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The Effect of Corporate Tax Avoidance on Investments, and its Relationship to Firm Liquidity

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Executive Summary

Despite decades of tax and investment research, little is known about the relationship between a firm's ability to avoid income taxes and its level of investments. For instance, several researchers conclude that firms' investment decisions are sensitive to cash flow variations. However, there is to our knowledge conducted little or no research on the relationship between liquidity and investment-sensitivity in relation to tax avoidance. The purpose of this study is to shed some initial evidence on these questions, and provide new valuable insight to both future and previous research on a frequently discussed topic.

Using firm-level panel data, we find both statistically and economically significant evidence of that investments is positively related to the cash flow effect of tax avoidance. We also find that higher liquidity firms tend to invest more and companies classified as "good liquidity firms" seem to have a greater investment sensitivity towards changes in the effective tax rate.

We strive to impose minimal requirements on our sample to maximize our coverage. Hence, our sample includes both listed and unlisted Norwegian companies for the 2006-2015 fiscal years. With respect to available data on each company's cash flow statement, including unlisted companies has its shortcomings. Since our dataset does not have a direct measure of investment or capital expenditures, we define three alternative Investment measures to ensure the robustness of our results. Further, tax avoidance is measured as the level of effective tax rates relative to pretax income. As in Dyreng et al. 2008, we define tax avoidance broadly to encompass anything that reduces the firm's taxes relative to its pretax accounting income.

All our results are thoroughly tested to ensure the robustness of our findings.

1.0 Introduction to research topic

According to Dobbins and Jacob (2016) the corporate tax level affects investments in two main ways - a lower required rate of return for profitable investments, as confirmed by Goh et al (2016), and higher after tax cash flows. Djankov et al (2010) also found that lower levels of corporate taxes lead to higher investments, which is in line with basic economic theory. Investment decisions have been found to be sensitive to cash flow variations (Fazzari et. al. 1988), and tax avoidance affects the cash flow of a company. Thus, we explore whether a change in the level of corporate taxes due to tax avoidance has the same influence on investments as a change in the level of corporate taxation due to changes in the tax code of a country. As an extension, we add liquidity factors to the relationship between tax avoidance and investment to see if it has a significant effect on determining the investment-sensitivity of a company.

It is important to emphasize that tax avoidance does not necessarily imply firms are engaging in anything improper. Tax avoidance is the legal utilization of the tax regime to one's own advantage, to reduce the amount of tax that is payable by means that are within the law. By contrast, tax evasion is the general term for efforts not to pay taxes by illegal means. In practice, of course, there are many gray areas where the dividing line is not clear, and sometimes the tax authorities may inappropriately characterize certain cases (Slemrod and Yitzhaki, 2002). Over the last 25 years, corporate tax avoidance has received much attention. For example, evidence of corporate tax avoidance led to the tax reform act of 1986, the largest overhaul of the U.S. tax code in history (Dyreng, Hanlon and Maydew, 2008).

There are ways in which our research and results can provide new insight to previous research. First, is the context in which we explore the relationship between tax avoidance and investments. Dobbins and Jacob (2016) utilize a natural experiment, and focus on change in the corporate tax rate, whereas our thesis focuses on tax avoidance, as proxied by a company’s effective tax rate without the access to a natural experiment. Second, we have not found any research on the link between liquidity and investment-sensitivity with regards to

taxes or tax avoidance. Finally, the relationship between tax avoidance, liquidity and investments, have not previously been explored using accounting data from Norwegian companies.

2.0 Previous literature

Separately, tax avoidance and firm investments are topics which have been researched extensively, and are common issues in every business education. According to Modigliani and Miller (1958), a firm´s financial status is irrelevant for real investment decisions in a world of perfect and complete markets. In a not so perfect world however, Fazzari et. al. (1988) emphasizes that the link between financing constraints and investment varies by type of firm. They tested two main hypotheses. First, firms which exhaust nearly all their low cost internal funds should be more sensitive to fluctuations in their cash flow than firms that pay high dividends. And second, Liquidity should have a greater effect on investment for low-dividend firms than for high dividend firms. They found that financial effects were generally important for investment in all firms. But the result consistently indicated a substantially greater sensitivity of investment to cash flow and liquidity in firms that retain nearly all their income. These results are also in line with more recent research by Kaplan and Zingales (1995) and Cleary (1999), who found that less financially constrained firms exhibit greater investment-cash flow sensitivity than those classified as more financially constrained. The high investment-cash flow sensitivities appear to be driven by managers choosing to rely primarily on internal cash flow for investment, despite the availability of low cost external funds (Kaplan and Zingales 1995). Hovakimian (2009) adds that the relationship can be explained by the company life-cycle hypothesis. First, given very low starting levels, it should, theoretically, take a long time until cash flows become high enough to serve as a considerable source of financing. Second, without current investments, higher cash flows in the future may not materialize. Thus, firms invest most when their cash flows are lowest using primarily external financing (Hovakimian 2009).

Moving on, the question is how taxes, and especially tax avoidance has been found to influence investment decisions. Taking advantage of a natural experiment, Dobbins and Jacob (2016) performed a study on how corporate tax

cuts affects investments, exploiting statutory tax cuts in Germany in 2008, when the corporate tax rate was cut from 39% to 29%. They found that firms with limited access to international profit shifting opportunities respond more strongly to a corporate tax cut than firms with foreign operations and the opportunity to shift income across borders. Furthermore, they found stronger investment effects for firms more reliant on internal funding. These firms benefit not only from reduced cost of capital, but also from higher after-tax cash flow. The results were tested using a difference-in-difference-in-differences test comparing the result with other EU-economies, to rule out the possibility of the financial crisis´ effect on the positive relationship.

