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When Non-Financial Companies Invest in Risky Financial Assets

A Dynamic Panel Analysis of Determinants of the Financial Portfolio Risk in Norwegian Firms

Anders Modum Bilet and Jo André Steen Henrichsen

Supervisor: Tommy Stamland

Master thesis, Economic Analysis (ECO) and Finance (FIE)

NORWEGIAN SCHOOL OF ECONOMICS

Abstract

This thesis examines determinants of the risky financial assets of Norwegian firms in the period of 1999 to 2015. Unlike previous research, and as recently requested in recognized academic papers, our analysis is aimed at a larger data sample that also consist of small and unlisted companies. Firstly, we present a literature review, theoretical predictions, and the applied econometric methodology. Then, empirical findings of pooled and first-difference OLS, fixed effects, and Arellano-Bond estimations are shown. In support of the theoretical prediction that financially constrained firms should invest less in risky financial assets, we find that firms with poor credit ratings have less risky financial asset portfolios. Furthermore, also consistent with this theory, we find that the investments in risky financial assets are increasing in the size of the firm. Moreover, firms paying dividends invest significantly less risky. On a different note, companies with concentrated ownership, and proprietorships, appear to invest riskier, possibly contrary to our theoretical predictions. Finally, in an attempt to measure effects of poor corporate governance, we also explore the effects various auditor remarks have on risky financial assets. One of the coefficients, which we relate to the rationality of firms' financial asset management, indicate that firms invest in riskier financial assets if tax withholdings have not been deposited in a dedicated account, or have not been fully paid.

Preface

This master's thesis completes our degree MSc in Economics and Business Administration at the Norwegian School of Economics (NHH), with our respective major profiles Economic Analysis (ECO) and Finance (FIE). The topic of our thesis reflects our interest in financial economics, and thoroughly analyzing our research question has been a rewarding experience.

We wish to express our gratitude to our supervisor Tommy Stamland for his valuable feedback and guidance. By sharing some of his knowledge and insights, he provided us with great motivation. We would also like to thank the Centre for Applied Research at NHH for giving us access to their comprehensive data set, enabling us to perform our empirical analysis.

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1 Introduction

It has been shown more than once in contemporary finance research that corporations over the past decades have increased the amount of cash at their hands.[1] At the same time, financial innovations have arguably made the number of alternative usages of excess cash a lot larger, making it increasingly accessible for both individuals and firms to invest in different types of asset classes. The investment opportunities are almost endless, and if a firm of any size or form wishes to, it can easily invest its cash in equity, bonds, or other financial assets.

The amounts of cash relative to firm values have increased over the years in Norway, by approximately 35 basis points per year, and it should be of a financial economist's interests to investigate how this cash is spent. Both theoretical and empirical research from the past have made a lot of predictions on the role of excess cash in corporate finance, and for instance is the agency theory of free cash flow likely as relevant today as when the ideas were introduced by Jensen (1986) some decades ago.

Recent research by Duchin et al. (2017) assesses the portfolios of corporate financial assets among the largest listed industrial firms in the United States. They show that the determinants of risky financial assets differ significantly from the determinants of safe financial assets, both regarding precautionary motives, agency issues, and other aspects. With this in mind, this thesis aims to explore what is causing risk-seeking behavior on corporate financial assets among all types of Norwegian non-financial firms.

This thesis will stick out from existing research in that it assesses the risky financial assets of firms that are unlisted and firms that are of smaller size. Importantly, this can make it possible to stake out whether or not measures of ownership structure affects firm behavior on corporate financial assets, as the agency problems of various organizational forms are expected to differ, pointed out by Fama and Jensen (1983). Furthermore, by utilizing observations of hundreds of thousands of Norwegian firms across multiple years, the power of the statistical evidence will be strong as well, and also provide a new type of dynamic panel evidence on the matter.

[1] As shown below; for the average Norwegian firm, the value of financial assets has increased nominally by 7.2% per year.

2 Related empirical research

Before going into the analyses of this master thesis, it is important to review some of the existent literature. The objective of our thesis is to present our findings while keeping important previous findings in mind. Therefore, a review of some of the most recognized empirical research is desirable, also in light of the recent critique by Ioannidis et al. (2017) that has gained some traction, i.e. their claim that empirical economics is often underpowered. Therefore, this section will be a short response to their call for more systematic reviews and meta-analyses.

Over the last couple of decades, a lot of empirical research has been done on the cash reserves of corporations, either on cash itself or more broadly on all corporate financial assets. Less prevalent are research on solely risky financial assets, with the recent notable exception of Duchin et al. (2017). They found across US industrial firms that they invest heavily in risky financial assets, making what they call a shadow hedge fund industry of $1.5 trillion. Essential for this thesis, the paper makes the distinction between risky and safe financial assets and find that key determinants of safe and risky assets are significantly different. For instance, risky financial assets are found to a larger extent in financially unconstrained firms and in firms that are poorly governed. Duchin et al. (2017) focus merely on the largest listed firms in the United States, and they explicitly welcome future research on small and private firms.

More generally, on corporate cash holdings, which we mostly call safe financial assets in this text, Opler et al. (1999) find support of a static trade-off model of cash holdings. Furthermore, they find that large corporations with a high credit rating hold less cash, in line with an argument which is important for this thesis, that these companies typically have greater access to financial markets. On a different note, Opler et al. (1999) find limited evidence for agency costs from cash holdings.

Denis and Sibilkov (2010) find that greater cash holdings are associated with higher level of investment for constrained firms with high hedging needs. This association is weaker for firms that are less financially constrained. Their findings connote that constrained firms with large cash holdings can undertake value-increasing projects that might otherwise be skipped due to not having sufficient cash at hand. This could also help to prove that cash holdings are more valuable for constrained firms, and hence supports the arguments of Opler et al. (1999) above.

In their research on how firms' precautionary cash holdings, cash flow uncertainty, and financial constraints interact with one another, Han and Qiu (2007) show that constrained firms increase their cash holdings in response to increased volatility in the cash flow to the firm, which in turn shows that there is a negative relationship between current investments and cash flow volatility.

On the determinants of corporate liquidity, Kim et al. (1998) models the firm's decision to invest in liquid assets when external financing is costly. They show that the optimal amount of liquidity is given by a trade-off between the return earned on liquid assets and the benefit of minimizing the need for costly external financing. These findings highlight the need for a financially constrained firm to have enough liquidity to manage their daily operations, consistent with the arguments of Opler et al. (1999).

In a paper important for this thesis, Bates et al. (2009) studies cash holdings in the period 1980 to 2006 and find that the US average cash ratio increases significantly by 0.46% per year. They argue that a plausible explanation for this phenomenon is the precautionary demand for cash, i.e. that firms hold cash as a buffer to protect themselves against shocks in the cash flow, described in the theory section below. They find no consistent evidence that agency conflicts contribute to the increase.

Harford (1999) studies the acquisition behavior of cash-rich firms. As he finds, consistent with theoretical predictions made for instance by Jensen (1986); firms with an abundance of cash are more likely to make value-decreasing acquisitions. Therefore, through his findings, he points out the corporate governance implication that large financial assets could remove important monitoring components for the external market.

Further related to the relationship between corporate governance and financial assets, Harford et al. (2008) find that firms with weaker governance structures have smaller cash reserves.

They explain this finding by the way cash is spent among these types of firms because as they argue, weakly controlled managers choose to spend cash quickly on acquisitions rather than to hoard it. Furthermore, these types of firms are found to be less willing to pay dividends and hence preferring to repurchase shares, as well as found to invest less in R&D.

Azar et al. (2016) argue that a major contributor to the allocation of cash to riskier liquid assets is the cost of carry, i.e. the difference between the cost of capital on firms' liquid assets and the return of the risky financial assets, and especially when prevailing interest rates are low. Their findings suggest that changes in the cost of carry can explain the dynamics of corporate financial assets, which is found significant in explaining the level of liquid asset holdings across countries.

Over the latest decades, it has with increased availability and flexibility become easier for corporations to hedge their positions, proposing an explanation for adding more risk to the balance sheet. However, as argued by Guay and Kothari (2003), the importance of hedging may have less of an effect than was previously documented in the literature. Derivatives used for hedging purposes appears to have a small portion of non-financial firms' overall risk profiles, and relative to size generates modest results. Related to these findings, we present below the relative size of the investments in different asset classes made by Norwegian firms.

All of the findings above have potential implications for both our model specifications and discussion of our findings, and some of them will be explicitly mentioned throughout this thesis. Rather than simply running regressions and presenting results, we wish also to discuss how our findings fit into the picture of existing literature. Nonetheless, in addition to empirical findings, theoretical predictions are also crucial for later inferences and discussions, which is why the following section aims to present some of the most central theoretical aspects of corporate financial assets.

3 Theoretical predictions

3.1 Frictionless capital markets

As explained by for instance Copeland et al. (2005) and Berk and DeMarzo (2014), if we have no frictions in the economy, the size of the financial assets of a corporation is irrelevant. This follows from the proof of Modigliani and Miller (1958), which shows that in the absence of taxes and frictions, capital structure will not matter in determining firm value. It also follows from the fact that without frictions, i.e. in perfect capital markets, no liquidity premiums will exist, and external financing is costless, pointed out by Duchin et al. (2017).

This text is based on testing whether it is possible to find deviations from Modigliani and Miller's model. At the outset, the objective is to explain potential issues that arise under asymmetric information and agency relationships.

3.2 Information asymmetry and agency theory

Consistent with the definitions of Bolton and Dewatripont (2004), a principal-agent problem occurs when an agent acts on behalf of a principal while their interests are not aligned, and the principal cannot observe the agent's actions. As they point out, this asymmetric information problem, also known as moral hazard, has been widely used as a representation of various standard economic relations. In our thesis, the theory will be used mainly on the relationship where the agent is the manager of a firm, while the principal is the firms' outside owners; a common application in corporate finance.

In their famous paper, Jensen and Meckling (1976) formalized[2] the agency costs in a corporate setting. In their framework, the agency cost is the dollar equivalence of the welfare reduction which occurs due to a manager not making the decisions that maximize shareholder value. Further, the paper defines the agency costs as the sum of monitoring expenditures made by

[2] The concept of agency costs were articulated by Adam Smith as early as 1776, who argued that when directors manage other people's money rather than their own, it cannot be expected that they watch over it with the same 'anxious vigilance'.

the principal, the bonding expenditures by the agent, as well as a residual loss. We find the paper very relevant for this thesis, as it is not unimaginable, pointed out for instance by Duchin et al. (2017), that managers make financial investment decisions based on other motives than maximizing firm value.

We find it fruitful in this text to try to utilize the theoretical foundation provided by Jensen and Meckling (1976) since it provides possible insight for our later discussions and empirical studies. In their paper, they define the vector

$$X = \{x_1, x_2, ..., x_n\} \tag{1}$$

as all factors and activities that a manager derives non-pecuniary benefits from. Her marginal utility is assumed positive for each of them, while the net benefit for the firm from the activities, following the notation of Copeland et al. (2005), is given by

$$V(X) = P(X) - C(X). \tag{2}$$

The optimal X^* for the firm, when a manager is a 100% owner, is hence given by the following first-order condition:

$$\frac{\partial V(X^*)}{\partial X} = \frac{\partial P(X^*)}{\partial X} - \frac{\partial C(X^*)}{\partial X} = 0 \tag{3}$$

Already by the equation above, we can observe that if a manager chooses a different X than X^*, it will pull the firm away from the optimal factors and activities causing firm value maximization. Jensen and Meckling (1976) define this cost, borne by the firm, as

$$F \equiv V(X^*) - V(X), \tag{4}$$

which is increasing in the deviation from the optimal X^*. The manager ends up in a situation with a trade-off between firm value V and non-pecuniary benefits F. Importantly, the managers' choice of X might be based on her own incentives of consuming perquisites at the firms' expense, which gives cause to the agency problem when outside ownership is introduced. Stated differently, the activities and factors maximizing the manager's utility $U(V, F)$, which could be denoted $\hat{X}$, might differ from X^*.

Jensen and Meckling (1976) makes the crucial point that perquisite consumption gets less costly for the manager when she owns a smaller fraction of the firm. They assume that the owner sells the firm while retaining a fraction α, and F is hence now shared with outside owners. Simultaneously, the benefits of the perks are unchanged for the manager, creating a shift in her incentives.

The financial market, assumed to be rational, anticipates that the manager will have stronger reasons to consume perks if the transaction occurs, and it therefore places a new and lower valuation on the firm. In equilibrium, the agency cost of the conflict between managers and stockholders emerge, since the new lower bid, combined with the optimal combination of V and F chosen by the manager, results in an efficiency loss.

The effect of outside ownership is important and gives some obvious empirical implications for our thesis. The most striking point is possibly that increased outside ownership is likely to give managers stronger incentives to consume perks. Accordingly, the cost F cannot by definition be optimally present when there is not any outside ownership, and it is theoretically predicted that a firm's agency cost exposure is increasing with the fraction of outside ownership. In our data sample, discussed below, we have a lot of companies of a sole proprietorship, and we also have variables on ownership concentration, which possibly can be related the size of the fraction of outside ownership $(1 - \alpha)$, discussed in section 7.3. Therefore, the ownership structure of a firm and its relation to agency problems will play an important part in this thesis.

Some of the agency problems change when companies are not publicly traded, a point that is discussed thoroughly by Fama and Jensen (1983). Decision making happens in different ways in for instance professional partnerships, proprietorships, and listed companies, and conveniently can also these distinctions be assessed empirically in this thesis. Therefore, related to agency problems and corporate governance, we run regressions on ownership structure in section 7.3.

3.3 Firms holding financial assets

Although this thesis is mostly concerned with the fraction of retained capital that is placed in risky financial assets, we find it necessary to discuss why firms hold financial assets altogether, and also why they might retain safe financial assets, i.e. cash and cash equivalents.

As mentioned in the literature review of section 2, Bates et al. (2009) show that US firms over the recent decades have increased their values of financial assets. As our data show, this also seems to have been a significant trend among Norwegian firms, as seen in table 2 and discussed in section 4.2. In this section, we choose to highlight two potential causes for this increase, namely precautionary savings- and agency motives.[3]

3.3.1 Precautionary savings motives

A company's motivations for holding cash and financial assets can be several, and as pointed out by Bates et al. (2009), one of the first extends from Keynes (1936), i.e. that firms hold cash as a precautionary measure. This motive definitely persists, but it is potentially less significant today because of financial innovation leading to higher accessibility of hedging opportunities, explained by Bates et al. (2009). By this, firms can increasingly ensure that cash is paid to them in the future states where it is needed. Nonetheless, as mentioned previously, they do conclude that the precautionary savings motive is a plausible explanation for the significant increase of cash holdings over the years.

In theory, the precautionary savings motive stems from assuming that the third derivative of the return function of the firm is positive, i.e. that $V''' > 0$, discussed for instance by Han and Qiu (2007). Under this assumption, firms wish to set aside cash to have more capital at hand in periods of uncertainty. If this is the case, the empirical implication is that in periods

[3]Two other motives are presented by Bates et al. (2009), i.e. the transaction motive based on e.g. Miller and Orr (1966), with the important implication that economies of scale should make firm size negatively correlated with cash holdings, and tax issues associated with foreign earnings, based on the arguments of Foley et al. (2007).

of increasing future uncertainty, firms will retain more financial assets. We can observe a significant increase in financial assets over the past years in Norway, shown in section 4.2, and we could theoretically justify it if we assume that the outlook of uncertainty has increased in the period from 1999 to 2015.

3.3.2 Agency costs of cash reserves

In his influential paper, Jensen (1986) discusses the agency costs of free cash flow. As he points out, the potential problem is that managers have incentives to cause their firms to grow beyond the optimal size, and hence spend cash on organization inefficiencies or investments with returns below the cost of capital. Accordingly, we might expect that given agency problems, when a firm does not have positive net present value investment opportunities, it still might retain cash and not optimally return it to the shareholders.

The agency problems of free cash flow can cause inefficiencies and deterioration of return on capital and investments, both for equity holders and the economy as a whole since the capital is not optimally put to use. Assuming that firms have leftover liquidity, it is desirable to design mechanisms that force them to pay out the excess cash in the future, pointed out by Tirole (2006), and as Kalay and Lemmon (2008) advocate, stockholders should insist that the free cash flow is paid to them. Empirically, as mentioned in the literature review of section 2, Harford (1999) finds evidence supporting the hypothesis of Jensen (1986), as cash-rich firms make significantly more value-decreasing acquisitions than firms that have less excess cash.

It is highly imaginable that an aspect of the agency costs of cash reserves could be risky financial assets as well. Of course, if Jensen (1986) is correct, and firms retain more cash than what is optimal for shareholders, this is cash that managers could invest in risky corporate financial assets. This could be contrary to the shareholders' interest, discussed below, and hence be an agency problem. However, as mentioned by Harford (1999), this is a less severe agency problem than for instance firms' behaving as predicted by Jensen (1986), i.e. that firms spend cash on bad projects. Because even though there are transaction costs related to managers' potential trading of financial assets, given efficient capital markets the investments are at least yielding expected returns consistent with a stochastic discount factor.

3.4 Firms holding risky financial assets

Our thesis is based on distinguishing state-independent financial assets, i.e. safe cash holdings, from state-dependent financial assets, e.g. shares, bonds, derivatives, and other risky financial assets. As pointed out by Duchin et al. (2017), the determinants of safe and risky financial assets are different, and furthermore, there are new aspects of agency conflicts that arise when risk is introduced.

In the following, we will discuss how whether or not a firm is financially constrained will affect the proportion of financial assets being risky. Then, we will use insights from asset pricing theory and managerial hedging to motivate why we might observe them shifting away from the safe financial assets. Finally, we will look into alternative potential causes for firms holding risky financial assets, and use insights from Jensen and Meckling (1976) as well as behavioral economics concepts such as overconfidence and confusion.

3.4.1 Financial constraints

In their theoretical discussion, Duchin et al. (2017) makes the proposition that financially unconstrained firms might have stronger incentives to invest in risky corporate financial assets than firms that are partially or fully constrained. They make the point that not only will whether or not a firm is financially constrained cause cash holdings, as argued by e.g. Opler et al. (1999), but also that it determines the risk of the financial assets. In fact, their proposition states that given risk-averse managers and shareholders, if a firm is partially or fully constrained, the manager never invests in a risky financial asset and hence only hold cash.[4] On the other hand, under the assumption of risk neutrality, Duchin et al. (2017) propose that there are cases where the firms are strictly better off by investing in risky financial assets, depending on the size of the risk premium and regardless of whether or not the firm is constrained. This result is obtained because such a firm's cost of capital is not adjusted for the additional risk that is undertaken by the risky financial assets.

[4] Another assumption for this to hold, arguably less relevant in our context, is the assumption that the firm's production has decreasing returns to scale.

When a firm with risk-averse managers and shareholders is unconstrained financially, it is according to the theoretical framework of Duchin et al. (2017) indifferent to investing in safe or risky assets, which follows from assuming that it has the same stochastic discount factor as the market. This result occurs since assuming that the stochastic discount factors are the same implies that investing in risky financial assets will change the cost of capital so that it exactly offsets the risk premium of the market. Therefore, as they show in figure 1, the prediction is that the fraction of the corporate financial assets portfolio being risky is increasing in the amount of retained capital, where more retained capital, of course, implies that a firm is less constrained financially.

