been made. How great impact the adjustments have on the validity is hard to decide, although the measures taken are evaluated to be necessary to implement the regression model.

The definitions of the variable in this paper should be taken into consideration before drawing conclusions applied to other regions or industries. For instance, return on equity has been chosen as control variable for this particular thesis where capital structure is investigated. Further, the reader should be aware of the potential accounting differences between banks in the U.S. and that of other regions. Regarding the panel data analysis, the size of the sample is crucial to draw significant conclusions about the population (Jaggia & Kelly, 2013). There are 1520 observations per variable after adjustments and balancing the data. The great number of observations validates the study further. As regards the sources, the frame of reference consists

of theory and empirical studies obtained from scientific research articles to create an understanding of the study. The articles are retrieved from academic research papers such as *Journal of Finance* and others found in the *Social Scientific Research Network*.

4. RESULTS

The results are presented in the following section, beginning with descriptions of the data and followed by the results from the regression.

4.1 DESCRIPTIVE STATISTICS

To give the reader a brief overview of our data we present descriptive statistics in Table 6 and a correlation matrix in Table 7.

TABLE 6: DESCRIPTIVE STATISTICS OF THE DATA

Variables	Max	Min	Average	Std.	Median
Debt/Equity	30.86	0.512	8.99	2.73	8.77
Return on Equity[14]	82,96	-133,03	10,05	10,42	10,36
Total Assets	2,622,532	238.28	102,993	360,530	9,730
Liquidity-ratio	7.4	0.0026	0.12	0.40	0.050

TABLE 7: CORRELATION MATRIX OF THE DATA

	MVBV	DE	ln(TA)	LR	RE
MVBV	1,0000				
DE	0,3361	1,0000			
ln(TA)	-0,1167	0,0679	1,0000		
LR	-0,0964	-0,1428	0,4300	1,0000	
RE	0,6189	0,2806	-0,0590	-0,1443	1,0000

[14] Expressed as a percentage

4.2 REGRESSION MODEL RESULTS

TABLE 8: REGRESSION MODELS RESULTS

Variable	Model 1	Model 2	Model 3	Model 4
DE	0,1527	0,1032	0,0930	0,0922
Std.	0,0087	0,0076	0,0091	0,0092
P-value	0,0000	0,0000	0,0000	0,0000
RE		0,0539	0,0529	0,0533
Std.		0,0022	0,3517	0,0024
P-value		0,0010	0,0000	0,0000
TA			-0,0640	-0,0631
Std.			0,0311	0,0312
P-value			0,0400	0,0430
LR				0,1465
Std.				0,2320
P-value				0,5280
Number of observations	1520	1520	1520	1520
Number of groups	76	76	76	76
R_2 overall	0,1130	0,3909	0,3927	0,3955
R_2 between	0,0280	0,3314	0,3327	0,3429
R_2 within	0,1777	0,4125	0,4143	0,4144
Hausman test	12,16	431,52	390,44	295,71
Breusch-Pagan test	1049,42	578,28	573,29	578,42

4.2.1 MODEL 1

$$MVBV_{it} = \alpha + ß_1 DE_{it} + \varepsilon_{it}$$

Column 1 in Table 8 shows the result from the regression where the debt to equity-ratio is the sole independent variable. The result indicates a positive relationship between the debt to equity-ratio and the market value to book value, and that debt to equity-ratio is statistically significant. However, the low R^2 value suggest that model fails to explain some of the variation in the dependent variable and hence induce the risk for omitted variable bias.

4.2.2 MODEL 2

$$MVBV_{it} = \alpha + ß_1 DE_{it} + ß_2 RE_{it} + \varepsilon_{it}$$

Column 2 in Table 8 shows the result from regression model 2, where return on equity is added as a control variable. The result suggests that a higher return on equity have a positive effect on MVBV and that the variable is statistically significant. The R^2 value indicates that Model 2 manage to explain more of the variation in the dependent variable than Model 1. Further, the results imply a reduced effect for debt to equity on MVBV when return on equity is included as a control variable.