A different set of researchers have also explored the relationship between taxes and investments using patent applications and patent citations as proxies for investment quantity and quality. Djankov et al. (2010) used information on corporate tax rates for 85 countries, and they could present cross-country evidence that corporate tax rates have a large and significant adverse effect on corporate investment and entrepreneurship. Furthermore, they discover that higher corporate tax rates are also associated with lower investment in manufacturing, but not in services, a larger unofficial economy, and greater reliance on debt as opposed to equity finance. In these new data, corporate taxes matter a lot, and in ways consistent with basic economic theory.

There are several factors affecting the extent to which companies choose to engage in corporate tax avoidance, or abstain from doing so. Richardson, Taylor and Lanis (2015) used information on Australian listed companies in a period spanning the global financial crisis in 2008 and found that the extent of corporate tax avoidance increased significantly during the global economic crisis. They postulated that the need to conserve capital or to meet the minimum capital needs of the firm is especially important in periods of financial distress so that the firm can maintain credit ratings, meet the requirements of debt covenants or to continue as a going concern. Furthermore, they argue that in times of distress the benefits from tax avoidance activities, in the form of increased cash flows outweigh the risks. This assumption is in line with the assumption that tax avoidance is beneficial to equity owners, but also risk engendering. On one hand,

Goh et al. (2016) find that the cost of equity is lower for tax-avoiding firms. This effect is stronger for firms with better outside monitoring, firms that likely realize higher marginal benefits from tax savings, and firms with higher information quality. The results suggest that equity investors generally require a lower expected rate of return due to the positive cash flow effects of corporate tax avoidance (Goh et al. 2016). On the other hand, Hasan et al. (2014) provide comprehensive empirical evidence that firms exhibiting greater corporate tax avoidance incur higher bank loan cost. Banks perceive tax avoidance activities as risk engendering and, accordingly, banks charge higher loan spreads when lending to firms with greater tax avoidance. This applies not only to interest rates and spreads, but also to non-price loan terms and debt covenants.

3.0 Research question and objectives of the thesis

As we have determined that changes in statutory tax rates has a significant effect on the level of firm investment, we find it interesting to research whether changes in corporate taxes due to *tax avoidance* has a similar effect. In addition, previous research has found that firm investment decisions are sensitive to cash flow variations, which is why we also want to explore the relationship between liquidity and investment-sensitivity in relation to tax avoidance. Especially, whether liquidity constrained firms have a higher, or lower investment sensitivity with regards to changes in effective tax rates. After reviewing some of the literature about tax avoidance and investments, we have found that there has been conducted little or no research on either of these relationships.

Our research helps determine whether changes in effective tax rates due to tax avoidance have a significant effect on firm investment decisions, without major changes in the statutory tax rates. This could strengthen findings by Dobbins and Jacob (2016) in that it defines a negative relationship between taxes and investment regardless of the situation. This relationship forms the basis for our first hypothesis:

$H_{1,1}$: Firm investment decisions are affected by the cash flow effect of tax avoidance.

If the relationship between tax avoidance and investment is like that of statutory tax rates and firm investments, we would expect the relationship between tax avoidance and investments to be positive. The assumption is that a reduction in corporate tax rates leads to higher investment levels (Dobbins and Jacob 2016). In addition, Aggarwal and Zong (2006) proved that investment levels are significantly positively influenced by levels of internal cash flows.

Building on the results found by Fazzari et. al. (1988), and Kaplan and Zingales (1995), we research to which extent the relationship between tax avoidance and investments is influenced by liquidity. Since FHP found a general positive relationship between liquidity and investments, we want to see if liquidity, as a proxy for financial constraints, can determine the investment-cash flow sensitivity of a company. Fazzari et. al. states that financially constrained firms may be more sensitive to changes in the average tax burden as well as to marginal tax rates. Furthermore, Kaplan and Zingales (1995) found that companies with *less* financial constraints may be *more* sensitive to cash flow variations than financially constrained companies, due to higher dependency on internal cash flow for investment funding. We wish to explore these connections ourselves both because it has not to our knowledge been conducted similar tests on Norwegian companies, and the link to tax avoidance remains unexplored. This leads us to the second hypothesis;

$H_{1,2}$: The liquidity of a company influences the Investment sensitivity with regards to tax avoidance.

We expect there to be a positive relationship between liquidity and investments. Building on previous research we also expect good liquidity firms to have a higher investment-sensitivity to changes in effective tax rates.

4.0 Methodology

4.1 Sample selection

Our sample selection starts with all Norwegian firms listed in the CCGR-database for the 2000-2015 fiscal years, and we strive to impose minimal requirements on our sample to maximize our coverage. In 2006, radical changes were incorporated in the Norwegian tax code. The aim from the legislator's point of view with this reform, was that companies, regardless of organization form, should be taxed by the same basic principles. For corporate shareholders, the exemption method was introduced to avoid double and triple taxation on dividends when it is paid from company to company, and only apply taxes when it is taken out of the corporate sector (SKD 4/06). To ensure the comparability of our tax measures across time, we avoid the 2004-2006 tax reform. Hence, our selected time-period is set from 2006 to 2015. Furthermore, we require non-missing data on the variables needed to compute our tax avoidance measures, during the selection period.

The period is set to include years before and after the financial crisis of 2007-2008, in addition to the oil price shock in 2014. Since Norway is a small open economy, and the level of investments is highly affected by the oil price, we exclude petroleum extraction companies from our dataset. In addition, we will use time fixed effects to account for these, and other events and factors in general market conditions outside the company's control. Following prior literature such as Richardson, Taylor and Lanis (2015), Dobbins and Jacob (2016) and Cleary (1999), we remove companies with certain Standard Industrial Classification (SIC) codes: Financial service activities, Insurance activities, Auxiliary financial services (SIC 64-66), Extraction of crude petroleum and natural gas (SIC 6), and regulated utilities (SIC 35-39). It is common to exclude these companies because of significant differences in the application of accounting policies and derivation of accounting estimates, in addition to exposure to different tax regulations. Further we want to exclude companies with revenues less than or equal to zero, or companies with a total equity of less than 1 000 000 NOK. This is to avoid inactive companies or those that are too small to compare to many companies in our sample due to differences in the application of accounting policies.