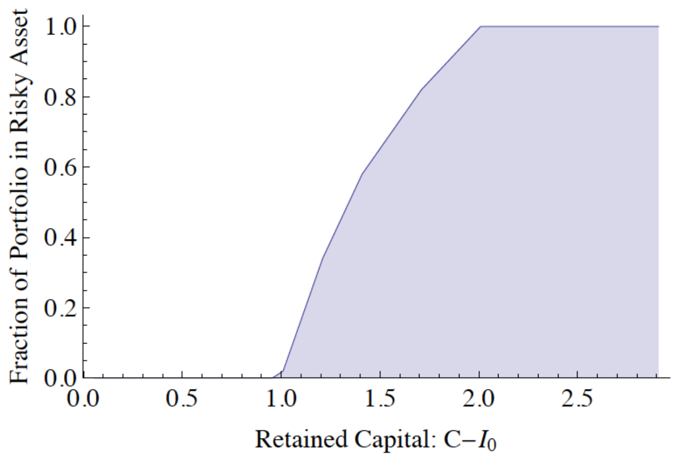

Figure 1: Risky corporate financial assets as a function of retained capital. As shown by Duchin et al. (2017).

The empirical implication presented by Duchin et al. (2017) is that firms with larger financial portfolios, e.g. greater values of financial assets, will invest more in risky financial assets. This is because of the point made above that the firm might be indifferent between risky and safe assets when it is unconstrained, and hence when a lot of capital is retained, the predicted random allocation will thus imply more risky assets.

In this thesis, we wish to bring the proposition of Duchin et al. (2017) further, and also test whether credit rating matters in determining the fraction of risky financial assets in the corporate financial assets portfolio. As pointed out by Opler et al. (1999), credit rating is a useful measure on how constrained a company is financially, since better creditworthiness gives greater access to capital markets. Further, since the theoretical proposition of Duchin et al. (2017) is essentially that the degree of access to external capital will determine to what extent firms invest in risky financial assets, our hypothesis is that firms with better credit rating will invest more in risky financial assets, while companies with poor credit ratings are expected to invest in safe financial assets.

An essential point of this subsection is that all of the predictions assume no agency costs, thus no conflict of interest between managers and shareholders. In that sense, similarly to the argument of Duchin et al. (2017), the following subsections of 3.4 could be ways that a firm with risk-averse managers and shareholders moves from being indifferent to actually preferring risky assets. Therefore, the effects on risky financial assets of the following subsections will potentially come on top of the impact of financial constraints.

3.4.2 Managers' hedging objectives

When we have frictions in the economy and a potential agency problem, e.g. when a managers' wealth are not fully diversified, an essential perspective of the motivation for a manager to invest in risky financial assets is the possibility of hedging the risk of her income and existing wealth. In that sense, in light of the paper of Jensen and Meckling (1976), the manager would yield private benefits of the investments. In the following, although not explicitly discussed, contract theory will be very important since the manager's compensation scheme directly affects whether a manager will hedge the operations of the firm. Therefore, it is important to point out that the following results might be avoided with complete contracts that are costlessly written and enforced, as explained by Fama and Jensen (1983).

It can be argued, as in Copeland et al. (2005), that a risk-averse manager might have incentives to invest in risky financial assets if it can contribute to hedging the risk of her compensation from work.[5] In their framework, from Reagan and Stulz (1986), it is assumed

[5] As pointed out by Tirole (2006), managers could hedge their wealth by investing in financial markets themselves outside the firm, and this section hence assumes that they are unable to do so, either because they are too heavily reliant on their bonus and firm value, or other frictions are present.

that a manager has a compensation linear in revenues s, i.e. $c = \alpha + \beta s$, as well as an asset with terminal value W (say, a risky portfolio) that cannot be freely traded. Therefore, she has expected utility given by

$$\begin{aligned} E(V) &= aE(W+c) - bVar(W+c) \\ &= a[E(w) + E(c)] - b[Var(W) + 2Cov(W,c) + Var(c)]. \end{aligned} \tag{5}$$

While the shareholders of the firm have an objective of maximizing the revenues they get a share of, since they can hedge their investment positions freely, the incentives of the manager might be different since she is heavily exposed to firm risk through her position as CEO. Under assumptions of the capital asset pricing model, where λ is the market price of risk $[E(R_M) - r_f]/r_m$, the following objective function of the shareholders' position is maximized, as shown by Reagan and Stulz (1986):

$$\max_{\alpha,\beta} \frac{(1-\beta)E(s) - \alpha - \lambda(1-\beta)Cov(s, R_M)}{1 + r_f} \tag{6}$$

Importantly, this function is constrained by the fact that the expected utility of the manager $E(V)$ given by equation (5) has to be larger than reservation utility $\underline{V}$. Nevertheless, by solving for the first-order condition and using some algebra, it can be shown that we get the following expression for the risk-bearing coefficient β:

$$\beta = \frac{\lambda a Cov(s, R_M)}{2bVar(s)} - \frac{Cov(W, s)}{Var(s)} \tag{7}$$

As seen in equation (7), we have a hedging factor in the second term of the right-hand side, which shows that the risk-bearing coefficient β giving optimality depends on the covariance between the risky financial asset W and the firm revenue s. Therefore, the asset W of the manager does play its part in the outsider shareholders' valuation of the firm.

Crucially, since the manager is assumed to be risk averse with a strictly concave utility function, she might have incentives to diversify by changing the firm's operations, potentially contrary to the shareholders' interests (i.e. moving away from shareholders' optimal β), if the covariance between the asset W and her compensation is positive. Similarly, if the asset with a terminal value of W could be traded, the same incentives of diversification would emerge.

A question arises on the fruitfulness of firms' diversifying operational risk. It is far from clear-cut that firms should diversify at all since outside shareholders themselves can diversify their financial positions in well-functioning capital markets. Accordingly, this gives a possible conflict of interest, hence a new type of agency costs, since shareholders likely wish to be invested in operational risk, while the managers might wish to diversify.[6]

Managerial hedging is also analyzed by Smith and Stulz (1985), and contrary to the analysis above, they focus more thoroughly on the perspectives of the manager. Similar to the analysis above, they also recognize that risk-averse managers might have incentives to hedge, now to make the firm's payoffs having a distribution with lower variance. As they point out, both risk-averse managers, employees, suppliers, and customers will require extra compensation to bear non-diversifiable operational risk, and this might give incentives to hedge.

Formally, the paper assumes a two-period world with a firm acquiring a hedge portfolio with a payoff in a state i given by

$$H_i = \sum_j N_j Q_{ij}, \tag{8}$$

where N_j is the number of shares bought of asset j, while Q_{ij} is the payoff of an asset j in state i. The utility of the manager is assumed to only be based on wealth at the terminal date, while wealth is a function of the firm value V_i and the hedging portfolio H_i. Therefore, the manager will maximize expected utility:

$$\max \sum_i p_i U(W(V_i + H_i)) \tag{9}$$

[6]Diversification of operations is explored by Denis et al. (1997), who find evidence for agency costs as an explanation. Further, they find that for instance management turnover and financial distress decreases diversification.

Subject to no cash outlays at time 0, and under the assumptions of no transaction costs and equal return on all assets, the optimization procedure gives the following first-order condition:

$$\sum_i p_i \frac{\partial U}{\partial W} W' \frac{Q_{ij}}{Q_{0j}} = \sum_j p_j \frac{\partial U}{\partial W} W' \frac{Q_{ik}}{Q_{0k}}, \quad \forall\ j\ and\ k. \tag{10}$$

As can be seen in the equation above, optimal investment relies on the first-order condition that the increase in marginal utility per dollar purchased of security j must equal the marginal utility impact per dollar of security k. This is a result that is commonly found in asset pricing theory of a state-contingent framework, and it follows from the concavity of the utility function.

Interestingly, as pointed out by Smith and Stulz (1985), if the manager's end-of-period wealth is a concave function of the end-of-period firm value, it follows from Jensen's inequality that the optimal strategy is to hedge the firm completely. If the manager's end-of-period wealth is instead a convex function of firm value, but she is still risk-averse, then it is optimal to hedge some, but not all, of the uncertainty. In that case, the expected value of the manager's income is higher without hedging, but she wishes to hedge some due to the concavity of her utility function. In any of the cases, the hedging motives might move the firm from the indifference proposed by Duchin et al. (2017), over to preferring risky assets.

In some cases, Smith and Stulz (1985) state that the manager will not wish to hedge at all. This will happen if the manager's expected utility is a convex function of end-of-period firm value, and hence that she is risk-seeking concerning her compensation or bonus. They show that as long as this is the case, the result of no hedging obtains even if the utility function of end-of-period wealth is concave. Further, pointed out by Tirole (2006), the manager might not hedge the risk of the firm at the expense of her shareholders if she can hedge her bonus herself outside the firm.

The concept of hedging will potentially have empirical implications, and it is not unthinkable that some Norwegian firms make financial investments with such motivations. It is likely not trivial to test the predictions empirically using corporate accounts data, however, since the firm risk exposure of managers is difficult to measure at an individual level, but it could help explain why some Norwegian firms prefer risky assets to some extent.

3.4.3 Managers' non-pecuniary benefits

One could consider the possibility, brought up for instance by Duchin et al. (2017), that managers might trade financial assets for private benefits.[7] If this is the case, it can be related to the paper of Jensen and Meckling (1976), as it could be considered a perquisite for the manager. In line with the notation from that paper, presented in 3.2, this explanation would give an increasing $F \equiv B(X^*) - B(\hat{X})$, i.e. an increasing cost to the firm and hence the outside owners. This result likely follows because the value of the private benefit, e.g. entertainment value or potential of increasing human capital, would likely be correlated with the deviation of the managers' utility-maximizing $\hat{X}$ from the X^* maximizing firm value. Hence, the manager gets better off by investing in risky financial assets at the expense, i.e. risk, of the firms' shareholders.

If non-pecuniary motives are the driver of risky financial investments, it is likely that agency costs arise, which is undesirable for a firms' outside interests. As proposed by Duchin et al. (2017), firms with poorer governance and more agency problems might invest their financial assets riskier. Based on this prediction, it could be worthwhile to empirically test whether firms have riskier corporate financial asset portfolios when an environment facilitating agency problems are present.

3.4.4 Behavioral economics

It is not unimaginable, as argued by Duchin et al. (2017), that managers through overconfidence might believe they can generate positive alphas by trading risky financial assets. As explained by DellaVigna (2009), overconfidence is a common nonstandard belief found among economic agents, and if overconfidence is a common trait for managers in Norwegian companies, we might expect the share of risky assets to be larger. As argued by Duchin et al. (2017), if this is the case it would obviously be undesirable for shareholders and the economy,

[7]For instance, as Duchin et al. (2017) propose, a manager might get experience in asset management which increases human capital.

as managers would act as if they can generate alphas, i.e. excess returns, while they in reality cannot. Accordingly, the outcome would be economically inefficient, and profit maximization would not happen.

Another possible explanation worth mentioning is that managers' might suffer from confusion. This concept is also brought up by DellaVigna (2009), and it could lead managers to make suboptimal choices with regards to their financial investments. As an example of such possible confusions leading to more investments in risky financial assets, Duchin et al. (2017) point out the fallacy of firms' not adjusting their cost of capital when increasing the risk of their corporate financial asset holdings. As mentioned previously, this could happen optimally if the managers and shareholders of a firm are risk-neutral, but it could also occur suboptimally for risk-averse managers and shareholders if the managers suffer from confusion.

3.4.5 Interest rates and macroeconomic uncertainty

Theoretically, the precautionary motive for holding cash is closely related to interest rates and monetary policy. As interest rates, other things equal, will be lower with increased uncertainty due to precautionary savings motives, while firms might retain cash due to precautionary savings motives, it is imaginable that lower interest rates are associated with firms' retaining cash. Therefore, also the portfolio choices of firms with regards to safe and risky financial assets could depend on, or at least have non-zero correlation with, the interest rate, which has seen remarkable shifts; from its high levels of 1999 and 2000, towards the very low levels of 2014 and 2015, as well as its highs and lows in between, depicted in figure 2.

The latest couple of years' development in interest rates, changing due to both quantitative easing and macroeconomic uncertainty, affects the time dimension of our data sample, and although the cross-sectional dimension is the primary focus of our thesis, we find it desirable to partly explore these factors in light of corporate financial assets as well.

By eyeballing figure 2 in conjunction with figure 3, as well as the yearly effects in table 17 in the appendix, there are some indications that total financial assets seem to have changed

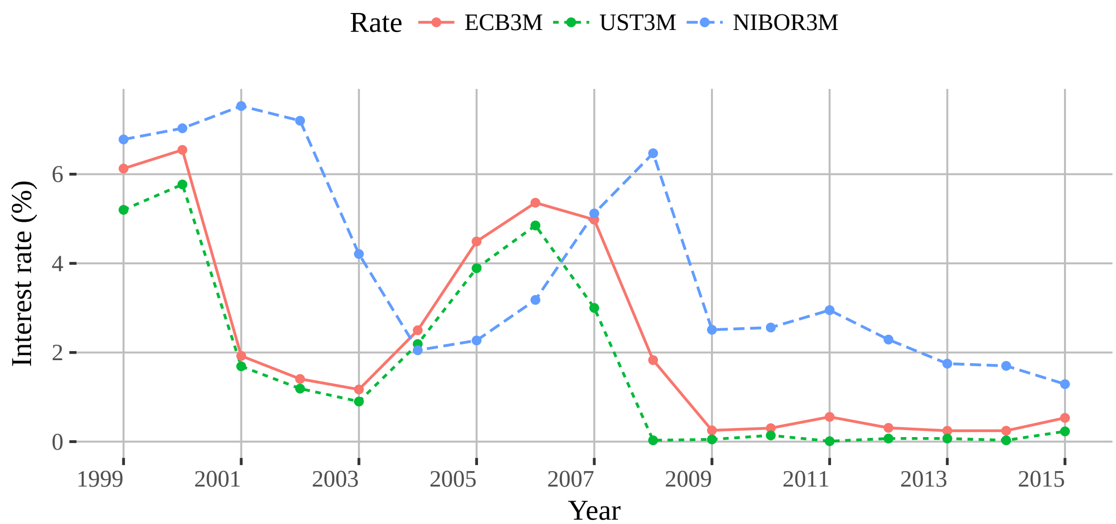

Figure 2: 3 month rates in Europe, USA and Norway.

significantly during the years, potentially related to shifts in interest rates. Although the interrelationship between interest rates and firms' risky financial assets are likely to be very important as well, it is probably easier to pinpoint the economic relation of interest rates and corporate financial assets altogether. Irrespective of risk, it is theoretically likely that with increased uncertainty in the future, financial asset holdings increase while interest rates decrease. However, it is not clear-cut which order the causality goes, and issues of simultaneity are very likely to arise.

3.4.6 Other potential motivations

As pointed out by Smith and Stulz (1985), if the bankruptcy costs are large, it could be optimal to invest in risky financial assets because it can make the costly scenario of bankruptcy less likely. This would happen if the operational risk can be hedged so that the total volatility of the firms' income decrease, hence lowering the future number of bankruptcy states. In some cases of the real world, this could perhaps be relevant, but it is likely difficult to test this prediction empirically by using solely Norwegian companies as panel members. As bankruptcy costs are not always trivially measured either, we have not pursued this motivation in our empirical analyses.

Another potential source of incentives for increasing the risk of corporate financial assets, also presented by Smith and Stulz (1985), is that given some tax structures, there can be advantages of investing in risky financial assets. For instance, if countries have double-taxation of equity, as the case used to be in Norway, it could have implications on the optimality both of firms paying dividends and investing in financial assets. However, we have decided not to pursue potential tax effects empirically in this thesis.

4 Data and descriptive statistics

Our data is collected from the Centre of Applied Research at Norwegian School of Economics, as presented by Berner et al. (2016). In its original form, the data consists of a full income statement and balance sheet for all Norwegian firms from the period 1993 to 2015, with approximately 4.3 million observations for the accounting data. Instead of solely relying on the accounting data, we also wanted to utilize some of the non-accounting information, such as the form of incorporation, whether a company is listed, if the auditor made any remarks on the fillings, the credit rating of the company, and so on. Combining both accounting and non-accounting information left us with more variables to utilize and thus enabling a more comprehensive analysis.

4.1 Data sampling

To get the data ready for empirical analyses and regression models, we carried out a thorough exploratory data analysis with an extensive data cleaning. This involved removing observations that did not meet our criteria, creating new features, and performing several regressions to make sure our cleaning process did not affect our results. Throughout the empirical analyses, we made sure that the results were robust both to outliers as well as model specification. At the early stages, we 'windsorized' at 1th to 99th percentile, consistent with for instance Cleary (1999) and Durnev and Kim (2005), and found that the coefficients were robust to the procedure. Therefore, in the estimations below, we decided not to windsorize at all, consistent with arguments of Wooldridge (2001, 2013). The removed observations are hence exclusively based on the criteria given in the next subsection.

4.1.1 Criteria for excluding observations

Due to the vast size of our data, there are some perhaps dubious data points, and we found it therefore fruitful to define some rules and specifications to ensure that we have a data sample with a limited number of missing values and outliers. The firm-year observations with the following properties are kept in our sample:

- Companies with the legal form of incorporation that are of relevance for this thesis, see appendix, table 16.
- Companies that are not in the finance sector, see discussion in subsection 4.1.3.
- Companies with a strictly positive value of total assets, i.e. $total\ assets \in \mathbb{R}_{>0}$
- Companies that are not registered with negative values of various corporate financial assets,[8] i.e.
  - $cash \in \mathbb{R}_{\geq 0}$
  - $stocks \in \mathbb{R}_{\geq 0}$
  - $bonds \in \mathbb{R}_{\geq 0}$
  - $other\ market\ investments \in \mathbb{R}_{\geq 0}$
  - $derivatives \in \mathbb{R}_{\geq 0}$
  - $group\ company\ shares \in \mathbb{R}_{\geq 0}$
- We have removed firm-year observations at times after liquidation, as some of these firm-years, although only few hundred, were not removed.[9]
- Observations from 1999 to 2015, since variables of interest, e.g. marketable securities, were not registered prior to 1999.

As it turns out, not that many observations are left out at the end. For most of the points, the number of observations left out are in the low thousands, hundreds, or even fewer, which is small numbers compared to the millions of observations at hand. The most severe exclusion is the finance sector, but as we will argue below, these companies are not in our

[8]These variables should not be negative in a balance sheet. As they are accounting figures, only observations of weakly positive values make sense and are hence kept, and the number of observations removed is mostly in the double-digits or very low triple-digits, i.e. very small compared to the millions of total observations.

[9]As a robustness measure, we run regressions where we also omit the firm-years that liquidation were initiated. None of the coefficients seem to change in any noticeable way, and we find it hence pragmatically sensible to only removing the couple of hundreds observations at times after liquidation.

population of interest. After the cleaning, we are left with approximately 3.08 million firm-year observations.

4.1.2 Outliers and missing values

Pointed out by Wooldridge (2013), outlying observations might cause measurement problems for ordinary least squares, and they will be especially problematic if their presence in the data set are due to misentering or other errors of such kind. As one can see in figure 6 in the appendix, it does appear to be some notable outliers in the data set. For instance, branches of banks with the legal entity 'NUF', i.e. Norwegian registered foreign companies, have been recorded with internationally consolidated income statements and balance sheets for the whole group, which results in completely wrong and overstated values for the Norwegian branch of such firms. Conveniently, however, the extreme observations, i.e. mostly banks, are removed from our sample anyway since our population of interest does not consist of financial companies. Therefore, by solely relying on the points in the list of section 4.1.1, we avoid these outliers.[10]

Regarding missing values, Verbeek (2012) argues that one way to deal with them is to create a dummy variable which takes value 1 if the value is missing. Since we do not utilize all the different variables in the data set but are limited to a few, we simply choose to impute variables with missing values where appropriate.[11] For instance, we rely on credit rating from Bisnode, but because a large part of our data consists of relatively small companies measured by the book value of total assets, some companies are not rated. Of all observations, approximately 113,000 have missing values in the credit rating score. We denote these as 'not assessed' in our analysis and thus distinguish them from Bisnode's 'not rated' label, which we interpret as a more active credit rating choice made by Bisnode.

[10] Also, since our variables of interest are not in absolute values and rather ratios of each other, it is not clear how severe the potential bias would be.