4.2.3 MODEL 3

$$MVBV_{it} = \alpha + ß_1 DE_{it} + ß_2 RE_{it} + ß_3 ln(TA)_{it} + \varepsilon_{it}$$

Further, column 3 in Table 8 shows the result from regression Model 3 where return on equity as well as the natural logarithm of total assets are included as a control variables. The result suggests a positive effect of the debt to equity-ratio and a negative effect of total assets. Model 3 reduces the debt to equity effect on MVBV further.

4.2.4 MODEL 4

$$MVBV_{it} = \alpha + ß_1 DE_{it} + ß_2 RE_{it} + ß_3 ln(TA)_{it} + ß_4 LR_{it} + \varepsilon_{it}$$

Column 4 in Table 8 shows the results from regression Model 4 where return on equity, logarithm of total assets and the liquidity ratio are included as control variables. The result indicates that a higher liquidity ratio has a positive effect in the MVBV. However, the result is not statistically significant.

5. ANALYSIS

H_0: capital structure does not affect the valuation of banks.

Based on the results from our regression models, we can reject the null hypothesis and conclude that capital structure does in fact affect the valuation of banks. The results provided from our regressions are statistically significant p > t = 0,000 for all regression models. Since the liquidity ratio shows no statistical significant effect, we will lead our analysis based on the results from Model 3. Our model shows that the debt to equity-ratio does affect the value of a company. However, we will not take it as far as calming that the Modigliani and Miller theory is invalid, since some of the assumptions in the MM-theorem don´t hold true in our model. The results are matching Gemmill (2001)´s research which found that "financial engineering" do increase the value of companies. Further, the results can also be explained by Beltratti & Stulz (2009)´s research which found that banks with more Tier 1 capital and deposits performed better throughout crises than their peers.

R^2 = 0,3955 implies that the variables included in our model can explain only 39,55% of the variation in the dependent variable. This somewhat large gap between our model and the true model indicates there might be omitted variable bias, some variables of importance are obviously missing in our model.

The results from the models show that the effect of the debt to equity-ratio decreases as more control variables are implemented. This might indicate a weaker causal relationship between the debt to equity-ratio and valuation of banks than what the relationship appears to be. This

study has limitations in its scope, but further research could implement more control variables to investigate the causal relationship even more.

Our study is focused on the largest publicly traded banks in the U.S, albeit we did not compare the banks by size. Because of this general approach we cannot comment the evidence provided by Graham & Leary (2011) where they argue that the leverage is generally higher in large companies which is in line with traditional trade-off predictions. As discussed in the theory segment, pecking order behavior is hard to decipher for the same reason. To draw any conclusions about the pecking order-theory application to banks probably requires a qualitative approach and is accordingly out of this thesis scope.

The time frame for this study has been characterized by a strong economic development in the U.S. and one of the largest booms in the stock market the years following the great financial crisis. The impact by the capital structure shown in this study is in accordance with Baker & Wurgler (2002)´s results that strengthens the Market Timing-theory. Baker & Wurgler (2002) showed a positive correlation between market performance and the frequency of equity issuance. However, one should be aware that we have not investigated IPOs of banks during 2000-2019. The Market Timing-theory should be considered as one possible explanation as the others.

6. CONCLUSION

Modigliani and Miller claimed that in a perfect market, the debt to equity-ratio should be irrelevant for the valuation of a company, but our result presents an opposite view. The model we presented conclude that capital structure does in fact affect investors valuation of banks. Our conclusion is not meant to falsify the Modigliani and Miller theorem since some of the assumptions are violated in our model. When Modigliani and Miller assumed perfect markets in their theorem, Stewart C. Meyers used market imperfections as a possible explanation for his pecking order theory. Adverse selection and asymmetric information costs can be a reason for companies to choose debt over equity. Our result shows that investors value a higher debt equity ratio, but it fails to validate if adverse selection and asymmetric cost is the reason.