Companies that report inconsistent numbers and report unbalanced numbers in their balance sheets are also excluded from our sample.

Imposing these requirements results in a sample of 202.764 firm-years, corresponding to 62.907 unique firms that have an unbroken string of Tax on Income, Tax Payable, and Pretax Income.

4.2 Variables

4.2.1 Dependent variable

Due to limitations of our dataset we do not have a direct measure of investment or capital expenditures, and hence we must make an alternative measure. In line with the standard definition of investment in the literature adopted by Fazzari et. al. (1988), Aggarwal and Song (2005) and Dobbins and Jacob (2016) we define our first measure of investments as follows;

$$\textbf{Inv1}_{i,t} = (\textbf{Tangible } \textit{net fixed capital}_{i,t} + \textit{Depreciation}_{i,t} + \textit{Impairments} - \textit{Tangible net fixed capital}_{i,t-1}) / \textit{Tangible net fixed assets}_{i,t-1}$$

where $Inv1_{i,t}$ represents investment in fixed tangible assets for firm i during period t. We define investments as the difference in fixed tangible assets from t to t-1 normalized by the beginning-of-period fixed tangible assets as in Dobbins and Jacob (2016) and Cleary (1999). We also add back depreciation and impairments to measure it as precisely as possible following the examples Cummins, Hassett and Hubbard (1996). However, to assert the robustness of our specifications, we also estimate our regression with two alternative measures of investments. Even though we originally use the standard definition of investment in the literature, it is possible that this definition is not equally applicable to all companies. To correct for some of these differences we introduce the alternative measure based on change in total assets as proposed by Carpenter and Petersen (2002).

$$\textbf{Inv2}_{i,t} = (\textbf{Total assets}_{i,t} - \textbf{Total assets}_{i,t-1}) / (\textbf{Total assets}_{i,t-1})$$

It is important to recognize that the change in total assets include all elements of the asset side of the balance sheet, including accounts receivable and inventory

investment, which are important to the operation of firms in less capital-intensive segments (Carpenter and Petersen 2002). In addition, we also use a third measure of investments to further ensure the robustness of our results. The third measure is calculated using the change in total fixed assets (tangible + intangible), divided by the beginning of period total fixed assets.

$$Inv3_{i,t} = (Total\ fixed\ assets_{i,t} + Depreciation + Impairments - Total\ fixed\ assets_{i,t-1}) / Total\ fixed\ assets_{i,t}$$

This specification also accounts for changes in intangible investments such as fixed financial assets, and could mitigate some of the factors not captured by the first two measures.

4.2.2 Independent variables of interest

4.2.2.1 Tax avoidance

The independent variable of interest, with regards to our first hypothesis, is tax avoidance, and it is important to clarify at the outset how we define it. Following prior literature, tax avoidance is measured as the level of effective tax rates relative to pretax income. As in Dyreng et al. 2008, we define tax avoidance broadly to encompass anything that reduces the firm's taxes relative to its pretax accounting income. A company's level of investment has been found to rely heavily on the available free cash flow (Fazzari et. al. 1988; Djankov et. al. 2010; Dobbins and Jacob 2016). Hence, it is the cash flow effect of tax avoidance which we find most interesting for our research, and try to capture through our tax avoidance measurements.

The first measure we use is the effective tax rate as defined under GAAP (hereafter GAAP ETR):

GAAP ETR = Total Tax Expense *(current plus deferred tax expense)* ***/ Pre-tax Income*** *(before extraordinary items)*

Total tax expense is calculated as the sum of current tax expense and deferred tax expense, and we exclude extraordinary items from Pre-tax Income as in Dyreng et

al. (2008). This measure reflects aggressive tax planning through permanent book-tax differences. Examples of such tax planning are investments in tax havens with lower foreign tax rates (if foreign source earnings are classified as permanently reinvested), investments in tax exempt or tax-favored assets, and participation in tax shelters that give rise to losses for tax purposes but not for book purposes (Wilson, 2009).

The problem with GAAP ETR as a measure of tax avoidance is that it is only based on annual data. There can be significant year-to-year variation in annual effective tax rates, as well as undefined effective tax rates due to negative denominators, that can obscure inferences about a firm's tax avoidance (Dyreng et al. 2008). Another weakness of only using GAAP ETR as a measure of tax avoidance is that tax expense is calculated as the sum of current tax expense and deferred tax expense. Where deferred taxes represent taxes that will be paid (or refunded) in the future due to the reversal of temporary book-tax differences. A great deal of tax avoidance involves accelerating deductions and deferring income for tax purposes relative to book purposes, which reduces current taxes but increases deferred taxes. Because GAAP ETRs include both current and deferred taxes, they will not reflect such forms of tax avoidance (Dyreng et al. 2008).

To overcome the limitations of GAAP ETR's ability to reflect the cash flow effect of taxes, prior research suggests a key modification using cash taxes paid, known as CASH ETR, rather than GAAP tax expense (GAAP ETR). It is well known that GAAP tax expense and Cash tax paid can be very different numbers even over long horizons (Hanlon, 2003; McGill and Outslay, 2004). We include both measures in our analysis to capture a wider perspective of tax avoidance.