[11] We have refrained from imputing missing numerical values as this could worsen the quality of the data sample.

4.1.3 Finance and insurance companies

In its original form, our sample consists of roughly 252,000 observations of companies in the finance and insurance sector. These companies are arguably irrelevant for our thesis, as our objective is to explore market-based financial investments of companies where the optimality of such investments is unclear. Companies with main operations involving owning or trading such assets are therefore removed, consistent with the approach of for instance Bates et al. (2009), Harford (1999), and Duchin et al. (2017). Furthermore, supporting this choice, and in line with Harford (1999), we find that the financial industry is a severe outlier on financial assets when we include them in regressions with a corresponding dummy variable.

4.1.4 Robustness checks of criteria

Before deciding to drop observations that did not meet our criteria in section 4.1.1, we performed several regressions to see whether they ended up changing coefficients or their significance. We compared the regression results before and after cleaning our data according to our criteria, and the results were as expected; due to the size of our data sample, our criteria do not have a large impact on the coefficients.

4.2 Descriptive statistics

After removing the observations as described above, our sample consists of 435,726 firms with 3,079,991 observations. We have companies that have been registered over the whole sample period, and some with just a single observation. On average, a firm is registered over a period of 7.06 years. This allows us to utilize the time dimension in our regression to some extent, although we need to be cautious and use estimators suitable for the relatively small T.

Our data is divided into ten common sectors, as defined by Lund (2008). For observations where 'sector' is missing, we label those as 'other'. The largest sectors in Norway for our period is 'construction', 'other services' and 'wholesale/retail', which makes up almost three-quarters of our data, as seen in table 1 below.

Sector	Abbreviation	Observations	Distribution (%)
Agriculture	Agri	59,587	1.93
Offshore/Shipping	Offsh	56,866	1.85
Transport	Transp	85,886	2.79
Manufacturing	Manuf	157,105	5.10
Telecom/IT/Tech	TTM	101,175	3.29
Electricity	Elects	15,814	0.51
Construction	Const	1,015,324	32.97
Wholesale/Retail	Retail	567,412	18.42
Other services	Oth.s	855,219	27.77
Other	Oth	165,349	5.37
Sum		3,079,737	100

Table 1: Sectors of the final data sample

Table 2 consists of mean and median financial assets in a percentage of book-value of total assets, aggregated for all Norwegian firms in our sample from 1999 to 2015. To assess the level of risk of the corporate financial assets, we have divided financial assets into two groups; risky and safe. Based on the definitions of Duchin et al. (2017), risky financial assets consist of investments in stocks, bonds, group companies, financial instruments, and other financial instruments, while safe financial assets consist of cash, cash equivalents, and bank deposits. By grouping financial assets in such a way, we can identify the behavior among firms with respect to the risk of their financial investments, and thus make the inferences relevant for our thesis.

It is important to note that among Norwegian firms, rather few companies have risky corporate financial assets at all. In fact, in our final sample, only approximately 10.33% of the observations do have financial assets other than cash. Size of the companies is likely attributable to these findings, as most of the firms are relatively small. This, of course, affects our later statistical inferences, as the coefficients will be rather small throughout. The most fruitful interpretation of the coefficients is probably to assess them relative to the existing fraction of risky financial assets the firms have.

From table 2 we can see that there is a slight increase over time in the proportion of safe financial assets, while risky financial assets seem to be on approximately the same level as

Year	N	Mean $\frac{Total\ financial\ assets}{Total\ assets}$	Median $\frac{Total\ financial\ assets}{Total\ assets}$	Mean $\frac{Risky\ financial\ assets}{Total\ assets}$	Mean $\frac{Safe\ financial\ assets}{Total\ assets}$
1999	127,153	26.31%	13.75%	2.530%	23.78%
2000	133,754	26.44%	13.73%	2.971%	23.47%
2001	137,589	26.47%	13.92%	2.673%	23.79%
2002	136,912	26.72%	14.21%	2.220%	24.50%
2003	146,509	28.59%	15.62%	2.383%	26.21%
2004	149,079	28.48%	15.78%	2.371%	26.11%
2005	159,175	28.39%	15.91%	2.530%	25.86%
2006	168,178	29.28%	16.87%	2.789%	26.49%
2007	184,911	30.11%	17.42%	2.774%	27.33%
2008	194,281	29.82%	16.58%	2.515%	27.31%
2009	194,398	30.05%	17.06%	2.684%	27.37%
2010	197,250	30.24%	17.17%	2.784%	27.46%
2011	204,179	30.10%	16.94%	2.556%	27.54%
2012	217,028	30.75%	17.43%	2.427%	28.32%
2013	234,484	30.66%	17.17%	2.529%	28.13%
2014	245,230	31.31%	17.77%	2.541%	28.77%
2015	249,627	32.40%	18.89%	2.479%	29.92%

Table 2: Financial assets as a percentage of book value of total assets

it was in the late 1990s. Noticeably, therefore; safe financial assets appear to be the driver of the increase in financial assets seen over the years. To assess whether the trend in mean and median financial assets is significant, we follow the approach of Bates et al. (2009) and run a regression of these ratios on a constant and time measured in years. For our in-sample evolution, we find that the trends both appear significant, as can be seen in the regression output of table 3.[12] Therefore, as was shown by Bates et al. (2009) in the US, also in Norway the amount of financial assets has increased significantly as a proportion of total assets over the last years, i.e. by approximately 35 basis points each year on average.

Above we infer that Norwegian firms have higher values of financial assets relative to total assets compared to previously, which of course also could come from total assets decreasing over the period. However, when running regressions to estimate whether the time trend comes from the numerator and denominator, we find that both have increased significantly over the period. As shown in the appendix table 13, the average book value of total assets has increased by approximately 2% per year. Therefore, the average total financial assets

[12]As Bates et al. (2009), we too wish to point out that this is a test merely on the in-sample evolution of cash holdings, and that the only possible inference is whether the increase is statistically significant in those years.

	Dependent variable:	
	‘Mean Financial Assets‘	‘Median Financial Assets‘
	(1)	(2)
Year	0.003509***	0.002856***
	(0.0003)	(0.0003)
Constant	−6.751***	−5.570***
	(0.503)	(0.577)
N	17	17
R^2	0.929	0.868

Robust standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Time trend in total financial assets

has been growing even stronger, and as seen in appendix table 14, it is by approximately a nominal 7.2% per year.

In this thesis, there are mainly in-portfolio properties we assess, partly because we consider our data of book value of total assets both a less reliable and less valid measure compared to financial assets that are registered at fair values, discussed in section 6.2.[13] However, we will argue that the significant increase in financial assets altogether, i.e. the average financial asset portfolios, still provides us with important motivations for assessing the risk of the assets. When regressing further on the time variable, and more concretely on the decomposition of the financial asset portfolios of the firms, we find that risky financial assets have significantly decreased over the years on average, while safe financial assets have significantly increased. These developments, i.e. time trends in the in-portfolio developments of the asset classes, can be seen in appendix table 15. Together with table 3, we can hence see that total financial assets have on average become less risky while increasing as a proportion of total assets.

Figure 3 illustrates the mean financial assets ratio by firm size quintile from 1999 to 2015. As can be seen, the ratio increases across each quintile except for the largest firms, i.e. the fifth quintile. The increase seems most pronounced for smaller firms, with the smallest firms, i.e. the first quintile, almost doubling their portion over the sample period. Furthermore,

[13] In our regressions, we use therefore predominantly dependent variables with total financial assets as the denominator.

the second smallest firms appear to show an increase of approximately 50% over the period. While the third and fourth quintile appear to show modest increases, for the largest firms it seems that the time trend is negative. In fact, the fifth quintile shows a decrease of approximately 23% from 1999 to 2015. Interestingly, and perhaps as expected, it appears to have been a drop across all quintiles in financial assets during the financial crisis of 2007 and 2008.

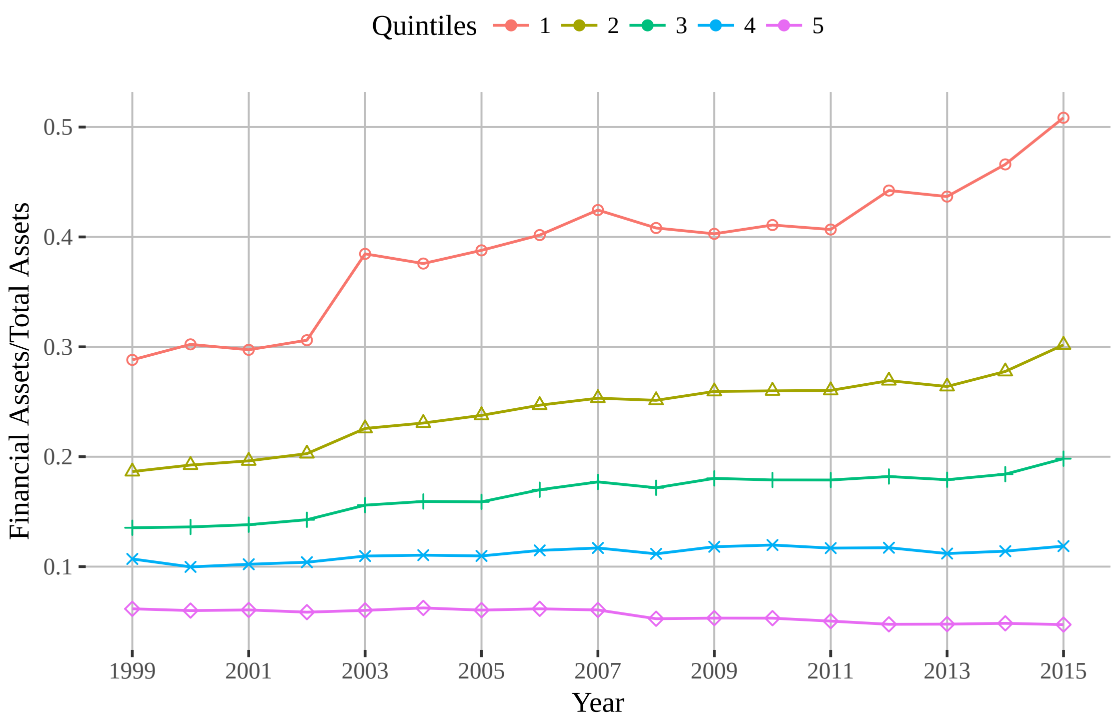

Figure 3: Average financial asset ratios by firm size quintiles. The quintiles are based on the log of total assets and are computed for every year for all observations in our data sample. The financial asset ratios are calculated as financial assets to book value of total assets for each year. The first quintile consists of the smallest firms in our sample, while the fifth quintile consists of the largest firms.

Because it could be of interest to test for significance of these quintile trends as well, we follow the regression procedures above and use the different quintiles' financial assets as dependent variables.[14] From the regressions we find a positive significant slope coefficient for each quintile except the largest size. This result has potentially an interesting implication because it indicates that the aggregated increases found above are not driven by the largest

[14]See regression results in appendix table 20.

firms, but rather by smaller ones. A possible explanation could be that small firms with less access to financial markets perceive future financing as riskier, and hence save more, related to the precautionary savings motive discussed above. On the other hand, larger firms might be less concerned about such risks.

Although the changing size of the total financial asset portfolios is undoubtedly interesting and relevant, it is the decomposition of the financial assets which is of primary interest in this thesis. As seen in table 4, safe financial assets, i.e. cash holdings, has clearly the largest portion of the portfolios of corporate financial assets. On average over our sample period from 1999 to 2015, the financial assets consist of 95.12% safe and 4.88% risky financial assets.

The portion of investments in different asset classes has been relatively stable in our sample period, and as can be seen, stocks make up the largest fraction of risky financial assets. Despite the appearance of relative stability across asset classes, we can see that investments in financial instruments peaked around the financial crisis of 2007 and 2008, which is an expected observation in light of various hedging instruments that were popular at that time.

Year	N	Stocks	Bonds	Group companies	Financial instruments	Other financial instruments	Risky financial assets	Safe financial assets
1999	127,153	3.87%	0.375%	0.247%	0.204%	0.341%	5.1%	94.9%
2000	133,754	4.64%	0.489%	0.200%	0.238%	0.351%	6.0%	94.0%
2001	137,589	4.30%	0.497%	0.187%	0.260%	0.287%	5.6%	94.4%
2002	136,912	3.70%	0.473%	0.175%	0.226%	0.293%	4.9%	95.1%
2003	146,509	2.96%	0.498%	0.150%	0.659%	0.493%	4.8%	95.2%
2004	149,079	2.82%	0.465%	0.140%	0.669%	0.486%	4.6%	95.4%
2005	159,175	2.96%	0.475%	0.166%	0.732%	0.388%	4.7%	95.3%
2006	168,178	3.18%	0.414%	0.169%	0.712%	0.540%	5.0%	95.0%
2007	184,911	3.13%	0.380%	0.164%	0.633%	0.688%	5.0%	95.0%
2008	194,281	3.25%	0.303%	0.167%	0.435%	0.664%	4.8%	95.2%
2009	194,398	3.39%	0.289%	0.141%	0.447%	0.677%	4.9%	95.1%
2010	197,250	3.52%	0.282%	0.128%	0.435%	0.685%	5.1%	94.9%
2011	204,179	3.21%	0.265%	0.134%	0.418%	0.638%	4.7%	95.3%
2012	217,028	2.92%	0.294%	0.150%	0.361%	0.623%	4.4%	95.6%
2013	234,484	3.08%	0.323%	0.175%	0.374%	0.657%	4.6%	95.4%
2014	245,230	2.93%	0.353%	0.204%	0.321%	0.737%	4.6%	95.4%
2015	249,627	2.73%	0.309%	0.217%	0.297%	0.683%	4.3%	95.8%

Table 4: Portfolio weights of various asset classes. N indicates the number of observations in each year. The ratios are calculated as the percentage of total financial assets, i.e. the sum of risky and safe financial assets.

From figure 4 we can see how the decomposition of the average risky financial asset portfolio has changed over the years, i.e. without considering safe cash holdings. Throughout our sample period, market-based shares have been by far the major part of the portfolio, with an average of approximately 70%. Bonds have been relatively stable throughout with an average portion of around 7% out of the total financial asset portfolios, although it has arguably decreased in some of the periods with low interest rates. Interestingly, in the average portfolio, other financial instruments have to a large degree surpassed and taken over financial instruments position after the financial crisis.[15] Before the crisis, other financial instruments made up approximately 9% but surged to almost 16% on average in the wake of the crisis. This could follow from an increase of more tailor-made financial instruments, which can

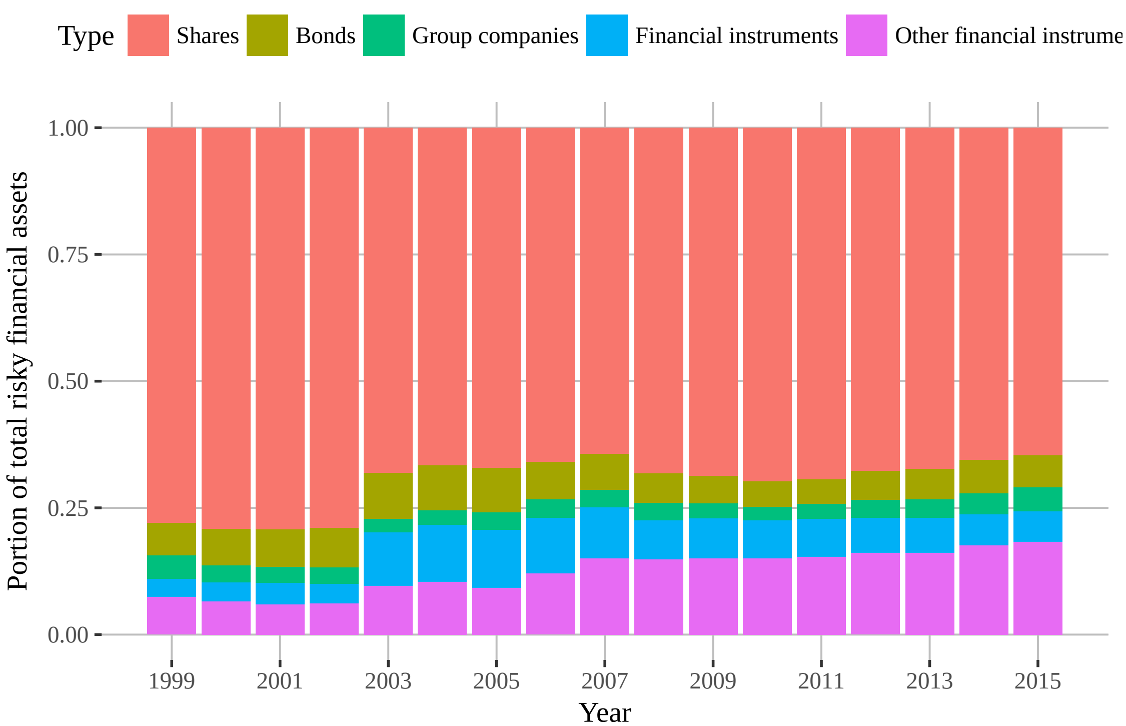

Figure 4: Portfolio weights of various asset classes. The bar plot shows the evolution of the average risky financial asset portfolios. It is calculated as the mean for every observation in our sample per year.

[15]According to Berner et al. (2016), 'Financial instruments' are financial instruments that are held for a relatively short period such as stocks and bonds. The documentation is not clear on the distinction between 'Financial instruments', 'Shares', and 'Bonds'. 'Other financial instruments' are likely derivatives. Regardless, most of the analyses of this thesis are based on the aggregated measure 'Investments' which correspond to 'Risky corporate financial assets' as defined in section 6.4.

to a larger degree be specified to suit the operations or hedging demand for each specific company. Further, the relative values of the asset classes could also, of course, have changed in the period due to fluctuating asset prices.

Although the time dynamics of financial assets provides an important motivation for our analysis, and highlight interesting aspects of our time period, it is the cross-sectional dimension that is utilized to the greatest extent in this thesis. Cross-sectionally our data has hundreds of thousands of firms, compared to a time horizon of 17 observations, and the scope of this thesis is hence mostly to estimate what determines varying in-portfolio risk across firms rather than years.[16] Accordingly, although both types of questions are assessed, our thesis will mostly answer questions on for instance what types of firms that invest more or less risky in corporate financial assets, rather than what is causing portfolios to change over time.

[16]Further, our unbalanced panel makes it arguably even less fruitful to assess time series properties.

5 Empirical specification and analysis

The firms of our sample have continuous observations on the time dimension, but the time series are of a varying length and starting at different times. We are hence dealing with unbalanced panel data, as some companies have been registered over the entire period, while others have just a single observation, due to for instance bankruptcies and mergers and acquisitions. There are several econometric issues related to unbalanced panel data, and the estimators we have based our empirical analysis on are hence chosen to deal with such issues efficiently.

5.1 Pooled cross-sectional OLS

The general case of a pooled regression model, which lays a foundation for all econometric methods in the following sections, can be shown by the following, in line with Verbeek (2012):

$$y_{it} = \beta_0 + x'_{it}\beta + a_i + \varepsilon_{it}, \quad i = 1, \ldots, n, \quad t = 1, \ldots, T_i. \tag{11}$$

Above, y is the dependent variable of interest, in our case prominently risky financial assets, β_0 is a constant term, ε is the error term or residual, while a is time-invariant and unobserved individual effects, in other words, firm-specific intercepts, important for later analyses. Further, x and β are vectors of exogenous variables and coefficients respectively, and the objective is to get unbiased coefficients β appropriate for economic inference. A slope coefficient of the pooled OLS estimator, which measures the variation both between and within groups, can be written the following way:

$$\hat{\beta}_{OLS} = \left(\sum_{i=1}^{N} \sum_{t=1}^{T} x_{it} x'_{it} \right)^{-1} \sum_{i=1}^{N} \sum_{t=1}^{T} x'_{it} y_{it} \tag{12}$$

As explained by for instance Wooldridge (2001, 2013), ordinary least squares (OLS) relies on several assumptions to be able to provide the best linear unbiased estimation. Furthermore, in longitudinal data sets, with observations from both a time and cross-sectional dimension, the assumptions get even more comprehensive.