Our findings differ from earlier studies on capital structure of banks since it focuses on the impact of capital structure on the valuation of banks. In addition, data covering the aftermath of the great financial crisis lays the foundation on which we made our analysis and concludes that capital structure still is a relevant parameter to keep in mind when evaluating a bank. We have presented empirical evidence and can conclude that capital structure has made an impact on valuation of large American banks included in our sample over the past two decades. Our study shows that profitability has a significant impact on valuations of banks as it does for non-financial firms. How much the effect differs from that of non-financial firms remains to be investigated.

6.1 FURTHER RESEARCH

This paper concluded that debt-equity ratio does affect the value of a bank. But the model showed diminishing effects as R_2 increased which indicate that there might be some omitted variable bias. Our sample were solely based on large American banks. It would be of most interest do further research with the same purpose, but with greater deviation in the sample. It's reasonable to assume that by including a variety of banks from different geographic regions and sizes, R_2 will increase and the research will provide additional value.

Further, our research expanded over two decades (2000-2019) to capture both economic booms and recessions, and to present a composed result. However, it does not tell us if some capital structure characteristics are better suited for different economic conditions. We suggest additional studies to be made were the observations are divided into two separate data sets, one

for economic boom and one for recession to enable the research to compare the characteristics of the two.

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APPENDIX

APPENDIX 1

TABLE A:1 BANKS IN THE DATASET

Ameris Bancorp	JP Morgan Chase & Co.
Associated Banc-Corp	KeyCorp
Atlantic Union Bankshares Corporation	M&T Bank Corporation
BancFirst Corporation	MGIC Investment Corporation
BancorpSouth Bank	NBT Bancorp Inc.
Bank of America Corporation	New York Community Bancorp, Inc.
Bank of Hawaii Corporation	Northwest Bancshares, Inc.
Bank OZK	Old National Bancorp
Banner Corporation	Pacific Premier Bancorp, Inc.
BOK Financial Corporation	Park National Corporation
Capitol Federal Financial, Inc.	People's United Financial, Inc.
Cathay General Bancorp	Popular, Inc.
Citigroup Inc.	Prosperity Bancshares, Inc.
Columbia Banking System, Inc.	Radian Group Inc.
Comerica Incorporated	Renasant Corporation
Commerce Bancshares, Inc.	Seacoast Banking Corporation of Florida
Community Bank System, Inc.	Simmons First National Corporation
Cullen/Frost Bankers, Inc.	South State Corporation
CVB Financial Corp.	Sterling Bancorp
East West Bancorp, Inc.	SVB Financial Group
F.N.B. Corporation	Synovous Financial Corp.
Fifth Third Bancorp	TCF Financial Corporation
First Bancorp.	The PNC Financial Services Group, Inc.
First Citizens BancShares, Inc.	Truist Financial Corporation
First Financial Bancorp.	Trustmark Corporation
First Financial Bankshares, Inc.	U.S. Bancorp
First Horizon National Corporation	UMB Financial Corporation
First Merchants Corporation	Umpqua Holdings Corporation
First Midwest Bancorp, Inc.	United Bankshares, Inc.

Fulton Financial Corporation	Valley National Bancorp
Glacier Bancorp, Inc.	Washington Federal, Inc.
Hancock Whitney Corporation	Webster Financial Corporation
Heartland Financial USA, Inc.	Wells Fargo & Company
Hope Bancorp, Inc.	WesBanco, Inc.
Huntington Bancshares Incorporated	Westamerica Bancorporation
IBERIABANK Corporation	Wintrust Financial Corporation
Independent Bank Corp.	WSFS Financial Corporation
International Bancshares Corporation	Zions Bancorporation, National Association