CASH ETR = Cash Taxes Paid / Pre-tax Income (less special items)

This measure reflects both permanent and temporary book-tax differences. CASH ETR reflects not only the assumption that managers view effective tax planning as the ability to minimize cash taxes paid (Dyreng et al. 2008), but also tax avoidance strategies that defer cash taxes paid to later periods. Cash effective tax rates considers the tax benefits of employee stock options, whereas GAAP ETR

(using total tax expense or only current tax expense) do not. Furthermore, CASH ETR is not affected by changes in estimates such as the valuation allowance or *tax cushion*. (Dyreng et al. 2008) One advantage of this metric is that it is free from possible accrual manipulation used to manage after-tax earnings. In addition, CASH ETR does not affect the tax expense on the financial statement. Following Dyreng et al. (2008), lower values of CASH ETR represent higher levels of tax avoidance.

Due to the limitations in our dataset, which does not include a cash flow statement, we use taxes payable in year t-1 as an approximation to taxes paid in year t. Taxes payable should be an accurate measure of cash taxes paid, as it has been reviewed and approved by an auditor. We do however acknowledge the limitations of this measure, in that there can be made changes to the taxes payable account by the tax authority if the auditor's assessment is faulty, or in case of disagreements.

4.2.2.2 Internal liquidity and Investment sensitivity

In our second hypothesis, we want to examine if *the liquidity of a company influences the Investment sensitivity with regards to tax avoidance.* We use financial slack as a stock measure of internal liquidity, to indicate a company's level of financial constraints. In effect, it is the company's savings which might help it get through a difficult period. As in Cleary (1999) we will measure financial slack as the sum of cash and marketable securities, 0.7 times accounts receivable and 0.5 times inventories, less accounts payable, then deflated by the firm's total assets, to get a comparable measure between companies. This variable is also used as a control variable when investigating the first hypothesis.

Further we divide the sample at the median value of financial slack, to separate above median from below median liquidity firms, as an indicator of "good" or "bad" liquidity. This gives us the liquidity dummy (*Good liquidity*), which is equal to 1 if the company's financial slack variable is above median, and zero otherwise. Since the goal is to explore whether or not high liquidity firms (*Good liquidity=1)* are more sensitive towards changes in effective tax rates, than those we regard as less liquid (*Good liquidity=0)*, we add an interaction term (λ)

between our liquidity dummy (*Good liquidity)* and tax avoidance measures (GAAP ETR and CASH ETR). This will be our independent variable of interest in our second hypothesis.

We acknowledge that our measure has its shortcomings, being aware that such a liquidity measure is highly generalizing, and does not account for the variation across firms and industries. Furthermore, we feel compelled to mention that our variable is not a direct measure of financial constraints, but rather an indicator of internal liquidity. Nevertheless, financial slack should be able to capture most relevant factors in assessing a company's liquidity.

4.2.3 Control Variables

In addition to our variables of interest, the following variables have been used because of their expected effect on firm investment expenditures as proxy variables for growth opportunities or firm liquidity because they have been associated with different levels of investment-cash flow sensitivity in previous research.

1. ***ROA:*** We include *ROA* as a measure of profitability, because it is generally expected that more profitable firms invest more due to higher availability to fund investments internally (Fazzari et al. 1988). The ratio will consist of Earnings before Tax and extraordinary items divided by Total assets.

2. ***Revenue Growth:*** Revenue growth is expected to affect firm investment as a proxy for growth opportunities. Revenue growth is defined as the change in revenues from the previous year's level, divided by the previous year's revenues.

3. ***Dividend Payout Ratio:*** Firms with lower dividend payout have been traditionally considered as more liquidity constrained and found to have higher cash flow sensitivity. Dividend payout may also have a more direct effect on firm investment through its relationship with growth opportunities. Specifically, firms paying lower dividends are more likely to have higher growth opportunities and, therefore, are likely to invest more according to Hovakimian (2009). Dividend payout ratio is calculated as Dividends divided by Net Income after Tax. Due to

limitations in our dataset we cannot include share buyback programs, which are a form of indirect dividends to shareholders. Share buybacks and dividends are commonly used to calculate an augmented payout ratio.

4. ***Firm Size:*** Firm size has been expected to affect cash flow sensitivity of investment for several reasons. Smaller firms are expected to face higher hurdles when raising capital. First, their borrowing costs are expected to be larger. Second, they get less analyst coverage and may have more difficulty accessing external sources of capital because of adverse selection problems (Myers and Majluf 1984). Third, transaction costs related to security issues decrease with the issue size, which is likely to be higher in larger firms. For similar reasons, smaller firms may also face a wider gap between the costs of external and internal financing. Thus, smaller firms have been expected to show higher investment-cash flow sensitivity. However, some studies also associate large firm size with more disperse ownership structure, higher likelihood of agency problems of overinvestment, and greater flexibility in investment timing, leading to higher cash flow sensitivity for larger firms. (Kadapakkam, Kumar and Riddick 1998). Hence, the relationship between cash flow sensitivity and firm size is ambiguous and we include Total Assets as an indicator of firm size as in Hovakimian (2009) and Dobbins and Jacob (2016). Further we also use the natural logarithm of Total Assets to handle problems with large outliers.

5. ***Firm age:*** Firm age, in combination with size might also affect firm investment levels directly since smaller and younger firms are expected to have higher growth opportunities. Also, older more established firms are expected to invest less because of mature markets (Hovakimian 2009). We measure firm *Age* by the natural logarithm of the number of years it has been operating.

6. ***Leverage:*** We also consider leverage, which, like firm size, has an ambiguous expected effect on investment-cash flow sensitivity and may also affect firm investment expenditures more directly. Leverage may affect investment in several ways. Due to reasons previously discussed by Myers (1977) and Jensen and Meckling (1976), excess leverage may impair a firm's ability to raise additional capital. However, high leverage for a certain group of firms may

be interpreted as high debt capacity and lower financial constraints. Leverage may also reduce the amount of free cash flow, which may curb the tendency of managers to overinvest as argued by Lang, Ofek, and Stulz (1996). Furthermore, leverage is related to interest expenses to be deductible for taxable income. This controls for the effect of debt on firms' incentives in tax planning. For instance, highly leveraged firms may have either a stronger motivation to avoid taxes to preserve cash to service the heavy debt burdens, or a weaker motivation due to the debt tax shield (Badertscher et al. 2010; Lim 2012). We measure leverage by total debt ratio, which is equal to the sum of long- and short term debt divided by total assets.