Firstly, pooled OLS relies on the assumption that the population model is linear in parameters and can hence be written in the form of equation (11). This is a flexible assumption[17] and will likely not cause problems in our models. Secondly, the estimation requires the sampling to be random, which is crucial and discussed in section 4.1.

The third assumption is that we do not have perfect collinearity between independent variables, i.e. as formulated by Wooldridge (2001), that we have a full rank, when K is the total number of explanatory variables:

$$rank[\sum_{t=1}^{T} E(x_t' x_t)] = K \tag{13}$$

This would probably not cause problems either, as although some of our independent variables might be positively correlated, the coefficient will likely not be equal to 1 to violate linearly independence across variables. An exception is the problem known as the dummy variable trap, i.e. if we would have included all dummy variables for e.g. credit rating. This is easily avoided by suppressing the constant, however, or by removing one of the dummies, hence this issue should not affect our analyses.[18]

The fourth assumption, which is often an assumption open for discussion, is the zero conditional mean assumption, i.e. that:

$$E[\varepsilon_{it}|x_{i1}, x_{i2}, \ldots, x_{iT_i}] = 0 \tag{14}$$

In words, this assumption is based on the notion that the explanatory variables are exogenous, hence that the error term is orthogonal to them, as formulated by Greene (2012). This assumption will be a theme persistently throughout our econometric discussions. A common

[17] Pointed out by Wooldridge (2013), this assumption is not very restrictive since the independent variables can be arbitrary functions of the underlying variables of interest.

[18] Furthermore, statistical software packages such as Stata omits variables when perfect collinearity arise.

source of violation would be omitted variable bias, which gives model misspecification, and this issue will be discussed in various subsections below.

When using OLS on panel data, we also rely on further assumptions, e.g. the assumption of homoscedasticity, i.e. that the variance of the error term ε is constant and is not dependent on time or the independent variables. Formally, the following condition must hence be fulfilled:

$$Var[\varepsilon_{it}|x_{i1}, x_{i2}, \ldots, x_{iT_i}] = \sigma_\varepsilon^2 \tag{15}$$

Furthermore, explained by Wooldridge (2001), serial correlation cannot be present in the residuals; hence we must have:

$$E(\varepsilon_t \varepsilon_s | x_t' x_s) = 0 \tag{16}$$

As argued by Greene (2012) on these two last assumptions, relevant for our data set; they might not be very important when the time series are not long, i.e. with small T. Also, by specifying in the statistics software that the procedure should derive robust standard errors, a lot of potential clustering in the errors can be adjusted for in cases such as ours.

An assumption that is pointed out by for instance Greene (2012) as well, is that we need to have that

$$Cov[\varepsilon_{it}, \varepsilon_{js}|x_{i1}, x_{i2}, \ldots, x_{iT_i}] = 0, \text{ if } i \neq j \text{ or } t \neq s. \tag{17}$$

That is, the covariance of the errors given all independent variables are zero, i.e. both current and past errors should not be correlated with any explanatory variables. If this assumption hold, it would ensure strict exogeneity of x_{it}, and adding this assumption makes pooled OLS the truly best estimator. This assumption will play an essential part in our econometric discussions, as it will affect our choice of panel data methodology. Also, it affects our choice of later pursuing dynamic panel data techniques.

There is a lot of heterogeneity across the firms of our sample,[19] which is a potential source of endogeneity problems in empirical corporate finance, often due to a violation of the strict exogeneity assumption discussed above, mentioned by Wooldridge (2001). Therefore, measures should be aimed at controlling for these issues so that we best possible can ensure that ceteris paribus inference is possible. Although clustered standard errors can help us with the problems mentioned above on for instance heteroscedasticity and autocorrelation in the residuals, it will not address the unobserved heterogeneity concerning model misspecification, hence other procedures are likely needed.

A popular approach to deal with heterogeneity in empirical corporate finance research is to demean the dependent variable by industry-adjusting it. However, Gormley and Matsa (2014) criticize the approach of solely relying on industry-adjusting the dependent variable and present evidence that it gives inconsistent results.[20] Instead, they advocate that fixed effects estimation is consistent, and we have in line with their arguments chosen to pursue this methodology. Furthermore, alternative approaches to deal with the potential time-invariant firm-specific effects are pursued as well, such as first-difference OLS and Arellano-Bond estimation. We recognize however that our sample could exhibit notable heterogeneity across industries in addition to the firm-specific effects alone, and we include therefore industry dummy variables in all regressions.

5.2 Fixed effects estimation (FE)

Verbeek (2012) argues that when dealing with panel data, fixed effects (FE) estimation probably gives interpretations most appropriate when the cross-sectional dimension, i.e. i below, denotes companies or industries. The interpretation of coefficients will then be within group, and the parameters are hence only identified through the within dimension of the data.

As explained by Wooldridge (2013), a potential advantage of using fixed effects estimation is

[19] Obvious examples are varying size, operational risk, managerial quality etc.

[20] In our case, as can be seen below when we use pooled OLS with industry fixed effects, the coefficients appear different from the other estimators, and even give the opposite sign on some of them.

that we can allow for time-invariant individual effects, e.g. firm-specific operational risk constant over time that could affect the demand of excess cash in a firm.[21] Thus, the methodology allows for correlation between the explanatory variables and the unobserved firm-specific fixed effects, i.e. between a_i and x_{it} in equation (18), which in ordinary least squares estimation would cause endogeneity problems making the estimator $\hat{\beta}_{OLS}$ biased and inconsistent, as discussed above.

In a general, and a simplifying case, we consider a firm that has risky financial assets given by the following equation:

$$y_{it} = \beta_0 + \beta_1 x_{it} + a_i + \varepsilon_{it} \tag{18}$$

We can take the sum of the equation at different points in time — in our case, it could be the years 1999 to 2015 — divide by the number of years, and hence calculate the individual-specific mean, $\bar{y}_i$. This can be subtracted from the dependent variable, and we have therefore controlled for a_i by completing the within transformation:

$$\begin{aligned} y^*_{it} &= y_{it} - \bar{y}_i \\ &= (\beta_0 - \beta_0) + \beta_1(x_{it} - \bar{x}_i) + (a_i - a_i) + (\varepsilon_{it} - \bar{\varepsilon}_i) \\ &= \beta_1 x^*_{it} + \varepsilon^*_{it} \end{aligned} \tag{19}$$

This regression, which can be generalized for our applications, is estimated, and we have avoided potential problems caused by a_i since it is no longer in the equation. The constant term also disappears, as subtracting individual-specific means makes all firms centered around the same origin. The constant term reported in the tables of fixed effects are hence the average fixed effects, and thus not appropriate for interpretation in the same way as the usual OLS in levels. We measure the variation after subtracting the firm-specific means, and we have

[21] Of course, endogeneity problems could arise from effects varying over time as well. Therefore, fixed effects estimation will only deal with some of the potential problems.

the following fixed effects estimator, consistent with the notation of Verbeek (2012):

$$\hat{\beta}_{FE} = \left(\sum_{i=1}^{N} \sum_{t=1}^{T} (x_{it} - \bar{x}_i)(x_{it} - \bar{x}_i)' \right)^{-1} \sum_{i=1}^{N} \sum_{t=1}^{T} (x_{it} - \bar{x}_i)(y_{it} - \bar{y}_i) \tag{20}$$

$\hat{\beta}_{FE}$ is estimated by OLS and can be compared to $\hat{\beta}_{OLS}$ given by (12). We can see that the fixed effects transformation makes the coefficient only identified through the within dimension. Therefore, in contrast to $\hat{\beta}_{OLS}$, the potential between group effects are not identified, and the coefficients must hence be interpreted as the effect after controlling for the time-invariant fixed effects.

5.3 First-difference estimation (FD)

Similar to fixed effects estimation, first-differencing (FD) equation (11) will remove the potential endogeneity problems of a_i, explained by Verbeek (2012). Furthermore, this estimation relies on less strict assumptions with regards to the time-dependent errors. For instance, the estimator allows for correlation between x_{it} and $\varepsilon_{i,t-2}$ since the requirement now is merely that $E[\Delta x_{it} \Delta \varepsilon_{it}] = 0$.

A drawback of the FD approach is that it is considered less efficient than FE, although efficiency is likely not the most prominent issue of this thesis. Furthermore, a typical argument raised is that a lot of valuable information in the data could disappear when differencing. For instance, the change in risky financial assets from one year to the next is arguably a variable carrying a different set of information compared to the levels of risky financial assets, perhaps also less relevant information in light of our research question. Nonetheless, it is fruitful to run an analysis also using the first-difference estimation, since it, if the estimation provides very different results from the fixed effects estimator, could be an indication of misspecification, e.g. by violation of $E[x_{it}\varepsilon_{is}] = 0 \ \forall \ s, t$, or other issues. Further, we will argue that it will provide us with coefficients that work as useful benchmarks to the other estimators.

In our thesis, we consistently first-difference the dummy variables in our FD regressions to capture effects of changes in these, which yield somewhat different information than having dummy variables in levels. The coefficients of the dummy variables in the FD column should be interpreted accordingly, for instance that they aim to answer questions such as how it affects risky financial assets in a given year if a firm goes from not paying dividends to suddenly paying them.[22]

Straightforwardly, the approach takes the first-difference of equation (11) in the following way:

$$\begin{aligned} y_{it} - y_{i,t-1} &= (x_{it} - x_{i,t-1})'\beta + (a_i - a_i) + (\varepsilon_{it} - \varepsilon_{i,t-1}) \\ \Delta y_{it} &= \Delta x'_{it}\beta + \Delta\varepsilon_{it} \end{aligned} \tag{21}$$

We have hence removed the time-invariant fixed effects a_i, while the constant term is removed as well so that we force the regression line through the origin,[23] and we get the following first-difference estimator, as shown by Verbeek (2012):

$$\hat{\beta}_{FD} = \left(\sum_{i=1}^{N} \sum_{t=2}^{T} \Delta x_{it} \Delta x'_{it} \right)^{-1} \sum_{i=1}^{N} \sum_{t=2}^{T} \Delta x_{it} \Delta y_{it} \tag{22}$$

Again, this estimator can be compared to $\hat{\beta}_{FE}$ and $\hat{\beta}_{OLS}$ from equations (20) and (12). It is easily observable that these estimators will give coefficients that likely vary in magnitude, as they identify through different dimensions. Here, not only are the between groups dimension as in $\hat{\beta}_{FE}$ removed, but also a lot of information which only appears in levels. Otherwise, the coefficients are interpreted similarly.

[22] As a robustness measure, we also run regressions where the dummy variables are in levels. In some of these cases, the coefficients of FD and FE differ strongly, and some have even opposite significant signs. When dummies are measured in levels on our FD estimations, the coefficients seem more consistent with pooled OLS' coefficients than fixed effects and Arellano-Bond.

[23] It is the constant term of the levels equation that disappears, and accordingly will a potential constant term resulting from the regression of equation (22) be a time trend.

5.4 Arellano-Bond estimation (AB)

Because there might be autoregressive dynamics in the financial investments of Norwegian firms, i.e. the investment ratios depend on previous values of themselves,[24] it could be desirable to include lagged dependent variables in the regressions. Both fixed effects and OLS are static models and does hence not take care of potential dynamic panel bias, as explained by Bond (2002), and utilizing past as well as current information could be desirable.

When applying dynamic panel data estimators, in a general sense, rather than equation (18) we might wish to include lagged dependent variables and estimate, for instance, the following equation believing that the correct model takes the form

$$y_{it} = \beta_0 + x'_{it}\beta + y_{i,t-1}\lambda + a_i + \varepsilon_{it}. \tag{23}$$

As explained by Bond (2002), it could also be beneficial to use methods that allow for an absence of strict exogeneity (see section 5.1 for discussion on strict exogeneity) when dealing with e.g. consumption or investment. This means that with such methods, it is not such a problem if explanatory variables are correlated with past or current errors. Furthermore, Bond (2002) makes the point that the methodology of Arellano-Bond estimation, from Arellano and Bond (1991), is appropriate when the time horizon is not very long. As pointed out by Greene (2012), the Arellano-Bond estimator is also able to accommodate unbalanced panels, which is the case of our sample. In fact, in their original paper, Arellano and Bond (1991) use the approach on an unbalanced panel of U.K. companies.

As argued by Verbeek (2012), although fixed effects estimation could make sense when dealing with corporate variables,[25] and therefore produce results more reliable than pooled OLS because of the fixed individual effects, the estimates might suffer from small-T bias.[26] If

[24] This is certainly the case, and we find significant autoregressive tendencies in our dependent variable throughout, see formal test results below.

[25] Verbeek (2012) use an example with capital structure as the dependent variable. Although this is somewhat different from the scope of this text, we find the arguments analogously reasonable also for our thesis.

[26] In the words of Bond (2002): "However, for panels where the number of time periods available is small, this [fixed effects] transformation induces a non-negligible correlation between the transformed lagged dependent variable and the transformed error term."

so, i.e. in the presence of correlation between transformed dependent variables and error terms, explained by Bond (2002), we might end up with an inconsistent within group estimator. Furthermore, concerning a_i above, it is also removed in the standard Arellano-Bond estimator by first-difference, i.e. Arellano-Bond will also remove time-invariant unobserved heterogeneity across the firms.

For a fixed T and $N \rightarrow \infty$, which approximately describes our data sample, a way to get more consistent estimates than the potentially biased FE estimator suffering from violation of strict exogeneity, is to use either Anderson-Hsiao Instrument Variable (IV) estimation or Arellano-Bond (AB) Generalized Method of Moments (GMM) estimation. Both of these methods try to exploit instruments for the first-differenced equation. However, the Anderson-Hsiao estimation has been criticized quite heavily and is potentially inconsistent due to asymptotic inefficiency and weak instruments, mentioned by Verbeek (2012).[27]

Contrary to Anderson-Hsiao estimation, which is an IV estimation approach using a lagged dependent variable as an instrument, Arellano-Bond estimation utilizes the framework of GMM as an alternative. Therefore, more lags are used as instruments, and as shown by Verbeek (2012), it ends up with an instrument matrix, and hence utilizes the maximum number of lagged dependent variables as instruments, as well as differenced explanatory variables:

$$Z_i = \begin{bmatrix} [y_{i0}, \Delta x'_{i2}] & 0 & \dots & 0 \\ 0 & [y_{i0}, y_{i1}, \Delta x'_{i3}] & 0 & 0 \\ \vdots & 0 & \ddots & 0 \\ 0 & \dots & 0 & [y_{i0}, \dots, y_{i,T-2}, \Delta x'_{iT}] \end{bmatrix} \tag{24}$$

The instrument matrix consists of instruments of GMM-type as well as standard type, i.e. both lagged values of the dependent variable as well as differenced explanatory variables. The number of instruments are hence increasing in time periods available, which is why our estimation of e.g. section 7.1, with the period from 1999 to 2015, are based on 146

[27] A different possible approach within the IV framework, as pursued by Duchin et al. (2017), is use 2SLS with instruments for a financial assets variable. Using our sample, the instruments are likely too weak for such methods.

instruments, while the estimation of section 7.2, with observations from 2005 to 2014, utilize only 61 instruments despite having more explanatory variables.

The Arellano-Bond estimation results in a transposed vector of first-difference error terms:

$$\Delta\varepsilon_i' = \begin{bmatrix}\varepsilon_{i2} - \varepsilon_{i1} & \varepsilon_{i3} - \varepsilon_{i2} & \dots & \varepsilon_{i,T} - \varepsilon_{i,T-1}\end{bmatrix}' \tag{25}$$

Hence the moment conditions are as follows:

$$E[Z_i'\Delta\varepsilon_i] = 0 \tag{26}$$

As explained by Verbeek (2012), we have $1+2+3+\cdots+T-1$ moment conditions, and the estimator hence minimizes its function in terms of these moments.

We can see that the Arellano-Bond estimation in section 7.2 utilizes 61 instruments in total. The regression has $T = 10$, because it has observations from 2005 to 2014, giving 33 dependent variable GMM-type instruments,[28] six standard instruments from the first-difference values of the elements in $controls_{it}$, six standard instruments from the first-difference values of the elements in $rating_{it}$, seven standard instruments from the elements in $year_t$, as well as nine standard instruments from the elements in $sector_i$.

The number of instruments is large in the Arellano-Bond estimation, and the trade-off between efficiency and the number of instruments is taken into account accordingly in our estimations. For instance, based on the arguments of Baltagi (2005), we have considered restricting the number of lags used as instruments. However, the number of observations N is in our estimations very large, and with the lowest number of observations being 691,540, small-sample issues do not appear too concerning. Explained by Roodman (2006), a minimal rule of thumb often used within the framework is to ensure that the number of instruments

[28]Because the set of instruments from the dependent variable, a total of 33, are in that particular example (differs from above due to more lagged dependent variables in the equation, see Roodman (2006)):

$$Z_i = \begin{bmatrix}[y_{i0}, y_{i1}, y_{i2}] & 0 & \dots & 0 \\ 0 & [y_{i0}, y_{i1}, y_{i2}, y_{i3}] & 0 & 0 \\ \vdots & 0 & \ddots & 0 \\ 0 & \dots & 0 & [y_{i0}, \dots, y_{i8}]\end{bmatrix}$$

is not larger than the number of groups, but the smallest number of groups we have in our regressions is 168,014. Based on the arguments of Verbeek (2012), Baltagi (2005) and Roodman (2006) on the issue of overidentification, our number of observations and groups seem large enough to correspond fruitfully to using the maximum number of lagged instruments in all estimations.

Pointed out by Baltagi (2005), and shown by Arellano and Bond (1991)[29] in the original paper, the Arellano-Bond estimator relies on the assumption of no second-order serial correlation to be consistent, i.e. that

$$E[\Delta\varepsilon_{it}\Delta\varepsilon_{i,t-2}] = 0. \tag{27}$$

In our case, we find that this assumption appears to hold if we include three lags of the dependent variable, which is why we run the following regression, in general form, throughout:

$$y_{it} = x'_{it}\beta + \sum_{k=1}^{3} y_{i,t-k}\lambda_k + a_i + \varepsilon_{it} \tag{28}$$

Therefore, the three lagged values of the dependent variables are always included, while the explanatory variables x'_{it} vary from section to section. By the Arellano-Bond test for zero-autocorrelation in the first-difference errors, we find no evidence of autocorrelation causing inconsistency, and the errors ε_{it} from the vector of equation (25) is therefore well-behaved. A test on for instance the regression in equation (34) gives the following results implying a consistent GMM estimator:

Order	z	Prob >z
1	-81.383	0.0000
2	-0.99471	0.3199
3	-1.3962	0.1627

Table 5: Arellano-Bond test for autocorrelation

By performing its generalized method of moments procedure, the approach gives the following

[29] The test statistic is presented by Arellano and Bond (1991) as (in our notation):
$m_2 = \frac{\Delta\hat{\varepsilon}'_{-2}\Delta\hat{\varepsilon}_*}{\Delta\hat{\varepsilon}^{1/2}}$ $\tilde{a}$ $N(0,1)$

estimator after deriving its first order conditions, as shown by Verbeek (2012):

$$\hat{\beta}_{AB} = \left(\left(\sum_{i=1}^{N} \Delta y_{i,-1} Z_i \right) W_N \left(\sum_{i=1}^{N} Z_i' \Delta y_{i,-1} \right) \right)^{-1} \left(\sum_{i=1}^{N} \Delta y_{i,-1}' Z_i \right) W_N \left(\sum_{i=1}^{N} Z_i' \Delta y_i \right) \quad (29)$$

Equation (29) for $\hat{\beta}_{AB}$, where W_N is the optimal weighting matrix that gives the most efficient estimator, can be generalized for the explanatory variables x_{it} in equation (28). The estimator can be compared to the estimators of ordinary least squares, fixed effects, and first-difference OLS, i.e. $\hat{\beta}_{OLS}$, $\hat{\beta}_{FE}$, and $\hat{\beta}_{FD}$ in equation (12), (20), and (22) respectively. The coefficients given by the various estimators, presented in section 7, will be comparable, hence in our view provide a broader picture of coefficients to make inferences from, and we thus present all of them throughout.