TABLE A:2 BANKS EXCLUDED FROM THE DATASET

Axos Financial, Inc.	PacWest Bancorp
BankUnited, Inc.	PennyMac Financial Services, Inc.
CenterState Bank Corporation	Pinnacle Financial Partners, Inc.
CIT Group Inc.	Regions Financial Corporation
Citizens Financial Group, Inc.	ServisFirst Bancshares, Inc.
First Hawaiian, Inc.	Signature Bank
First Interstate BancSystem, Inc.	Texas Capital Bancshares, Inc.
First Republic Bank	TowneBank
Hilltorp Holdings Inc.	United Community Banks, Inc.
Home Bancshares, Inc.	Walker & Dunlop, Inc.
Independent Bank Group, Inc.	Western Alliance Bancorporation
Investors Bancorp, Inc.	

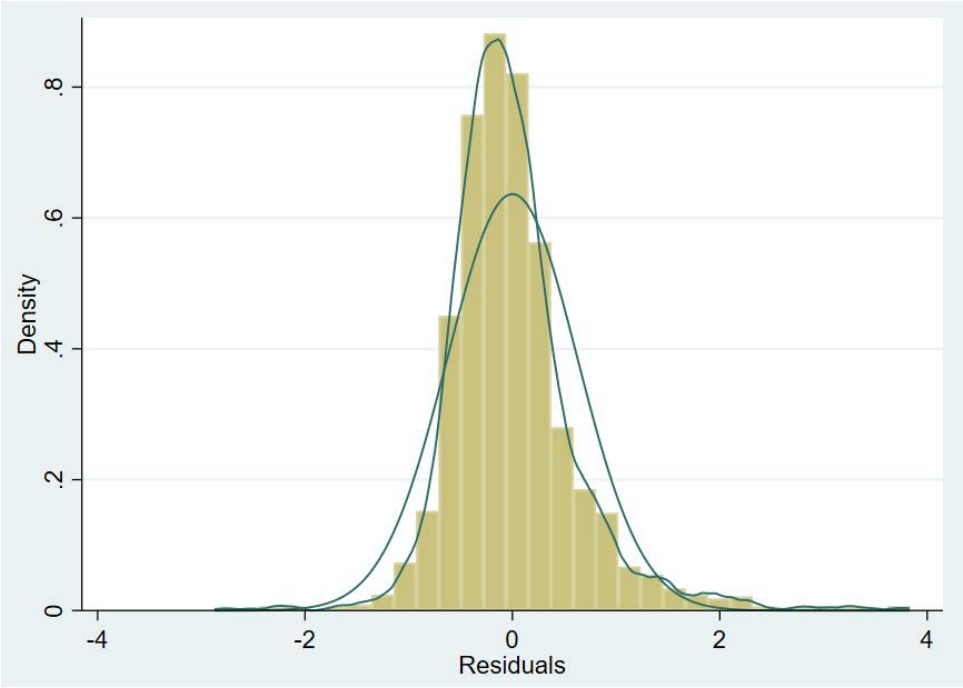
APPENDIX 2

TABLE A:3 TEST FOR NORMAL DISTRIBUTION

Regression	Jarque-Bera	Probability
Model 1	984,7	0,00000
Model 2	1037	0,00000
Model 3	1056	0,00000
Model 4	2359	0,00000

Model 1 test for D/E. Model 1 test for D/E + Total assets. Model 1 test for D/E + Total assets + Liquidity ratio.

APPENDIX 3



APPENDIX 4

Durbin-Watson test

Model 1

```
. dwstat

Durbin-Watson d-statistic(  2,  1520) =  .5009607
```

Model 2

```
. dwstat

Durbin-Watson d-statistic(  3,  1520) =  .9303549
```

Model 3

```
. dwstat

Durbin-Watson d-statistic(  4,  1520) =  .9318147
```

Model 4

```
. dwstat

Durbin-Watson d-statistic(  5,  1520) =  .9339873
```