7. ***Asset Tangibility:*** Asset tangibility assess a firm's ability to obtain external capital, and principally, debt financing. We estimate asset tangibility by dividing the book value of a firm's net fixed capital over total assets as in Hovakimian (2009) and Hall (2012). Firms with lower tangibility of assets are more likely to have difficulties borrowing due to the lower collateral value of their assets. However, firms with lower asset tangibility are also more likely to operate in industries with higher growth opportunities.

4.3 Descriptive statistics

4.3.1 Dependent variables (INV1, INV2 and INV3)

Table 1 gives an overview on the distributional characteristics of our three investment measures. Clearly there are some extreme values in our sample which may strongly affect the suitability of the indicator to enter our regression model. To reduce potential "noise" from large outliers we winsorize all the Investment variables at p (0.05) p (0,025) p (0,01) each year.

Table 1: Summary statistics for dependent variable.

Measure	Variable	mean	sd	min	max	p25	p50	p75
(1)	INV 1	2.722	247.169	-1	95 170	0.000	0.062	0.478
	*INV 1	0.823	2.913	-1	22.580	0.000	0.062	0.478
(2)	INV 2	2.225	155.964	-0.999	38 719	-0.013	0.097	0.291
	*INV 3	0.258	0.703	-0.543	5.099	-0.013	0.097	0.291
(3)	INV 3	3.443	254.885	-1	95 170	0.000	0.066	0.429
	*INV 3	0.757	2.851	-0.994	22.472	0.000	0.066	0.429

** winsorized at bottom 1 % and upper 99 %*

4.3.2 CASH ETR & GAAP ETR

Table 2 presents distributional characteristics of CASH ETR and GAAP ETR. Even when income before tax is positive, non-meaningful CASH ETR (GAAP ETR) can arise when taxes paid (tax on income) are negative (causing negative ETRs) or are so high as to exceed Income before tax (causing a ETR greater than 1). When there are values that are considerably different from others, they may strongly affect the suitability of the indicator to enter a statistically-based model. Outliers bias the mean, inflate the standard deviation, and affect all subsequent analysis (Stock and Watson, 2012). To make CASH ETR (GAAP ETR) more interpretable and reduce potential "noise" from large outliers we winsorize both at bottom 2,5 % and upper 97,5 % level each year. This transforms the most extreme observations that fall outside the band from zero to one. This gives an average CASH ETR (GAAP ETR) of 20,61% (22,41%) and median of 25,97% (27,89%) respectively.

Table 2: Summary statistics on our two independent variables of interests

Measure	Variable	mean	sd	min	max	p25	p50	p75
(1)	GAAP ETR	0.235	2.455	-359	459	0.185	0.279	0.284
	*GAAP ETR	0.224	0 .121	0.000	0.468	0.185	0.279	0.284
(2)	CASH ETR	0.219	2.863	-681	240	0.004	0.260	0.289
	*CASH ETR	0.206	0.161	0.000	0.679	0.004	0.260	0.289

** winsorized at bottom 2.5 % and upper 97.5 %*

4.3.3 Control variables

All control variables (except Leverage) in the regressions are winsorized at the bottom 1 % and upper 99 % level each year to handle problems with large outliers. The following control variables are used in assessing both hypotheses.

Table 3: Summary statistics on our control variables

	Variable	mean	sd	min	max	p25	p50	p75
(1)	Rev. growth	1.979	294.973	-0.999	127 350	-0.066	0.050	0.220
	*Rev. growth	0.284	1.289	-0.932	10.089	-0.066	0.050	0.220
(2)	ROA	0.160	1.075	-20.624	466.274	0.042	0.122	0.241
	*ROA	0.159	0.176	-0.279	0 .803	0.042	0.122	0.241
(3)	POR	0.176	35.062	-15 000	1 556	0.000	0.000	0.251
	*POR	0.222	0.473	0.000	2.907	0.000	0.000	0.251
(4)	lnTA	15.866	1.115	13.822	25.096	15.083	15.684	16.431
	*lnTA	15.857	1.073	14.119	19.493	15.083	15.684	16.431
(5)	Slack	0.492	0.269	-0.353	1.920	0.286	0.504	0.700
	*Slack	0.493	0.270	0.003	0.996	0.286	0.504	0.700
(6)	Tang	0.231	0.285	0.000	1	0.011	0.095	0.376
	*Tang	0.231	0.284	0.000	0.977	0.011	0.095	0.376
(7)	Age	14.584	13.014	0.000	170	6	11	20
	lnAge	2.347	0.905	0.000	5.136	1.792	2.485	2.996
	*lnAge	2.345	0.900	0.000	4.263	1.792	2.485	2.996
(8)	LEV	0.484	0.244	0.000	0.999	0.294	0.502	0.681

** winsorized at bottom 1 % and upper 99 %*

Table 3 presents descriptive statistics for the independent variables used in the regressions with investments (INV1, INV2, INV3) as the dependent variable. After winsorizing the Payout ratio at 1% and 99 %, there are no observations with negative payout ratio, and this solves the statistical problems with ranges from negative to positive. Furthermore, the winsorization of the other variables also produce more "normal" values. Leverage is kept as-is, since it is a ratio, consistently between 0 and 1.