6 Specification of variables

As pointed out by Parsons and Titman (2008), the most significant cause of concern for researchers of empirical corporate finance is endogeneity, and this will be a concern regardless of econometric methodology. As they explain, endogeneity occurs when the errors of the model are not truly random, since information in the explanatory variables can help predict them.

In addition to an issue of reverse causality causing misspecification, where the dependent variable cause changes in the independent variables, we may also have endogeneity problems from omitted variable bias, as explained by Wooldridge (2013), which also is a common occurrence in empirical corporate finance. This is something to be concerned with regarding our hypotheses because if we do not control for variables that belong in the population model, for instance, if we do not include the size of the companies in the regressions, we might end up with biased estimators. In such a case, potential explanatory variables which depend on size, e.g. ownership concentration, would not be able to provide ceteris paribus effects in the regression.

There are many more sources of endogeneity problems, and they will be discussed throughout this text. The fixed effects regression, as well as various instrument variable approaches such as GMM and Arellano-Bond estimation, could help remove some of the endogeneity problems, as described above and for instance by Wooldridge (2001, 2013). However, as pointed out by Parsons and Titman (2008), endogeneity problems are often easier to recognize than to adequately treat, and regardless of how sophisticated the statistical methods are, another essential aspect is that variables are correctly specified. In the following subsections, we hence discuss some crucial considerations we think require explicit discussions in this regard.

6.1 Using ratios rather than absolute values

First of all, our empirical analyses are strongly based on using ratios, consistent with for instance Bates et al. (2009). As using absolute values might be a source of bias in a lot of cases, we find it necessary to use for instance risky financial assets as a fraction of another variable as a dependent variable. Also, almost every explanatory variable that we have used are either ratios or dummies. Our data sample consists of a lot of variables that has absolute values varying significantly in size on the cross-sectional dimension, and not controlling for this would likely cause endogeneity problems.[30] Therefore, by using ratios throughout, we could avoid a problem of the confounding factor size causing a spurious relationship between absolute-valued variables.

6.2 Fair value versus historical cost

Another potential cause of problems in empirical corporate finance is different accounting measures for book values of assets. For instance, as explained by Berner et al. (2016) in the documentation of our data set, some assets of Norwegian firms will be valued based on historical cost and others at fair value. This may give a bias in empirical analyses across firms, and lead to less reliability. In fact, it could also adversely affect the validity, as we should mainly concern ourselves with market values since these give a more realistic value of the balance sheet, especially when dealing with market-based securities as done in our thesis. Importantly, pointed out by Berner et al. (2016), the Norwegian accounting standards are, contrary to for instance IFRS, mainly income statement focused. This is a drawback when using book-value of assets for empirical analyses on Norwegian firms since balance sheet focused accounting likely has higher validity when all empirical studies are based on balance sheet variables.

There might be potential benefits to us restricting the empirical analysis to mainly using financial assets. These values, e.g. cash holdings and risky financial investments, are all measured at fair values, which should limit the bias discussed above. For instance, both Duchin et al. (2017) and Bates et al. (2009) makes to some extent use of a variable $\frac{Total\ financial\ assets}{Book\ value\ of\ total\ assets}$, and we do descriptively as well, but we show additional caution in light of the accounting standards in Norway, and refrain from using it as a dependent variable in

[30]Note that even with ratios the size effect will be highly prevalent. Therefore, in all regressions we have included a size variable, measured as the logarithm of total assets, following e.g. Bates et al. (2009) and Duchin et al. (2017).

any of our main regressions of section 7.

6.3 The distinction between working and excess cash

As mentioned previously, the objective of our thesis is to make inferences on excess cash, i.e. the cash that is leftover and essentially ready to be paid out as dividends, in line with the definition of Jensen (1986). As discussed in the book of Koller et al. (2015), some of the cash holdings on any financial statement will be working cash. Also, as they state, previous analysis shows that 2 percent of sales is likely the minimum amount of cash needed for operations. Therefore, they propose that 2 percent of sales could be decent proxy variable for working cash, while the rest can be considered excess cash. However, it is naturally the case that the amount of liquidity at work will differ greatly both across industries and individual companies, due to the inherent variation across different kinds of operations. For instance, capital-intensive companies are often more likely to hold more cash due to larger capital expenditures.

There are multiple ways of attempting to deal with the issue of distinguishing cash that is operational from cash that is leftover. We considered using the proxy variable proposed by Koller et al. (2015), i.e. simply computing $excess\ cash = cash\ holdings - 0.02 revenue$, but decided otherwise. We will argue that the procedure of Koller et al. (2015) will not deal with much of the heterogeneity that arises from the different cash dependency across industries and firms. Therefore, we do not intervene with regards to the cash variable.

There are also econometric ways of reducing the problems of the operational heterogeneity. For instance, as shown above, if working cash is assumed to be time-invariant and firm-specific, i.e. equivalent to a_i above, simple fixed effects or first-difference estimations could reduce the problem. Furthermore, following the approach of for instance Bates et al. (2009), a lot can be controlled for by including more variables in the equations, hence trying to avoid omitted variable bias, which is why we throughout our thesis e.g. include both the vectors $controls$ and $sector$ in the regressions, discussed below in section 6.5.

6.4 Specification of dependent variables

In our empirical analyses, although not explicitly presented to a great degree in this text, we have tried to vary the dependent variable. For most analyses, however, we were, consistent with Duchin et al. (2017), interested in measuring the effect on risky financial assets, i.e. only distinguish safe from unsafe financial assets. The dependent variable in these cases are hence the following, where total corporate financial assets is the sum of risky and safe financial assets, while risky corporate financial assets is the sum of all risky asset classes:[31]

$$Risky\ financial\ assets_{it} = \frac{Risky\ corporate\ financial\ assets_{it}}{Total\ corporate\ financial\ assets_{it}} \tag{30}$$

The dependent variables of some of the other cases, used in empirical analyses in e.g. the appendix, are more straightforwardly specified. For instance, stocks ratio and bond ratio are simply market-based shares and market-based bonds replacing the numerator of equation (30). The cash ratio, used both in the descriptive statistics and some descriptive regressions is defined as $Cash\ ratio_{it} = \frac{Total\ corporate\ financial\ assets_{it}}{Book\ value\ of\ total\ assets_{it}}$, following Bates et al. (2009).

6.5 Continually used control variables

We find it desirable to include some control variables in all regressions. As mentioned previously, because there are a lot of factors that potentially can cause financial investments, we wish to control for such effects and try to isolate the effects of our chosen explanatory variables.

Firstly, we include yearly dummies in all regressions, consistent with the advice of Wooldridge (2001), which helps us control for aggregate changes over time. The yearly changes are in fact found to be significant, seen in appendix table 17, which is not very surprising as risky financial assets varied significantly in the financial crisis. It is also easily seen in figure 3 that total corporate financial assets have varied over the years. Therefore, to capture some of

[31]As described above, we consider market-based shares, market-based bonds, market-based financial instruments, other financial instruments, and shares in group companies as risky financial assets, while bank deposits, cash, and cash equivalents are considered safe.

the potential business cycle effects, our regressions include $year_t$ dummies, which is all years except the first one,[32] i.e.:

$$year_t' = \begin{bmatrix} y00 & y01 & \dots & y15 \end{bmatrix}' \tag{31}$$

Another variable we think is potentially desirable to control for, which is done by for instance Bates et al. (2009) and Duchin et al. (2017), is industry effects, which has the coefficients presented in appendix table 18. The list of sectors can be seen in table 1, and in all regressions, we have included dummies for each $sector_i$, i.e.:

$$sector_i' = \begin{bmatrix} agri. & offsh. & transp. & manuf. & TTM & electr. & const. & retail & oth.s \end{bmatrix}' \tag{32}$$

As discussed previously, for instance will size likely play a crucial part in explaining whether a company invests much in risky financial assets or not. Therefore, a size variable is included in all regressions, measured as in Bates et al. (2009), i.e. as the natural logarithm of the book value of total assets. Furthermore, as leverage — which we measure by book values of debt and equity — also potentially could help explain liquidity choices of firms, we also control for this variable throughout.

Another fundamental economic indicator we have included, again consistent with Bates et al. (2009), is free cash flow,[33] measured as profit before tax and extraordinary items, less interest and taxes, plus depreciation and amortization, scaled by total assets. We have furthermore included net working capital, defined as current assets less short-term liabilities divided by total assets, a research and development expenditures variable, which is also scaled by total assets, as well as a dividend dummy.

[32] The first year is removed due to the dummy variable trap.

[33] Also, again inspired by Bates et al. (2009) and Duchin et al. (2017), in some regressions we control for the variable $unexpected\ cash\ flow$, estimated as the residual $\varepsilon_{i,t}$ of $CF_{i,t} - CF_{i,t-1} = \alpha + \beta_1(CF_{i,t-1} - CF_{i,t-2}) + \beta_2(CF_{i,t-2} - CF_{i,t-3}) + \beta_3(CF_{i,t-3} - CF_{i,t-4}) + \varepsilon_{i,t}$. As it turns out, there are a lot of missing values, and it is ambiguous whether or not it has a fruitful place in our equations at all.

Formally, the regressions are hence all including $\beta' controls_{it}$, where:

$$controls' = \Big[size \quad leverage \quad RD \quad NWC \quad Div \quad cashflow\Big]' \tag{33}$$

We include the vectors *year*, *sector*, and *controls* in all of our regressions to utilize these variables to try to isolate the effects of our independent variables. Furthermore, these control variables themselves provide rather interesting results, presented in the next section.

7 Empirical findings

7.1 Coefficients of control variables

Although the variables $size_{it}$, $leverage_{it}$, RD_{it}, NWC_{it}, Div_{it}, and $cashflow_{it}$ are mainly included as control variables, and hence together are meant to control for various effects, it is certainly in our interest to attempt to get a measure of the coefficients for these variables as well, since they have clearly relevant economic interpretations. Therefore, as a start of our empirical analyses, we run the following regression:

$$\begin{aligned} Risky\ financial\ assets_{it} = \beta_0 + \beta_1 size_{it} + \beta_2 leverage_{it} + \beta_3 RD_{it} + \beta_4 NWC_{it} \\ + \beta_5 Div_{it} + \beta_6 cashflow_{it} + \Phi' year_t + s' sector_i + \varepsilon_{it} \end{aligned} \tag{34}$$

Or in a more compact notation:

$$Risky\ financial\ assets_{it} = \beta_0 + \beta' controls_{it} + \Phi' year_t + s' sector_i + \varepsilon_{it} \tag{35}$$

Because our different methods require different specifications of variables, the equation above is changed accordingly. For instance, first-difference OLS will obviously have all variables on a differenced form, while the Arellano-Bond estimator will have first, second, and third lagged values of the risky financial assets variable as explanatory variables, as described in section 5.4.

Seen in the results of table 6, we note that there is some variation in the coefficients across the different approaches, and pooled OLS claim that some coefficients are statistically significant where the other methods do not, perhaps because it is biased and inconsistent, discussed in section 5. As explained by Wooldridge (2013), pooled OLS might suffer from bias when firm-specific fixed effects a_i are correlated with the explanatory variables x_{it}, and we will therefore in the following put less weight on the coefficients of pooled OLS. Also, since the other estimators seem consistent on the signs of their significant coefficients, we will argue that putting more weight on FD, FE, and AB is appropriate.

An effect appearing to be crucial across estimators, also for pooled OLS, which we have discussed in previous sections as well, is the size of a firm. Predictably, all of the statistical estimations imply a positive coefficient for size and hence indicate that larger firms, everything else equal, has on average a larger fraction of their financial assets being risky. This could make intuitive sense, as for a lot of the smallest firms, investing in risky financial assets are arguably less relevant.[34] Further, it is possible that some of the small firms with less access to financial markets have to rely more on holding pure cash and therefore have less risky financial asset portfolios. Hence, the positive coefficient for size could also be consistent with the theoretical proposition made by Duchin et al. (2017) that unconstrained firms, everything else being equal, invest more in risky financial assets.

The Arellano-Bond estimator is the only one not showing a significant effect of research and development (R&D), and in general, this estimator appears more conservative with regards to indicating significance. A possible reason for this general tendency is that part of the effect is removed by controlling for some of the persistence in the time-series by including lagged variables. More concretely on R&D, some of the impacts of this particular variable might be reduced by scaling the variable by total assets.[35] Nevertheless, the other estimators indicate a significant negative coefficient on R&D, i.e. firms with higher R&D investments hold less risky financial assets. Interestingly, this is the opposite of the finding of Duchin et al. (2017) on large and listed US firms. The negative coefficient could make intuitively sense if we assume that firms devoting a large part of their capital to R&D have less to spend on risky financial investments. For these types of firms, in many cases it would be more important to spend capital wisely on R&D rather than investing in risky assets. An anecdotal example would, for instance, be a pharmaceutical company in its early stages, devoting most of its cash into R&D.[36]

[34]For instance, a small proprietorship with perhaps one or two employees, providing some kind of service, will likely not have cash management dealing with investments in risky corporate financial assets.

[35]Scaling by total assets is consistent with the specification of Duchin et al. (2017), and we recognize that this measure might be affected by our sample of small firms having very low total assets. We also attempted scaling it by revenue in the regressions, as done by Bates et al. (2009), creating a ratio that also can be a measure of growth opportunities. As it turns out, scaling by revenue yielded coefficients very close to zero in all estimations.

[36]As seen in figure 7 in the appendix, 'Electricity', 'TTM' and 'Other services' are the sectors with highest median R&D investments measured as a percentage of total assets.

On a different note, all of the econometric approaches provide a significant coefficient on the dividend dummy variable, indicating that whether or not a firm pays dividends plays a part in explaining the degree of risk in corporate financial assets. The estimators of fixed effects, first-difference OLS, and Arellano-Bond show that firms paying dividends have financial asset portfolios that are less risky on average, which is interesting because it could indicate that some firms might use excess cash on risky financial assets rather than paying dividends. The pooled OLS estimator suggests a significant positive relationship between the two variables, which appears puzzling at first, but if OLS is biased and inconsistent, it is possible that the bias can flip the sign of the coefficient compared to other, more consistent estimators.[37] We will argue throughout this text that it is more important that FD, FE, and AB appear more consistent with each other, since it is in general advocated in panel studies that one should pursue methods that try to control for unobserved heterogeneity, explained for instance by Wooldridge (2013) and Baltagi (2005).[38]

As seen in table 6, e.g. the Arellano-Bond estimator suggests that if a firm pays dividends, it will on average have approximately 28 basis points less in risky financial assets. If we assume that dividend payments and investments in risky financial assets are mutually exclusive options, it could lead to a claim that firms might inefficiently hoard cash and spend it on risky financial investments. However, this argument hinges, of course, on the suboptimality of individual firms investing in risky financial assets, and although it is in many cases difficult from our theoretical predictions of 3.4 to rationalize the investments, for many firms in our sample the risky financial investments might be unproblematic.

It could also be desirable to explicitly discuss the time-series properties of risky financial assets. As presented under the Arellano-Bond estimation in the column at the far right in table 6, both first-, second-, and third lagged dependent variables appear to have significant positive coefficients. This is a strong indication that the risky financial assets of a firm have autoregressive tendencies, a finding that is expected. Whether or not a firm has risky financial

[37]Finding that pooled OLS are so biased that it leads to opposite signs of coefficients appears to be a fairly common finding in panel studies of firms, see for instance Baltagi et al. (2000), Himmelberg et al. (1999), and Gormley and Matsa (2014).

[38]Aside from fixed effects and first differencing, two common static methods of trying to deal with heterogeneity of panel data are random effects (RE) and least-squares dummy variables (LSDV), where LSDV is theoretically equivalent to FE.

investments will likely to a large extent depend on whether it had so in the previous year, and it is thus reasonable to argue that these lagged variables belong in the model. Importantly, by including the lagged variables, the undesirable autocorrelation of the residuals disappear, and the assumption of the estimator is hence met in this regard, discussed above in section 5.4. The autoregressive properties are vital if we would attempt predicting the risky financial assets of a Norwegian firm because as can be seen throughout our empirical findings, on average will approximately 60% of risky financial assets be explained by the investments of the previous year.

In all regressions throughout our empirical analyses, we include control variables for industries as well as years, i.e. all regressions consist of $year_t$ and $sector_i$, and the coefficients of these dummies can be seen in table 17 and 18 in the appendix. As we can see, the coefficients for most of the time dummies seem significant across estimators, implying that the investments in risky financial assets have depended on time. With regards to industry effects, firms in the offshore sector appear to invest significantly less risky, while the other sectors show minor variation with respect to corporate financial asset risk.[39]

Overall from this section, the control variables of both $controls_{it}$, $year_t$ and $sector_i$ seem relevant to our empirical estimations. In the following sections, we thus include the variables of this section continually, consistent with e.g. Bates et al. (2009) and Duchin et al. (2017). We will not explicitly present the coefficients of the control variables when we run regressions on new explanatory variables from now on, but they appear robust to all of the following sections' specifications, i.e. the coefficients do not appear to change a lot by including more variables.

[39]In general, we do not find major significant variation across industries when our control variables are included. This is not necessarily as puzzling as it may first seem, as one can imagine that choices with regards to where to place excess cash might be fairly independent of industry.

Dependent variable: Risky financial assets$_{it}$	(1)	(2)	(3)	(4)
	OLS	First difference	Fixed effects	Arellano-Bond
size	0.00925***	0.00460***	0.00721***	0.00386***
	(0.0000627)	(0.000161)	(0.000192)	(0.000336)
leverage	0.000000864***	3.53e-08	-0.00000115	-0.00000117
	(0.000000295)	(0.000000909)	(0.00000144)	(0.00000194)
R&D	-0.0588***	-0.0121*	-0.0102***	-0.00407
	(0.00582)	(0.00705)	(0.00270)	(0.00467)
NWC	-0.00000257***	0.00000400	0.000000619	0.00000159
	(0.000000890)	(0.00000319)	(0.00000265)	(0.00000571)
Div	0.00248***	-0.00309***	-0.00255***	-0.00282***
	(0.000286)	(0.000224)	(0.000340)	(0.000395)
cash flow	-0.00000448***	0.00000203	-0.00000140	0.00000505
	(0.000000940)	(0.00000192)	(0.00000202)	(0.00000409)
Risky financial assets$_{i,t-1}$				0.589***
				(0.0237)
Risky financial assets$_{i,t-2}$				0.0870***
				(0.00354)
Risky financial assets$_{i,t-3}$				0.0244***
				(0.00294)
Constant	0.00725***	0.000766***	0.000650	-0.0118***
	(0.000866)	(0.0000795)	(0.00175)	(0.00321)
$year_t$	Yes	Yes	Yes	Yes
$sector_i$	Yes	Yes	Yes	Yes
N	2,816,087	2,318,013	2,816,087	1,363,165
Number of instruments				146
Within R^2			0.0034	
Between R^2			0.0162	
Overall R^2	0.018	0.001	0.118	

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Regressions on various control variables

7.2 Financial constraints

As proposed in section 3.4.1 as well as by Duchin et al. (2017), whether or not a firm is financially constrained will theoretically be important when explaining the motivation of investing in risky corporate financial assets. In fact, if for instance a firm with risk-averse managers and shareholders is constrained in cash to any extent, the theoretical prediction is that it will have no risky financial assets.[40]

As argued by Opler et al. (1999), credit ratings could be a useful measure on how constrained a company is financially, since a firm with high creditworthiness will likely have greater access to capital markets. With that in mind, we run the following regression:

$$Risky\ financial\ assets_{it} = \beta_0 + \delta' rating_{it} + \beta' controls_{it} + \Phi' year_t + s' sector_i + \varepsilon_{it}, \quad (36)$$

where

$$rating' = \begin{bmatrix} Bankrupt & C & B & A & AA & AAA \end{bmatrix}' \quad (37)$$

and $year_t$, $sector_i$ and $controls_{it}$ are given by equation (31), (32) and (33). The regression is similarly run by first-difference OLS, fixed effects estimation, as well as Arellano-Bond, where the credit rating value in the intercept, i.e. the dummy that is left out, are firms not assessed by the credit agency. Unfortunately for this section, the data for credit ratings only cover the years 2004 to 2015, and the number of observations is therefore somewhat smaller. Nonetheless, the power of the analysis should not be too affected, as the number of observations is still very large across estimators, e.g. 691,540 in the Arellano-Bond estimation. The results are presented in table 7, and we can see that the coefficients among of the different estimators appear fairly consistent.

[40]Under the assumption of risk neutrality, it might be optimal to invest in risky financial assets regardless of whether or not a firm is constrained. In such cases, it depends on the size of the risk premium, as explained in 3.4.1.

Interestingly, and consistent with the theoretical predictions made in section 3.4.1, the firms that appear the most heavily constrained, i.e. the firms with the rating 'bankrupt', are significantly less invested in risky financial assets. Also, as predicted by the fixed effects estimation, only firms with a rating of 'bankrupt' and 'C' have statistically significant coefficients indicating less risk. This finding could be rationalized by firms of these ratings having a higher default risk and stronger precautionary savings motive, thus avoiding risky financial assets. The dummy for the poorest credit rating has the strongest negative coefficient, which is consistent with the theoretically predicted result. As table 7 show, the Arellano-Bond estimator predict that if a firm has the credit rating of 'bankrupt', it has approximately 63 basis points less in risky financial assets on average.

On the least financially constrained firms, i.e. firms with 'AAA' rating, the Arellano-Bond estimation finds significant deviations from average, indicating that firms of this rating invest approximately 51 basis points less in risky financial assets. Our theoretical predictions in section 3.4.1 stated that only financially unconstrained firms have potential reasons to invest in risky financial assets, given that we assume that managers and shareholders are risk-averse, and theoretically we should thus find that risky financial assets populate such firms. However, we might observe that 'AAA' rated firms invest less risky because firms of the very best credit rating are likely well-known, well-governed and have greater access to financial markets, and therefore stick to total financial assets that are safer.

Our findings by exploring the effects of firms' credit ratings; that firms with the poorest credit ratings invest significantly less risky, and that firms of the very best credit rating 'AAA' also invest less risky, made us tempted to pursue whether or not credit rating upgrades or downgrades in a given year affects the risky financial assets of Norwegian firms. By generating variables for 'upgrade', 'downgrade' and 'no change' respectively — ignoring the magnitude of the change — we do not find that changes in rating have any significant effect on risky financial assets. Therefore, we omit the results from these regressions that were performed with same control variables and estimators as we have done consistently throughout this thesis.

As argued by Opler et al. (1999) and above, firms that have better credit ratings are more financially sound and can thus reduce their financial asset values, as the precautionary motive for holding cash is less of an issue. Related to these arguments, we have plotted financial assets as a percentage of total assets for each credit rating, as seen in figure 8 in the appendix. By looking at the ratios, 'AAA' rated companies appear to have more financial assets as a percentage of total assets compared to the other ratings. It is hence possible that a company with a better credit rating has a more extensive opportunity set in terms of investing financial assets risky, despite table 7 indicating that they invest safer.[41]

Duchin et al. (2017) use a different approach when testing the hypothesis that financially constrained firms are investing less in risky financial assets. By using an instrument variable approach to predict an exogenous measure of a financial asset portfolio, they find that as the financial assets portfolio increase in size, the amount of risk in the portfolio also increases. This is consistent with the notion that if a firm is less constrained, it needs less cash, and the firm might be more willing to invest in risky assets. When we perform econometric testing on this, we also find that this correlation is significantly positive.[42] However, if we would simply include $\frac{Total\ corporate\ financial\ assets}{Book\ value\ of\ total\ assets}$ in the regression below, we would surely get an endogeneity problem, and unfortunately, the instrument approach of Duchin et al. (2017) gives in our case instruments that are too weak. Therefore, we omit this variable from our regressions. Nevertheless, the statistical evidence is showing that the fraction of risky financial assets over total financial assets are increasing endogenously with the increase in total financial assets, further supporting the theoretical prediction of 3.4.1. Therefore, adding to the coefficients of $rating_{it}$ and $size_{it}$ as well, the results of this section could support the theoretical prediction that the investments in risky financial assets are lower in firms that are more financially constrained.

[41] A little caution is likely needed when interpreting the relationship between credit ratings and financial assets, as it might be the case that firms have a better credit rating because they have better liquidity, and hence that the causality goes the other way.

[42] Our four estimators OLS, OLS-FD, FE, and AB give coefficients for *financial assets* of 0.168***, 0.0394***, 0.0681***, and 0.0417*** respectively. Interestingly, in spite of including the endogenous variable $financial\ assets$, the coefficients of the credit rating dummies turn out to appear robust to including the financial assets variable.

Dependent variable: Risky financial assets$_{it}$				
	(1)	(2)	(3)	(4)
	OLS	First difference	Fixed effects	Arellano-Bond
Bankrupt	-0.0329***	-0.00489***	-0.00578***	-0.00627***
	(0.000886)	(0.000713)	(0.000833)	(0.00138)
C	-0.0459***	-0.00104	-0.00202**	-0.000440
	(0.000834)	(0.000767)	(0.000932)	(0.00178)
B	-0.0343***	-0.000721	-0.000954	-0.00288**
	(0.000757)	(0.000649)	(0.000789)	(0.00138)
A	-0.0104***	0.0000566	0.000415	-0.00160
	(0.000757)	(0.000640)	(0.000775)	(0.00135)
AA	-0.0350***	-0.000777	-0.000340	-0.00262*
	(0.000750)	(0.000645)	(0.000788)	(0.00134)
AAA	-0.0207***	-0.00225***	0.000462	-0.00507***
	(0.000849)	(0.000698)	(0.000869)	(0.00141)
Risky financial assets$_{i,t-1}$				0.605***
				(0.0110)
Risky financial assets$_{i,t-2}$				0.0847***
				(0.00479)
Risky financial assets$_{i,t-3}$				0.0226***
				(0.00380)
Constant	-0.00189*	0.00115***	0.00574***	-0.00579
	(0.000997)	(0.0000970)	(0.00197)	(0.00411)
controls$_{it}$	Yes	Yes	Yes	Yes
year$_t$	Yes	Yes	Yes	Yes
sector$_i$	Yes	Yes	Yes	Yes
N	1,809,931	1,418,924	1,809,931	691,540
Number of instruments				61
Within R^2			0.0027	
Between R^2			0.0143	
Overall R^2	0.014	0.001	0.0104	

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Regressions on credit rating

7.3 Ownership structure

A repeated topic of this thesis is corporate governance and ownership structures, and our theoretical predictions are highly based on such measures. Rather than the focus of Duchin et al. (2017) on large and listed companies only, our larger data set including unlisted and small firms allows us to test for potential effects of the type of ownership. As pointed out in the section of theoretical predictions, poorer governance might lead to more risky financial assets, and it is clear that corporate governance and agency problems could be affected by ownership concentration. With this in mind, we wish to investigate whether ownership, e.g. the prevalence of blockholders, affects the portfolio of corporate financial assets.

We use the variable Herfindahl Index (HHI)[43] as a measure of ownership concentration, where a value of 1 means that we only have one owner, while the minimum value $1/N$ indicate that all owners have the same share. It is calculated as

$$HHI = \sum_{i=1}^{N} s_i^2 \tag{38}$$

and can possibly work as a proxy variable on potential exposure to agency costs. Shleifer and Vishny (1997) argue that increasing the ownership concentration, i.e. a HHI value closer to one, can encourage large shareholders to pursue the goal of maximizing shareholder value through activism. Because of this, as explained by Tirole (2006), will large shareholders be one of the important monitoring mechanisms in corporate governance. Further, in some small firms with high HHI, there could be few but large owners with a direct, informal contact with managers, so the distance between owners and management could be smaller, leading to fewer governance problems.[44]

In the case of more evenly distributed concentration of shareholders, i.e. a low HHI value, a free rider problem might occur, where shareholders rely on others to maximize their value. If this is the case, we might observe that potential agency problems are negatively correlated

[43] The measure is often used in industrial organization as a measure of market concentration, where s_i indicate market share of firm i.

[44] However, there could be more incompetence and hence confusion found in small firms, leading to investments in risky financial assets in line with the arguments of section 3.4.4.

with HHI, hence if firms invest more in risky financial assets when they are poorly governed, it could make the coefficients for HHI negative.

It is also possible to relate the HHI variable to the theoretical framework of Jensen and Meckling (1976) presented in section 3.2, and hence claim that by decreasing HHI, the retained fraction α of an entrepreneur also must decrease, making it less costly for her to consume non-pecuniary benefits F. Therefore, also consistent with the arguments above, a decreasing HHI could make the agency costs larger, which in turn is predicted in section 3.4.3 to make investments in risky financial assets larger. For instance, if a manager gets positive human capital returns by investing in risky financial assets, and she can do so on outsider shareholders' expense, it is theoretically predictable also here that HHI should have a negative coefficient in our regression equations. However, the obvious drawback to these arguments is that HHI simply measures ownership concentration, and insider ownership itself is hence not quantified. Therefore, although a low HHI must be associated with a low retained ownership α, a high HHI does not have to be associated with a high α, making this theoretical prediction somewhat weaker. Regardless, the prediction goes in the same direction as the arguments of Shleifer and Vishny (1997).

Another drawback of the Herfindahl index, which could be worth mentioning, partly related to the point above and pointed out by Overland et al. (2012), is its lack of explanation for the individual shareholders' relative power. For instance, if one shareholder owns twice as much as another one, it does not follow that the smaller shareholder has less influence than the larger. The smaller shareholder can form a winning coalition with a larger shareholder to get a majority vote. Furthermore, in small firms, there could be direct contact between owners and management, potentially independent of ownership stake.

We also find it interesting to test whether it matters what kind of shareholders there are in the firm, i.e. whether the firm is owned by individuals or firms, and whether the owners are foreign or Norwegian. We recognize that these measures might depend strongly on the type of the firm, even after our control variables are included, and it is therefore important to show caution before interpreting potential correlations causally.

We also include a variable for the total number of owners, as there could be effects from this as well. For instance, if the number of owners is one, the agency problems should be very limited as the owner and manager likely are the same person.[45] We run the following regression to test the effects of ownership structure:

$$\begin{aligned} Risky\ financial\ assets_{it} = \beta_0 + \gamma_1 HHI_{it} + \gamma_2 number\ of\ owners_{it} + \Theta' owned\ by_{it} \\ + \beta' controls_{it} + \Phi' year_t + s' sector_i + \varepsilon_{it}, \end{aligned} \tag{39}$$

where

$$owned\ by' = \begin{bmatrix} company & individuals & foreigners \end{bmatrix}'. \tag{40}$$

Table 8 shows the results of testing the effects of ownership structure. We can see that HHI yields significant results for all models except the Arellano-Bond estimation. The estimators indicate that firms with larger shareholders, i.e. with more concentrated ownership, invest more in risky financial assets. This result might not be consistent with the argument made by Shleifer and Vishny (1997). If we consider investing in risky financial assets as not being optimal in terms of maximizing firm value, e.g. if the firm is partly or fully concentrated financially, the results could contradict their hypothesis. On a different note, the positive sign of the coefficient potentially also contradicts the implications of the theory of Jensen and Meckling (1976), since it appears that a low HHI, giving less costly perquisites for the manager, does not lead to more risky investments, but less. However, there will, of course, be a lot of other factors potentially causing the investments in risky financial assets for a firm with high ownership concentration, not related to the manager's perks.

The Arellano-Bond estimation, controlling for possible dynamic panel bias, does not show a coefficient of HHI being significantly different from zero, and we will therefore not put too much weight on the positive coefficient. However, if we trust for instance the fixed effects estimation indicating a positive coefficient significant on a 1% level, it is economically

[45] It is clear that HHI and $number\ of\ owners$ are related measures, as the latter simply is the N of the former. However, as the variables carry different information, we find it desirable to include both. Also, the correlation between them is rather low, at $\rho = -0.13$. By running regressions with just one of them at the time, it does not alter the coefficients considerably, although the HHI coefficient of Arellano-Bond appears significant (on a 1% level) at 0.0044 if the number of owners is left out.

Dependent variable: Risky financial assets$_{it}$	(1)	(2)	(3)	(4)
	OLS	First difference	Fixed effects	Arellano-Bond
HHI	0.0300***	0.00185**	0.00384***	0.00280
	(0.000450)	(0.000925)	(0.00117)	(0.00173)
Number of owners	0.0000221***	-0.0000103	0.0000199	-0.0000472
	(0.00000558)	(0.00000685)	(0.0000181)	(0.0000343)
Company owned	-0.0128***	-0.000490	-0.00146**	0.0000686
	(0.000499)	(0.000561)	(0.000688)	(0.00113)
Individuals	0.0428***	0.00361***	0.01000***	0.000240
	(0.000500)	(0.000636)	(0.000752)	(0.00138)
Foreigners	-0.0282***	0.000967	-0.00222*	0.000655
	(0.000710)	(0.00107)	(0.00132)	(0.00209)
Risky financial assets$_{i,t-1}$				0.604***
				(0.00862)
Risky financial assets$_{i,t-2}$				0.0784***
				(0.00416)
Risky financial assets$_{i,t-3}$				0.0231***
				(0.00342)
Constant	-0.0573***	0.00121***	-0.00886***	-0.0157***
	(0.00158)	(0.0000919)	(0.00224)	(0.00424)
controls$_{it}$	Yes	Yes	Yes	Yes
year$_t$	Yes	Yes	Yes	Yes
sector$_i$	Yes	Yes	Yes	Yes
N	1,947,124	1,558,505	1,947,124	823,600
Number of instruments				81
Within R^2			0.0038	
Between R^2			0.0293	
Overall R^2	0.039	0.001	0.0235	

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Regressions on ownership structure

interesting since, after controlling for a lot of the fixed factors, ownership concentration correlates with the risk of the financial assets among non-financial Norwegian firms.

We find through some of the estimators that subsidiaries, i.e. company-owned firms, tend to invest less in risky financial assets. It is difficult to pinpoint the reason for this, and the literature on the topic seems scarce. However, one possible argument is that holding companies in the non-financial sector are to a large extent means of strategic operating importance. Thus, increasing financial asset risk in subsidiaries would not necessarily benefit the owner. Furthermore, it is imaginable that a firm might be less exposed to sources of agency conflict when another firm owns it because there might be interdependence between them and also less information asymmetry. Since our theoretical prediction is that firms with more agency problems invest riskier financially, it could support this indication.[46]

In our sample, the majority of firms are owned by one or more individuals. From the regression output in table 8 we can see that if individuals control the company, it has, according to FD and FE, more invested in risky financial assets compared to the other ownership structures. Fixed effects estimation further indicates on a 10% level that if the owners are foreign, the firm invests less in risky assets, but we do not put much weight on any of these relations in terms of economic inference since they appear weak.

In line with the arguments of Fama and Jensen (1983) that exposure to agency costs will depend on organizational form — since the separation of ownership and control varies across these forms, and since the features of the residual claim impacts decision rules — we have also run a regression solely with dummies indicating whether a firm is a sole proprietorship, a partnership, or has no clearly defined ownership, consistent with the descriptions of Berner et al. (2016).[47] The dummy variable that is left out is the one indicating limited responsibility,

[46]As always, there might also be factors that explain these relationships that we have not successfully controlled for, and hence the ownership measures might merely give a proxy variable on e.g. a firm's precautionary cash dependence.

[47]The reason why we omit variables of e.g. *number of owners* and HHI in this regression is that collinearity issues would arise because when *proprietorship* = 1, HHI and *number of owners* obviously equal 1 as well.

and the following regression is estimated:

$$\begin{aligned} Risky\ financial\ assets_{it} = \beta_0 + \gamma_3' org\ form_{it} + \beta' controls_{it} + \Phi' year_t \\ + s' sector_i + \varepsilon_{it}, \end{aligned} \tag{41}$$

where

$$org\ form' = \Big[partnership \quad ownerless \quad proprietorship\Big]'. \tag{42}$$

The resulting coefficients are seen in table 9, and we observe that the Arellano-Bond estimator indicates that sole proprietorships have significantly riskier corporate financial asset portfolios, consistent with the finding above of a positive coefficient on HHI. Therefore, as sole proprietorships cannot be exposed to agency costs arising from the separation of ownership and control, it is a further indication that risky financial assets can be found to a larger extent in non-financial Norwegian firms when governance problems are smaller.

There might be multiple reasons why proprietorships appear to invest their financial assets riskier, and it could come from a greater degree of incompetence in small proprietorships, consistent with section 3.4.4. However, it could also come from the rational hedging motives discussed in section 3.4.2, which in this case is not an agency problem since the owner-manager only hedges her own wealth. Nevertheless, aside from the coefficient of $proprietorship$ from Arellano-Bond, neither estimator appear to show a significant variation on the indicator variables of equation (42).

Taken together, the impact of ownership structure does not appear to be empirically strong, since our dynamic panel data approach does not suggest that there are any significant coefficients aside from the positive coefficient for $proprietorship$. Also, as mentioned above, it might be the case that e.g. HHI has a non-zero correlation to a firm's need for cash and that the indications of the fixed effects and first difference estimators suffer from omitted variable bias. Therefore, we will argue that this thesis finds fairly limited support of a notion of for instance blockholders affecting the risk of the portfolios of financial assets, and also for any major effects of ownership characteristics.

Dependent variable: Risky financial assets$_{it}$	(1)	(2)	(3)	(4)
	OLS	First difference	Fixed effects	Arellano-Bond
partners	-0.0507***	-0.0261	0.0125	0
	(0.000922)	(0.02418)	(0.0133)	(.)
ownerless	0.0581***	0.00069	-0.00180	0.00398
	(0.000979)	(0.002225)	(0.00331)	(0.00377)
proprietorship	-0.0384***	0.00347	0.00659	0.00630**
	(0.000909)	(0.00429)	(0.00942)	(0.00276)
Risky financial assets$_{i,t-1}$				0.589***
				(0.0237)
Risky financial assets$_{i,t-2}$				0.0870***
				(0.00354)
Risky financial assets$_{i,t-3}$				0.0244***
				(0.00294)
Constant	0.0159***	0.000766***	0.000511	-0.0120***
	(0.00101)	(0.0000795)	(0.00176)	(0.00321)
$controls_{it}$	Yes	Yes	Yes	Yes
$year_t$	Yes	Yes	Yes	Yes
$sector_i$	Yes	Yes	Yes	Yes
N	2,816,087	2,318,013	2,816,087	1,363,165
Number of instruments				148
Within R^2			0.0034	
Between R^2			0.0151	
Overall R^2	0.018	0.001	0.011	

Robust standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Regressions on organizational forms

7.4 Auditor's remarks

Annual reports are arguably the most important medium by which most companies communicate information to outsiders and investors, while being most likely the primary source of understanding a company and its accounts. Furthermore, any comments on these accounts made by the auditor are of great interest for outsiders and investors. Such information, if any, could help investors to make an informed decision. Also, very important in our context; it provides important signals about the quality of management, and thus is potentially important in mitigating agency problems. Because of course, as pointed out by Tirole (2006), audits are one of the most important monitoring mechanisms of corporate governance.