4.3.4 Correlation

Table 4: Correlation matrix including all variables

	^INV 1	^INV 2	^INV 3	^^GAAP ETR	^^CASH ETR	^Rev. growth	^ROA	^POR	^lnTA	^Slack	^Tang	^Age	LEV
^INV 1	1.0000												
^INV 2	0.2677*	1.0000											
^INV 3	0.5845*	0.3641*	1.0000										
^^GAAP ETR	-0.0100*	-0.0499*	-0.0084*	1.0000									
^^CASH ETR	-0.0372*	-0.0813*	-0.0245*	0.6734*	1.0000								
^Rev. growth	0.0727*	0.3719*	0.0791*	-0.0516*	-0.0847*	1.0000							
^ROA	0.0195*	0.2608*	0.0583*	0.1938*	0.1224*	0.1650*	1.0000						
^POR	-0.0167*	-0.0735*	-0.0280*	0.1424*	0.1677*	-0.0437*	0.1010*	1.0000					
^lnTA	0.0284*	0.0884*	0.0134*	-0.0590*	-0.1269*	-0.1462*	0.0584*	0.0489*	1.0000				
^Slack	-0.0085*	0.0050	-0.0372*	0.1013*	0.1416*	-0.0057	0.3417*	0.1025*	-0.2608*	1.0000			
^Tang	-0.0268*	-0.0313*	-0.0257*	-0.0120*	-0.0391*	-0.0233*	-0.2473*	-0.0841*	0.1301*	-0.6747*	1.0000		
^Age	-0.0745*	-0.2030*	-0.0955*	0.0049	0.0082*	-0.1419*	-0.1535*	0.0867*	0.1072*	0.0063*	0.0198*	1.0000	
LEV	0.0555*	0.0876*	0.0331*	0.1757*	0.0700*	0.0212*	-0.0802*	0.1197*	0.2971*	-0.2730*	0.2107*	-0.0457*	1.0000

^ winsorized at bottom 1 % and upper 99 %
^^ winsorized at bottom 2,5 % and upper 97,5 %
** significant at 99%*

Table 4 presents the pairwise correlations between the dependent and independent variables. Since the standard correlation estimate can be heavily influenced by extreme values, we use the winsorized correlation to compensate for this by setting the tail values equal to a certain percentile value. As expected, there are strong positive correlations between the investment variables, with correlations ranging from 0.36 for INV2 and INV3 to 0.58 for INV1 and INV3. CASH- and GAAP ETR are also not surprisingly highly correlated at 0.67. Interestingly, we find a negative correlation between the tax avoidance measures and all the different investment measures, although at very low levels ranging from -0.08 to -0.01. None of the other pairwise correlations exceed 0.37 in absolute value, and many are below 0.1. Finally, we find financial slack to be negatively correlated with all investment measures, ranging from -0.013 to -0.008.

4.4 Regression

With regards to our first hypothesis, we want to check if *investment decisions are affected by the cash flow effect of tax avoidance.* Hence, we arrive at the following baseline regression model,

Eq. (1)

$$Inv_{i,t} = \beta_0 + \beta_1 \theta_{i,t} + \beta_2 Tax\ avoidance_{i,t} + \alpha_i + \alpha_t + \varepsilon_{i,t}$$

where the investment ($Inv_{i,t}$) of firm *i* in year *t* is the dependent variable, and *Tax avoidance* is the independent variable of interest. The list of control variables ($\theta_{i,t}$) includes; *ROA, Sales Growth, Dividend Payout Ratio, Financial Slack, Leverage, Asset Tangibility*, *Firm Size(lnTA) and Age,* all defined as described in section 4.2.3. Eq. (1) is estimated for each of the investment and tax avoidance measures as presented in section 4.2.1 and 4.2.2.

In our second hypothesis, we want to examine if *the liquidity of a company influences the Investment sensitivity with regards to tax avoidance.* Hence, we extend our model to include the liquidity dummy (*Good liquidity*) and the interaction term ($\lambda_{i,t}$) as described in section 4.2.2.2. This leads us to the following regression,

Eq. (2):

$$Inv_{i,t} = \beta_0 + \beta_1 \theta_{i,t} + \beta_2 Tax\ avoidance_{i,t} + \beta_3\ Good\ liquidity_{i,t} + \beta_4\ \lambda_{i,t} + \alpha_i + \alpha_t + \varepsilon_{i,t}$$

where $Inv_{i,t}$, Tax avoidance$_{i,t}$ and all the control variables ($\theta_{i,t}$) are the same as in *Eq. (1)*. With regards to the second hypothesis, the independent variable of interest is now $\lambda_{i,t}$.

In both Eq. (1) and Eq. (2), we control for unobservable differences over time and between companies, using time- and firm-fixed effects (Stock and Watson 2012). The decision is supported by the Hausman test which tests whether the unique errors are correlated with the regressors (Greene 2013). We ran two different Wald-type tests, the first indicated that we should include time-fixed effects (α_t). The second, a Modified Wald test strongly indicates problems with heteroscedasticity and the Wooldridge-test also indicates that our regression might have problems with autocorrelation. To deal with some of the potential biases, all regressions are estimated with robust standard errors which are adjusted for heteroscedasticity and autocorrelation.

The results from the OLS estimations on equation (1) and (2) are reported in section 5.1 and 5.2.

4.5 Reverse causality problem

Given the fact that there could be a reverse causality relationship between tax avoidance and investments, we could potentially be facing problems with the OLS regression (Stock and Watson 2012).

(1) $INV_i = \beta_0 + \beta_1 x CASH\ ETR_i + u_i$

(2) $CASH\ ETR_i = \beta_0 + \beta_1 x INV_i + v_i$

To deal with this potential problem, theory suggests using a two stage least square analysis, using an Instrumental variable. The instrumental variables approach (IV) is without doubt the most widely used technique to deal with simultaneity problems in econometric specifications (Cingolani and Crombrugghe 2012).

However, in similar research and previous literature there are no examples of good indicator variables, nor examples where instrument variables have been used. Since the results might not be reliable using IV without a valid instrument we avoid using this method.