For this thesis, auditor's reports are interesting in multiple ways. First of all, since the auditor remarks likely are to some extent preventable by a firm's management, simply observing that a company has anything else than a 'clean' auditor report might itself be a proxy of poor corporate governance. However, this proxy is not perfect, as there could be firms where all owners know that there are no governance problems; thus the auditor remarks are not related to agency problems, and the remarks might just come from disagreement on accounting. With this caveat in mind, since we established in the section of theoretical predictions that poorer governance could lead to more risk-taking in the corporate financial assets of a firm, we start by running the following regression:

$$\begin{aligned} Risky\ financial\ assets_{it} = \beta_0 + \psi not\ clean_{it} + \beta' controls_{it} + \Phi' year_t \\ + s' sector_i + \varepsilon_{it} \end{aligned} \tag{43}$$

The resulting coefficients can be seen in table 10, and we observe that the FE and FD estimators indicate that if a firm has any remarks on its accounts, the firm invests significantly more in risky financial assets on average. Further, although not significant,[48] the Arellano-Bond estimator also indicates that there is a positive relationship between financial asset risk

[48] P-value of ψ is given by the Arellano-Bond estimator as 11.2%.

and unclean audit reports.[49] If we assume that auditor remarks are correlated with poor governance, the positive coefficients are consistent with our theoretical predictions.[50]

Dependent variable: Risky financial assets$_{it}$	(1)	(2)	(3)	(4)
	OLS	First difference	Fixed effects	Arellano-Bond
Not a 'clean' report	-0.00806***	0.000611**	0.00117***	0.00113
	(0.000392)	(0.000306)	(0.000369)	(0.000711)
Risky financial assets$_{i,t-1}$				0.674***
				(0.0121)
Risky financial assets$_{i,t-2}$				0.0908***
				(0.00545)
Risky financial assets$_{i,t-3}$				0.0309***
				(0.00435)
Constant	-0.0175***	0.000663***	0.00918***	-0.0137**
	(0.000861)	(0.000102)	(0.00172)	(0.00427)
$controls_{it}$	Yes	Yes	Yes	Yes
$year_t$	Yes	Yes	Yes	Yes
$sector_i$	Yes	Yes	Yes	Yes
N	1,723,552	1,138,168	1,723,552	617,313
Number of instruments				47
Within R^2			0.0023	
Between R^2			0.0143	
Overall R^2	0.018	0.001	0.011	

Robust standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 10: Regressions on unclean auditor's reports

To bring the analysis of this section further, it could also be worthwhile to look explicitly at the comments, as it is not unimaginable that for instance if a firm has made an unlawful loan to an individual, i.e. is given letter code A by the auditor, as seen in the description of the

[49]We note that OLS in levels indicates a negative relationship, but as we have argued previously, this likely arises from a correlation between explanatory variables and time-invariant firm-specific effects. Hence, OLS in levels is possibly biased and probably less reliable compared to the other estimators.

[50]As a robustness measure, we interact the variable *not clean*$_{it}$ with HHI above. The procedure does not considerably alter the coefficient.

different remarks in table 11, the firm could be remarkably poorly governed.[51] Furthermore, since also many of the other comments could imply that managers act in ways that are contrary to shareholders' interests, a lot of them could potentially indicate agency problems between managers and shareholders.

Code	Definition
D	Equity capital lost in whole or in part.
A	Unlawful loan to shareholder, general manager, board member or others.
B	Tax withholdings have not been deposited in a dedicated account, or have not been fully paid.
L	The auditor refers to the notes/annual report and accounts.
C	Missing documentation and internal control.
K	The company is involved in a dispute.
I	The company has acquired its own shares in contravention of the Limited Liability Companies Act.
J	The company's assets have not been transferred to the company.
E	Uncertainty about whether the requirements for the ongoing concern assumption are met.
H	The annual accounts have not been submitted by the statutory deadline.
M	Other clarifying comments.
Reservations	
O	The accounts for the previous year were not audited by the company's present auditor, and the opening balance cannot be verified.
S	Missing documentation because of a special event (force majeure).
R	Weaknesses in the company's procedures/internal control/documentation.
N	Valuation of assets.
P	The annual accounts do not contain sufficient information (e.g. about whether there is a risk of substantial losses on the sale of the company's assets should it be dissolved).
T	Other reservations not mentioned elsewhere.
Other matters	
Y	Negative comments on the auditor's report.
Z	The auditor is unable to state an opinion.

Table 11: Auditor's comments and definitions. From Berner et al. (2016).

Figure 5 below shows the frequency of the different remarks made by the auditor. The two most common remarks in every quintile are missing the filing deadline of annual accounts as well as equity capital lost in whole or in part, i.e. H and D respectively. Some of the remarks are considerably less prevalent, as seen in the figure, and for instance is the remark S, i.e. missing documentation because of a special event, is not registered at any of the firms in our final sample.

[51]However, the remark could also be unrelated to governance. As mentioned above, if there are no governance problems, we might have a situation where owners and managers agree on taking advantage of the system.

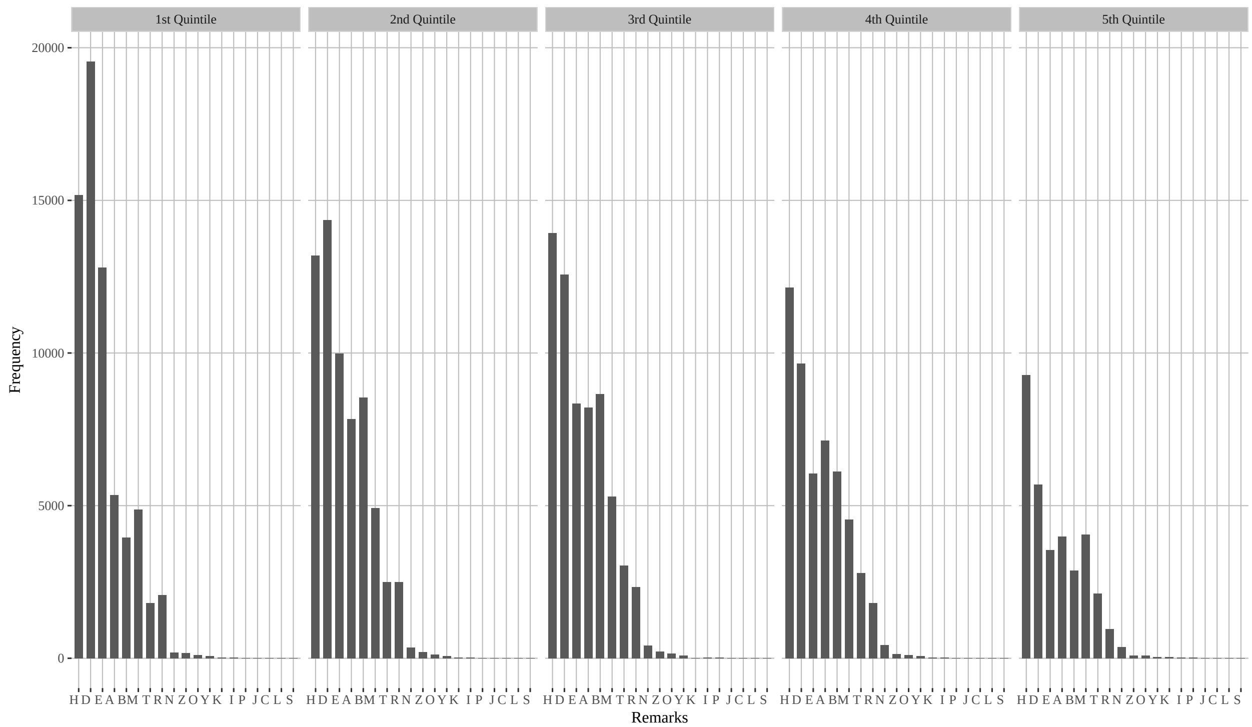

Figure 5: Auditor's remarks to the accounts by size. The plot shows the most common remarks made by the auditors. The plot is grouped into quintiles by the log of total assets, where the smallest firms are in the first quintile, while the largest ones are in the fifth quintile.

As discussed extensively throughout this text, the size of the firm likely matters, and this appears to be the case for this section as well. The total number of remarks seems to decrease in size, with the smallest firms having almost twice as many remarks as the largest firms.[52] One could argue that the reason for this is that larger firms are likely more concerned about governance problems, or that, unrelated to governance, some small firms can more easily find agreement among owners to take advantage of the system. Furthermore, smaller firms with fewer employees might not have the same capacity to follow, and less experience with, important accounting rules, which also could lead to a higher frequency of remarks.

Because some auditor remarks are registered very rarely, as can be seen in figure 5, we omit some of the remarks from the regressions. Hence, to test for the effects the different remarks might have on the risk in the corporate financial asset portfolios, we run the following

[52]The total number of remarks in each quintile are as follows, from firm sizes smallest to largest: **(1)** 66,183 **(2)** 64,654 **(3)** 63,325 **(4)** 51,060 **(5)** 33,181

regression:

$$\begin{aligned} Risky\ financial\ assets_{it} &= \beta_0 + \Psi' remarks_{it} + \beta' controls_{it} + \Phi' year_t \\ &+ s' sector_i + \varepsilon_{it}, \end{aligned} \tag{44}$$

where

$$remarks' = \begin{bmatrix} A & B & D & E & H & M & N & R & T & Z \end{bmatrix}'. \tag{45}$$

As can be seen in the results of table 12, some auditor remarks appear to have a significant effect on the composition of risk in the financial assets. For instance, both FD and Arellano-Bond indicate on a 1% level that if a firm has not deposited tax withholdings into a dedicated account, or has not fully paid them, it has on average a significantly riskier corporate financial asset portfolio. This could come from rational financial asset management if penalties for paying taxes late are so small that expected returns on investments in financial assets are higher than expected penalties. In Norway, wrongly or neglected deposits of tax withholdings could result in two years in prison, according to the law 'Skattebetalingsloven' §18-1 from 17 June 2005. Further, the law 'Forsinkelsesrenteloven' §3 from 1 January 1978 states that the interest rate on arrears is eight percentage points above the prevailing key policy rate. Therefore, although perhaps depending on the unknown probability of getting caught, we will argue that it appears to be a fairly costly financial asset management strategy.

On a different note, although not yielding broad consensus across our statistical estimators, the fixed effects estimator indicates that if equity capital is lost in whole or in part, the firm invests significantly riskier. This could be consistent with the concept of asset substitution, arising from the agency conflict between equity and debt holders, i.e. that firms under distress might substitute safe assets with risky assets and hence increase the risk for creditors. In such a case, the objective is to increase the equity value by increasing a firm's upside risk, since equity holders have limited downside risk by holding a call option on the firm.

Some other coefficients are appearing more or less statistically significant across the other auditor's remarks as well. However, we will argue that the economic effects of the comments apart from the two discussed above seem fairly limited.

Dependent variable: Risky financial assets$_{it}$				
	(1)	(2)	(3)	(4)
	OLS	First difference	Fixed effects	Arellano-Bond
A	0.00176	-0.000657	-0.000654	0.000461
	(0.00109)	(0.000822)	(0.000991)	(0.00205)
B	-0.0169***	0.00152***	0.000781	0.00433***
	(0.000816)	(0.000570)	(0.000692)	(0.00151)
D	-0.00643***	0.000276	0.00118**	-0.00138
	(0.000687)	(0.000459)	(0.000539)	(0.000934)
E	-0.0130***	0.00100**	0.00135**	0.00101
	(0.000721)	(0.000502)	(0.000608)	(0.00114)
H	0.00236***	0.000749	0.000700	0.00130
	(0.000795)	(0.000514)	(0.000618)	(0.00115)
M	-0.0135***	-0.00153**	-0.00271***	-0.000592
	(0.00103)	(0.000679)	(0.000824)	(0.00124)
N	0.00545	-0.00122	0.00679*	-0.0104
	(0.00526)	(0.00328)	(0.00371)	(0.00661)
R	-0.0181***	0.000538	0.000772	-0.00355
	(0.00142)	(0.000967)	(0.00108)	(0.00266)
T	-0.0117***	-0.000375	-0.00229*	0.00123
	(0.00150)	(0.00103)	(0.00118)	(0.00218)
Z	-0.00586	0.000572	-0.000147	-0.00479
	(0.00542)	(0.00443)	(0.00469)	(0.0145)
Constant	-0.0178***	0.000660***	0.00909***	-0.0135***
	(0.000859)	(0.000102)	(0.00172)	(0.00428)
$controls_{it}$	Yes	Yes	Yes	Yes
$year_t$	Yes	Yes	Yes	Yes
$sector_i$	Yes	Yes	Yes	Yes
3 *lags of risky fin.*				Yes
N	1,723,552	1,138,168	1,723,552	617,313
Number of instruments				56
Within R^2			0.0023	
Between R^2			0.0143	
Overall R^2	0.018	0.001	0.011	

Robust standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 12: Regressions on auditor's remarks

8 Concluding remarks and discussion

An argument which has dominated corporate finance theory for decades is that excess cash, i.e. truly free cash flows, should be paid out to shareholders. This comes from the idea that if firms hold too much cash, agency problems lead them to spend it on inefficiencies which moves the firm away from profit maximization. Therefore, in corporate finance textbooks, it is advocated that mechanisms should be put into place to make firms pay out excess cash to shareholders.

In Norway and elsewhere, the amounts of cash holdings and other financial assets have increased significantly over the latest couple of decades, both relative to total assets and in absolute numbers. Whether or not this cash is efficiently spent in firms is an essential question and a potential determinant of welfare losses in the overall economy. With that in mind, exploring firm behavior in terms of cash reserves is an empirically important task, which on the outset was our main motivation for our empirical studies.

A potential use of excess cash that in most theoretical cases are not considered optimal is investing it in risky financial assets. The theoretical predictions of our thesis show that rather strict assumptions are needed to rationalize the investments in shares, corporate bonds, or other risky financial assets. Therefore, previous findings in the US, i.e. that large industrial firms do invest heavily in for example stocks and corporate bonds are arguably a concern. In our sample, across all types of Norwegian non-financial companies, the picture is different, as there is a smaller fraction that invests in risky financial assets. However, this is as expected, and it is imaginable that if future research assesses both small and unlisted companies in the US, the fraction of firms investing in risky corporate financial assets is likely fairly small in the US as well.

We estimate determinants of risky financial assets by using an econometric approach that has not been applied in previous research that we know of, i.e. a dynamic panel data estimator, and we find some support to the normative theory that if a firm with risk-averse managers and shareholders is financially constrained, it should not invest in risky financial assets. Consequently, the financial asset portfolios of financially constrained Norwegian companies, i.e. firms with poor credit ratings, appear to be significantly less risky.

On other coefficients proving to be robustly significant, we find that firms' paying dividends invest significantly less in risky financial assets, while larger firms invest significantly riskier. Both of these coefficients have signs that seem economically sensible, especially if we imagine that free cash flow spent on dividends or risky financial assets are mutually exclusive alternatives. The positive coefficient for the size of the firm could further support the point above on financial constraints, as it could be an indication of the indirect effect of larger firms having greater access to financial markets and hence higher propensity to invest their cash in risky financial assets.

Because our data sample also consists of small and unlisted firms, unlike previous research, we measure the potential effects the ownership structure has on the risk of the corporate financial asset portfolios of Norwegian firms. We find limited support for a hypothesis that ownership structure should strongly affect the preferences of firms on investing in risky financial assets. The few indications we get, however, points in the direction that higher ownership concentration, measured by the Herfindahl index, is associated with more risk-taking in financial assets. Further supporting this finding; proprietorships appear to invest significantly riskier in such assets. These results might be in contrast to our theoretical predictions, and although there could be a lot of causes for it, it could be an indication that Norwegian non-financial firms with fewer governance concerns actually invest riskier.

By exploring the effects of auditor's remarks in a quest of identifying firms where the quality of governance is poor, which is theoretically expected to affect the risk of financial investments, we find that both the first-difference and fixed effects estimators indicate that firms receiving remarks invest significantly riskier in financial assets. More concretely on the various comments, we find that firms not depositing tax withholdings into a dedicated account or not fully paying them, appear to invest significantly riskier. As discussed above, this could be a rational asset management strategy assuming low expected penalties for such behavior. On a different remark, we find some indications that if equity capital is lost fully or partly, the firms increase the risk of their financial asset portfolios, possibly consistent with the agency problem of asset substitution.

As our theory section propose that it is in a lot of cases difficult to rationalize investments in risky financial assets, potential policy measures should be related to the possible suboptimality of the risky investments. Therefore, parallel to the common argument that policy measures should be aimed at making firms pay out excess cash to shareholders, they could be aimed at requiring transparency of the investments in risky financial assets. Accordingly, in the non-financial firms with excess cash, where investments in risky financial assets are potentially not maximizing firm value, shareholders can be informed if such investments are made.

For future research, it could be interesting to explore the time dimension of risky financial assets to a greater extent. This thesis has mainly concerned itself with cross-sectional differences between firms, and hence which firm characteristics that might be associated with riskier financial asset portfolios. An alternative approach is to have a stronger focus on the time dynamics of the portfolios, i.e. how firms shift their portfolios over time. Assessing such a research question likely hinges on having a different data set than the one used in this thesis, both with more frequent observations and possibly more detailed microdata on the portfolios. Nevertheless, we will argue that more research on non-financial firms' investments in risky financial assets should have a safe place in the academic finance literature.

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Appendices

Appendix A Additional descriptive statistics

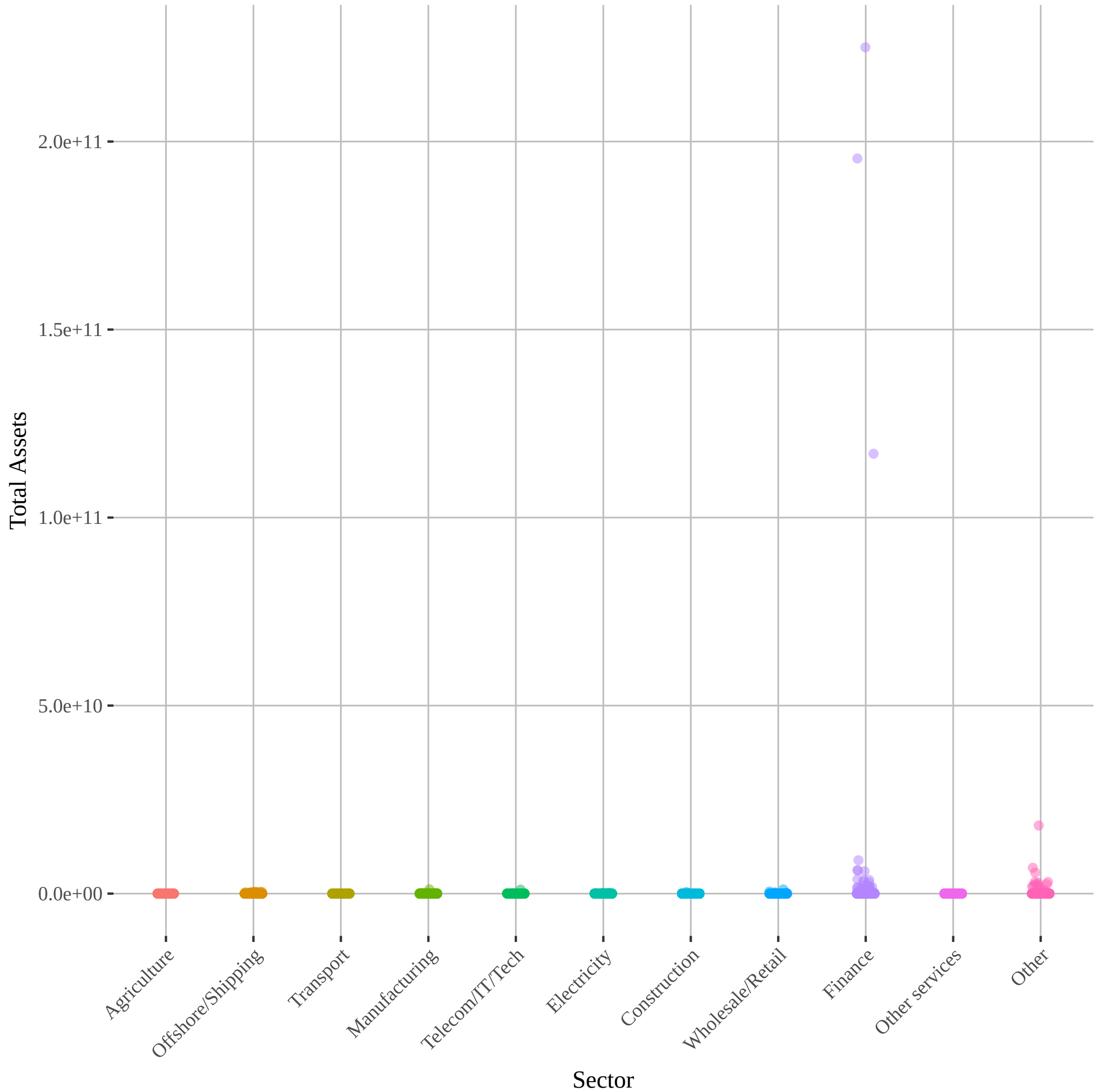

Figure 6: Illustration of outliers. Total assets for every company grouped by each sector. As seen in the 'Finance' sector, as well as 'Other', there are some obvious outliers.

	Dependent variable:	
	Log of Mean Total Assets	Log of Median Total Assets
	(1)	(2)
Year	0.01992***	0.02535***
	(0.005)	(0.004)
Constant	−32.380***	−43.253***
	(10.689)	(8.634)
N	17	17
R^2	0.482	0.698

Robust standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 13: Regressions on time trend in total assets

	Dependent variable:	
	Log of Mean Financial Assets	Log of Median Financial Assets
	(1)	(2)
Year	0.07212***	0.02825***
	(0.023)	(0.006)
Constant	−136.330**	−51.388***
	(46.684)	(12.007)
N	17	17
R^2	0.391	0.598

Robust standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 14: Regressions on time trend in financial assets

	Dependent variable:			
	Stocks	Bonds	Risky financial assets	Safe financial assets
	(1)	(2)	(3)	(4)
Year	-0.0006942^{***}	-0.0001316^{***}	-0.0006141^{***}	0.0006141^{***}
	(0.0002)	(0.00003)	(0.0002)	(0.0002)
Constant	1.427^{***}	0.268^{***}	1.281^{***}	-0.281
	(0.409)	(0.056)	(0.311)	(0.311)
N	17	17	17	17
R^2	0.436	0.595	0.512	0.512

Robust standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 15: Regressions on time trends in different asset classes

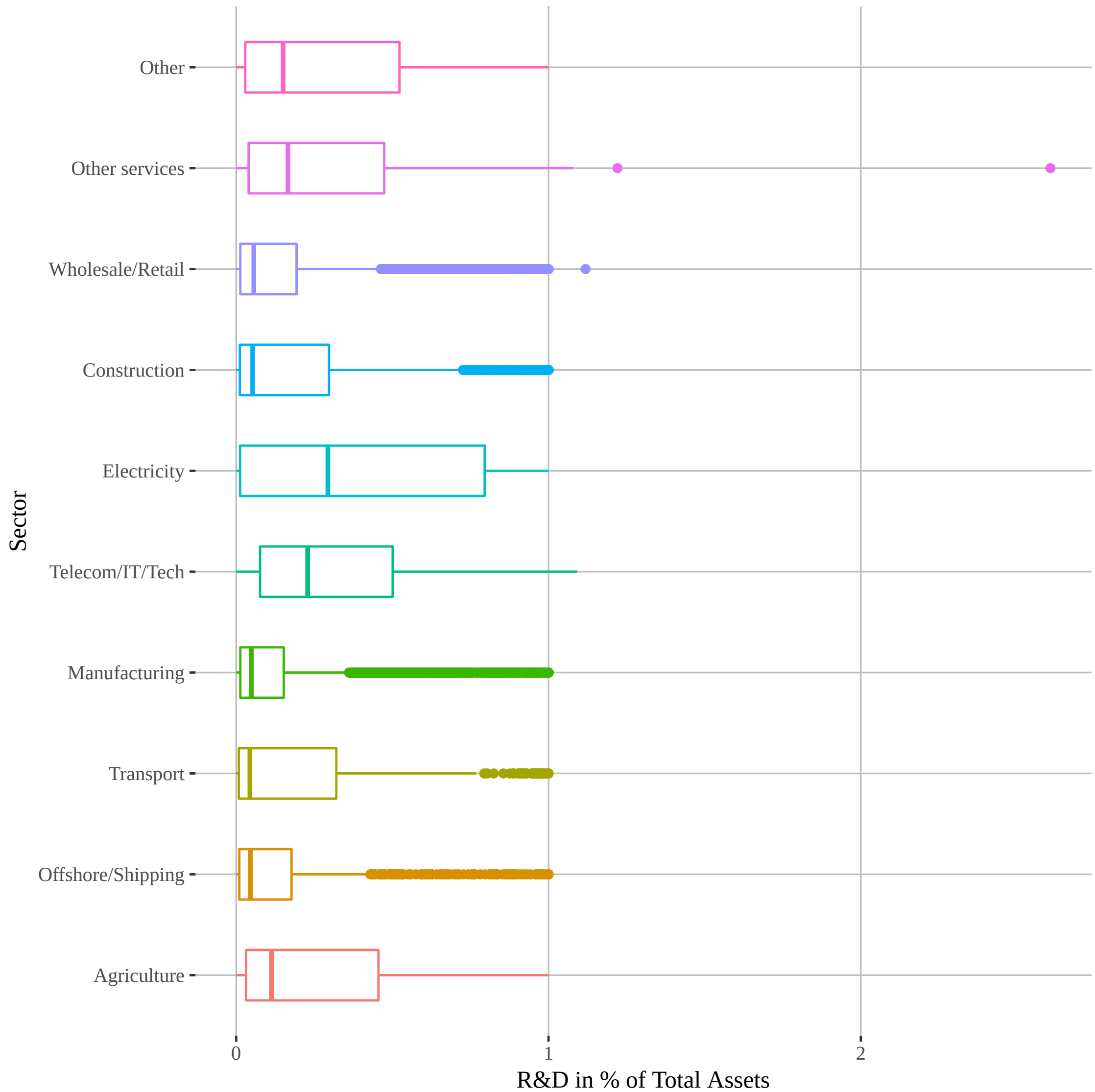

Figure 7: Investments in R&D per sector. The box plot indicates the 25%, median and 75% quartile for each sector where R&D is 5% or less out of total assets (99% of the firms). The figure shows some outliers where a relatively large part of total assets in the firm is devoted to R&D. Electricity, TTM, and Other services have the highest medians.

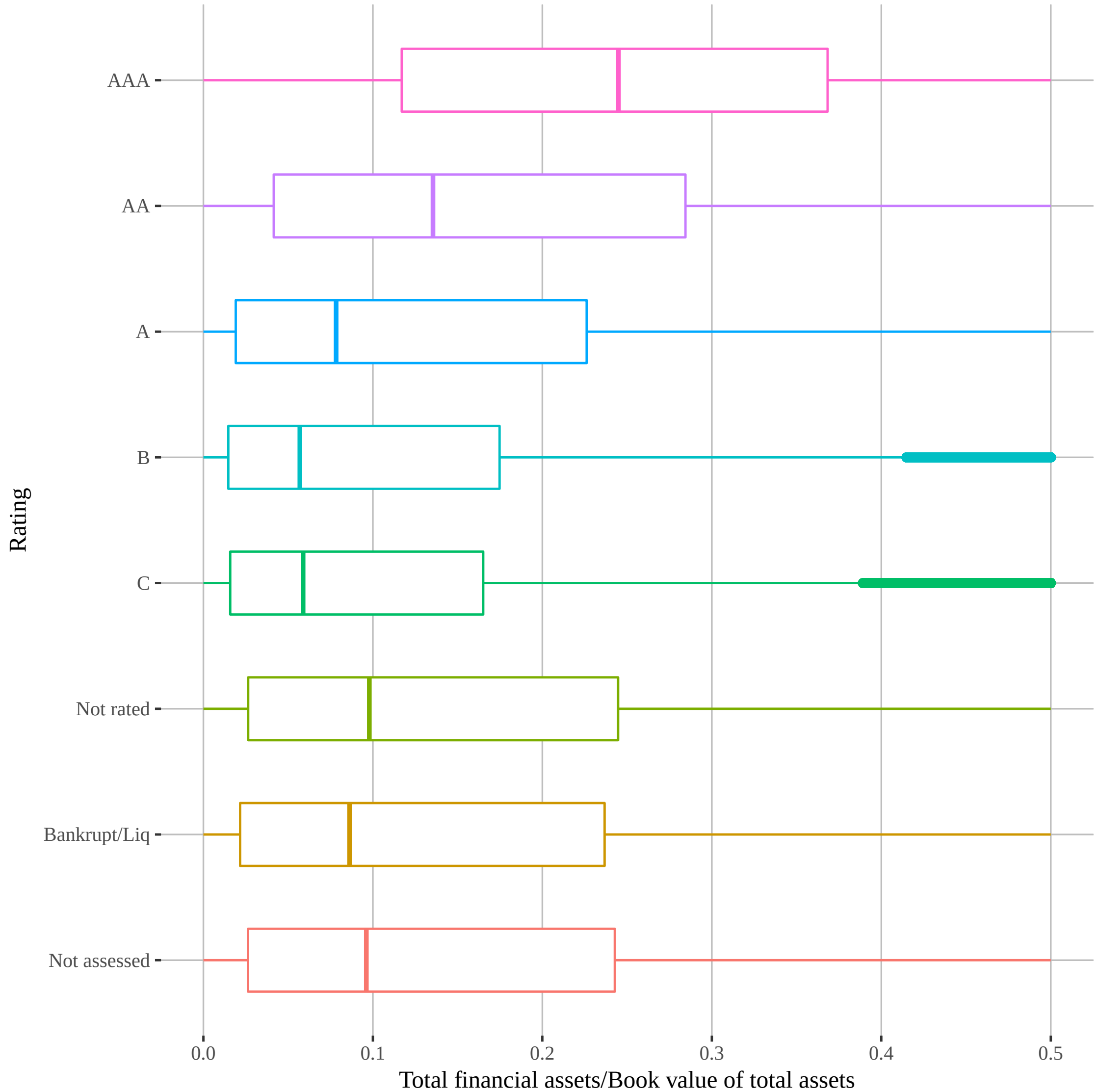

Figure 8: Investments in financial assets for each rating. The box plot indicates the minimum, lower quartile (25%), median and upper quartile (75%) for each credit rating, and outliers, measured as 3/2 time the upper quartile. To get a better visualization of the results, we constrained the proportion to be all observations with financial assets and those with less than 50% invested out of total assets (there are only three observations above this threshold).

Appendix B Data cleaning

B.1 Legal form of incorporation

Below we present a list of legal forms of incorporation that we have disregarded from our sample, as we find the following types of firms not relevant for our analysis. There were also some observations where the legal form of incorporation was missing, and such firms were hence also removed from our sample.

Legal entities not considered		**Legal entities considered**	
Variable	Description	Variable	Description
ANN	Other legal entity	ANS	Unlimited company
ANNA	Other legal entity	AS	Limited share company
AVD	Department	BA	Limited company
BBL	Coop. building association	DA	Shared liability
BRL	Housing cooperative	ENK	Sole proprietorship
ESE	Real estate partnership	GFS	Mutual insurance company
ESEK	Real estate partnership	IKS	Inter municipal company
FKF	County company	KS	Municipality
FLI	Associations etc.	NUF	Joint office
IKJ	Other non-legal persons	PK	Organizational unit
IKJP	Other non-legal persons	SPA	Savings bank
KF	Municipal company	STI	Trust/Foundation
KIRK	Church council		
KOM	Municipality		
KTR	Office		
KTRF	Office		
ORG	UK Limited company		
ORGL	Organization unit		
REV	Shipowning partnership		
SA	Cooperative		
SF	State company		
SÆR	Other, legally defined		
UTB	Real estate		
UTBG	Real estate		
VPF	Mutual fund		
VPFO	Mutual fund		

Table 16: Legal entities

Appendix C Other regressions

C.1 Aggregated yearly effects

Dependent variable: Risky financial assets$_{it}$	(1) OLS	(2) First difference	(3) Fixed effects	(4) Arellano-Bond
y00	0.00743***	0.00962***	0.00612***	
	(0.000781)	(0.000578)	(0.000434)	
y01	0.00230***	0	0.00249***	
	(0.000762)	(.)	(0.000492)	
y02	-0.00467***	-0.00309***	-0.00357***	
	(0.000746)	(0.000550)	(0.000539)	
y03	-0.00709***	0.00313***	-0.00403***	0.00374***
	(0.000723)	(0.000535)	(0.000550)	(0.000542)
y04	-0.0100***	0.00299***	-0.00442***	0.00352***
	(0.000717)	(0.000501)	(0.000577)	(0.000602)
y05	0.00363***	0.00442***	-0.00392***	-0.00317***
	(0.000715)	(0.000521)	(0.000605)	(0.000680)
y06	-0.00780***	0.00563***	-0.00258***	0.00369***
	(0.000716)	(0.000511)	(0.000626)	(0.000664)
y07	-0.00890***	0.00401***	-0.00230***	0.000939
	(0.000701)	(0.000510)	(0.000643)	(0.000664)
y08	-0.0105***	0.00124**	-0.00378***	-0.00344***
	(0.000704)	(0.000504)	(0.000658)	(0.000701)
y09	-0.00770***	0.00747***	0.000770	0.00216***
	(0.000705)	(0.000484)	(0.000669)	(0.000718)
y10	-0.00772***	0.00358***	0.00148**	-0.000411
	(0.000710)	(0.000474)	(0.000681)	(0.000706)
y11	-0.0112***	0.000765	-0.000475	-0.00446***
	(0.000692)	(0.000470)	(0.000683)	(0.000727)
y12	-0.0137***	0.00211***	-0.00128	-0.00426***
	(0.000676)	(0.000457)	(0.000687)	(0.000749)
y13	-0.0111***	0.00423***	0.000293	-0.00307***
	(0.000674)	(0.000458)	(0.000697)	(0.000769)
y14	-0.0113***	0.00345***	0.00109	-0.00363***
	(0.000667)	(0.000459)	(0.000708)	(0.000773)
y15	-0.0140***	0.00475***	0.00317***	-0.00283***
	(0.000658)	(0.000456)	(0.000716)	(0.000782)
Constant	0.00725***	0.000766***	0.000650	0.00105
	(0.000866)	(0.0000795)	(0.00175)	(0.00211)
$controls_{it}$	Yes	Yes	Yes	Yes
$sector_i$	Yes	Yes	Yes	Yes
3 lags of risky fin.				Yes
N	2,816,087	2,318,013	2,816,087	1,935,695
Number of instruments				151
Within R^2			0.0034	
Between R^2			0.0162	
Overall R^2	0.018	0.001	0.118	

Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 17: Regressions on yearly fixed effects

C.2 Industry fixed effects

Dependent variable: Risky financial assets$_{it}$				
	(1)	(2)	(3)	(4)
	OLS	First difference	Fixed effects	Arellano-Bond
agriculture	-0.0381***	0.00456	-0.00482	0.0068925
	(0.000893)	(0.00357)	(0.00543)	(0.0067797)
offshore	-0.0146***	-0.00866**	-0.0112**	-0.0183173***
	(0.00118)	(0.00359)	(0.00451)	(0.00587)
transport	-0.0397***	0.00318	-0.00149	0.00456
	(0.000771)	(0.00216)	(0.00377)	(0.00468)
manufacturing	-0.0516***	-0.00215	-0.00615**	-0.00396
	(0.000670)	(0.00157)	(0.00268)	(0.00271)
ttm	-0.0244***	-0.00109	-0.000825	-0.00326
	(0.000799)	(0.00225)	(0.00296)	(0.00480)
electricity	-0.0450***	-0.0160	-0.0166	-0.0374
	(0.00145)	(0.0117)	(0.0101)	(0.0264)
construction	-0.0107***	-0.000413	-0.000605	0.000747
	(0.000619)	(0.00104)	(0.0015396)	(0.00213)
retail	-0.0457***	-0.00111	-0.00655***	-0.00246
	(0.000606)	(0.000925)	(0.00156)	(0.00170)
otherservice	-0.0104***	0.000206	-0.000212	-0.000305
	(0.000612)	(0.000848)	(0.00132)	(0.00183)
Constant	0.00725***	0.000766***	0.000650	0.00105
	(0.000866)	(0.0000795)	(0.00175)	(0.00211)
$controls_{it}$	Yes	Yes	Yes	Yes
$year_t$	Yes	Yes	Yes	Yes
3 $lags\ of\ risky\ fin.$				Yes
N	2,816,087	2,318,013	2,816,087	1,935,695
Number of instruments				151
Within R^2			0.0034	
Between R^2			0.0162	
Overall R^2	0.018	0.001	0.118	

Robust standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 18: Regressions on industry fixed effects

C.3 Time dimension regressions

	Dependent variable:	
	‘Mean Financial Assets‘	‘Median Financial Assets‘
	(1)	(2)
Year	0.004^{***}	0.003^{***}
	(0.0003)	(0.0003)
Constant	-6.751^{***}	-5.570^{***}
	(0.503)	(0.577)
N	17	17
R^2	0.929	0.868

Robust standard errors in parentheses
$*p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Table 19: Regressions on time trends

	Dependent variable:				
	Quintiles				
	(1)	(2)	(3)	(4)	(5)
Year	0.011^{***}	0.006^{***}	0.004^{***}	0.001^{***}	-0.001^{***}
	(0.001)	(0.0004)	(0.0003)	(0.0002)	(0.0001)
Quintiles					
Constant	-22.517^{***}	-12.207^{***}	-7.094^{***}	-1.797^{***}	2.119^{***}
	(2.300)	(0.868)	(0.578)	(0.369)	(0.266)
N	17	17	17	17	17
R^2	0.869	0.932	0.913	0.641	0.801

Robust standard errors in parentheses
$*p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Table 20: Regressions on time trends

	Dependent variable:			
	Mean Financial Assets	Median Financial Assets	Mean Risky Financial Assets	Safe Financial Assets
	(1)	(2)	(3)	(4)
Year	0.004***	0.003***	−0.00003	0.004***
	(0.0003)	(0.0003)	(0.0001)	(0.0003)
Constant	−6.751***	−5.570***	0.088	−6.840***
	(0.503)	(0.577)	(0.190)	(0.516)
N	17	17	17	17
R^2	0.929	0.868	0.007	0.927

Robust standard errors in parentheses
$*p < 0.1$; $**p < 0.05$; $***p < 0.01$

Table 21: Regressions on time trends

	Dependent variable:						
	Group companies	Shares	Bonds	Financial instruments	Other financial instruments	Cash	Investments
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Year	0.004***	0.018	−0.008***	0.010	0.029***	0.244***	0.050***
	(0.001)	(0.017)	(0.003)	(0.011)	(0.003)	(0.026)	(0.017)
Constant	−7.997***	−34.538	16.372***	−19.105	−57.106***	−461.319***	−96.460**
	(2.020)	(34.512)	(5.339)	(22.840)	(6.410)	(52.471)	(33.327)
N	17	17	17	17	17	17	17
R^2	0.517	0.071	0.376	0.047	0.843	0.853	0.376

Robust standard errors in parentheses
$*p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Table 22: Regressions on time trends