Another common way of dealing with simultaneity problems in financial research is the use of lagged variables. Despite being commonly used, Reed (2014) and Bellemare, Masaki and Pepinsky (2017) have found significant evidence discouraging the use of lagged variables to deal with simultaneity. Reed shows through both theory and simulations the infeasibility of identifying structural parameters of the data generation process when the relationship between X and Y is characterized by simultaneity. BMP demonstrate that lag identification is almost never a solution to endogeneity problems in observational data, and that rather than allowing for the identification of causal relationships, lag identification merely moves the channel through which endogeneity biases estimates of causal effects. The implication of both studies is that we should avoid the practice of lagging variables to circumvent the problems of reverse causality in financial research. We acknowledge the potential problems regarding reverse causality, which might interfere with our OLS regression. However, in lack of a good remedy we choose not to use the instrumental- or lagged variables method. We attempted using lagged versions of the control variables and independent variables of interest, but the results were highly inconsistent. The sign of the tax variables varies from positive to negative, and are not consistently different from zero in most cases. *(For full results of the regressions using lagged variables, see appendix. Table 13, 14 and 15).*

5.0 Empirical result

5.1 The effect of tax avoidance on investment

Table 5: Regression - The effect of tax avoidance on investment

Variables	INV 1	INV 2	INV 3	INV 1	INV 2	INV 3
GAAP ETR				-0.4705***	-0.3486***	-0.4728***
CASH ETR	-0.7489***	-0.2015***	-0.3974***			
Rev. growth	0.1838***	0.1135***	0.1293***	0.1877***	0.1144***	0.1311***
ROA	0.4641***	0.9492***	1.0690***	0.5392***	0.9725***	1.1104***
POR	-0.0390*	-0.0652***	0.0094	-0.0558***	-0.0650***	0.0055
lnTA	0.5748***	0.4286***	0.7217***	0.5669***	0.4303***	0.7210***
Slack	-0.2782*	-0.0348	-4.6166***	-0.3316***	-0.0444*	-4.6376***
Tang	5.0781***	-0.1656***	0.4125***	5.0979***	-0.1618***	0.4227***
lnAge	-0.5187***	-0.3031***	-0.8291***	-0.5140***	-0.3032***	-0.8279***
LEV	0.3728***	0.5917***	-0.2869***	0.3914***	0.5924***	-0.2818***
Cons	-8.4350**	-6.1267***	-6.5929***	-8.3847***	-6.1184***	-6.5649***
R^2	0.0511	0.2891	0.0570	0.0501	0.2897	0.0569
N	161 978	190 023	179 847	161 978	190 023	179 847

^ Regression estimated using year- and firm-fixed effects, and robust standard errors.
**** significant at 99%*
*** significant at 97,5%*
** significant at 95%*

Table 5 presents the regression results of Eq. (1) in section 4.1.1, showing the effect of both CASH- and GAAP ETR on the three different measures of investments. In the three first columns where INV1, INV2 and INV3 are the dependent variables, we notice that the coefficients of CASH ETR are negative and highly significant (CASH ETR-coefficient = -0.7489, -0.2015, -0.3974 respectively, all with p value < 0,00), after controlling for other factors (θ) associated with Investments. The results indicate that an increase in tax avoidance (a lower effective tax rate), on average leads to increased investments. The same results are shown in the regressions where we use GAAP ETR as a measure of tax avoidance. GAAP ETR is negative and highly significant (GAAP ETR-coefficients = -0.4705, -0.3486, -0.4728 respectively, all with p value < 0,00), in all cases after controlling for other factors (θ) associated with Investments. R-squared is consistent with other research articles on investment sensitivity, such as Dobbins and Jacob (2016) and Cleary (1999) as it ranges between 0,0501 (5,01%) and 0,2897 (28,97%).

As expected, the results of our regressions consistently indicate that tax avoidance (whether it is measured by GAAP ETR or CASH ETR) is positively related to the

level of Investment. Dobbins and Jacob (2016), and Djankov et al. (2010) proved that corporate tax *cuts* induce *increased* investment. Similarly, yet with the opposite measure, Egger, Ehrhardt and Keuschnigg (2014), found that *increased* corporate tax rates as well as income taxes *reduce* investment for all types of firms. Hence, we believe that a change in a company's effective tax rate due to tax avoidance has similar influence on investments as a change in the level of corporate taxes due to changes in the tax code of a country.

The question which arises from these results is *why* tax avoidance can be assumed to increase investments. Dobbins and Jacob (2016) argue that reduced taxes impacts investment through two main channels. First, a lower effective tax rate reduces the required rate of return (*Cost of capital channel)*. Goh et al. (2016), substantiates this assumption by proving that companies engaged in tax avoidance face a lower cost of capital. And second, the main reason is the higher after tax cash flow (*The Cash Flow Channel)*. Higher after tax cash flow have been proved to have a significantly positive effect on investment by many researchers such as; Lamont (1997), Aggarwal and Zong (2005) and Fazzari et. al. (1988). The cash flow effect on investment related to tax avoidance, is further elaborated in the section below. In conclusion, we can prove a significantly positive relationship between tax avoidance and investment. Our findings, in combination with previous research, lead us to reject the null-hypothesis that there is no relationship between investments and the cash flow effect of tax avoidance.

Furthermore, the results are thoroughly tested by using different classifications of the tax avoidance variables, and different scaling methods for the dependent investment variables. In addition, we run the entire regression using a balanced dataset, to see if there are any problems with idiosyncratic errors. The results from the alternative methods all yield the same result, further ensuring the robustness of our findings.

5.2 Internal liquidity and Investment sensitivity

In this section, we test whether liquidity, as a proxy for financial constraints influence investments, and the relationship between investment sensitivity and tax avoidance. In most instances the results indicate that we can reject the null-hypothesis that liquidity is irrelevant for firm investments. In fact, the results indicate that higher liquidity firms invest more. In addition, companies in the group of "good" liquidity firms seem to have a greater investment sensitivity towards changes in the effective tax rates, indicated by the negative interaction term coefficient. This result is statistically significant in all regressions at the 99% level. Hence, we can also reject the null-hypothesis that liquidity is irrelevant for a company's investment-sensitivity with regards to tax avoidance. The results are consistent with previous findings made by both Kaplan and Zingales (1995) and Cleary (1999), using a sample of American listed firms. They found that *less* financially constrained firms have a higher investment sensitivity to changes in cash flow, compared to *more* financially constrained firms. The results are also in line with the findings by Aggarwal and Zong (2006), indicating that better liquidity has generally a positive effect on investments.

The results raise some questions, as to why high liquidity companies are more sensitive to changes in effective tax rates. Kaplan and Zingales (1995) have a possible explanation, that high investment cash flow sensitivity seems to be driven by managers relying primarily on internal funding for financing, despite the availability of cheap external funding. Hovakimian (2009) tries to answer this question with the life cycle hypothesis. He suggests, younger more financially constrained firms invest more, irrespective of internal liquidity, to generate an income basis for future periods, while older more mature firms rely on existing investments to generate income. This is consistent with the negative coefficient of lnAge on investments. *In conclusion*, our results seem to support previous research claiming that higher liquidity companies tend to invest more and show higher investment sensitivity towards changes in the effective tax rates. We also add to previous research by proving that *tax avoidance* influence the relationship between liquidity and investment-sensitivity.

Table 6: Regression - Internal liquidity and Investment sensitivity

Variables	INV 1	INV 2	INV 3	INV 1	INV 2	INV 3
GAAP ETR				-0.0465	-0.2111***	0.0057
CASH ETR	-0.6425***	-0.1388***	-0.3671***			
Rev. growth	0.1834***	0.1134***	0.1292***	0.1870***	0.1143***	0.1307***
ROA	0.4675***	0.9491***	1.0692***	0.5549***	0.9758***	1.1193***
POR	-0.0384*	-0.0649***	0.0095	-0.0541***	-0.0645***	0.0073
lnTA	0.5743***	0.4286***	0.7217***	0.5648***	0.4297***	0.7182***
Slack	-0.1064	-0.0381	-4.6010***	-0.1953	-0.0584**	-4.6909***
Tang	5.0759***	-0.1693***	0.4102***	5.0809***	-0.1711***	0.3881***
lnAge	-0.5203***	-0.3035***	-0.8293***	-0.5158***	-0.3037***	-0.8284***
LEV	0.3790***	0.5944***	-0.2855***	0.4046***	0.5961***	-0.2693***
G_liq	-0.0471	0.0280***	0.0039	0.1424**	0.0685***	0.2557***
G_liq x GAAP ETR				-1.0114***	-0.2977***	-1.1010***
G_liq x CASH ETR	-0.2492*	-0.1374***	-0.0694			
Cons	-8.4828***	-6.1374***	-6.5996***	-8.4699***	-6.1327***	-6.6029***
R^2	0.0512	0.2894	0.0570	0.0505	0.2904	0.0573
N	161 978	190 023	179 847	161 978	190 023	179 847

^ Regression estimated using year- and firm-fixed effects, and robust standard errors.

**** significant at 99%*

*** significant at 97,5%*

** significant at 95%*

We examined the robustness of these with two alternative measures of internal liquidity, *cash-at-hand including readily convertible securities (CASH)* and *working capital less inventories (WCLI)* as done by Fazzari et. al. (1988). The results are reported in the robustness section below, but the pattern for the estimated coefficients on *CASH* and *WCLI* variables are virtually identical to the patterns found in the model estimated with *Financial Slack.*

6.0 Robustness of results

6.1 Alternative specification of the tax avoidance variable

To ensure the robustness of the results in section 5.1, indicating that tax avoidance has a positive effect on investments, we also use an alternative specification of the tax avoidance variables. Instead of using the continuous variables GAAP- or CASH ETR, we use indicator variables indicating high-, medium high-, medium low- or low tax level. Those categories are based on the quartile distribution of the tax avoidance variables as shown in table 2.

Table 7 shows the result of the regression of our baseline model for INV1, INV2 and INV3 using the alternative specification of the tax avoidance variables. The results are clear. If a company is in the High tax group, investments are on average significantly lower than in the medium high-, medium low- or low tax level group. Only when using CASH ETR on INV1 and INV3, investments are at highest in the medium low tax level group. This confirms our hypothesis that companies that has a lower effective tax rate, invest more. This is in line with what Fazzari et. al. discovered in 1988, that firms´ investment decisions are highly affected by the available cash flow, due to the opportunity for cheap internal financing, as opposed to the alternative of seeking financing from external sources. As stated earlier, both Dobbins and Jacob (2016) and Djankov et al. (2010) confirmed these findings, and specifically found the effect of corporate income taxes on the level of investments to be both statistically and economically significant.

Table 7: Robust test regression - alternative specification of the tax avoidance variable

Variables	INV 1	INV 2	INV 3	INV 1	INV 2	INV 3
Rev. growth	0.1814***	0.1133***	0.1278***	0.1870***	0.1144***	0.1304***
ROA	0.3599***	1.0100***	1.0219***	0.4995***	0.9850***	1.0826***
POR	-0.0359	-0.0634***	0.0140	-0.0558***	-0.0662***	0.0029
lnTA	-0.2347	-0.0305	-4.5877***	-0.3282**	-0.0445*	-4.6328***
Slack	0.5616***	0.4349***	0.7189***	0.5572***	0.4313***	0.7123***
Tang	5.0132***	-0.1663***	0.3702**	5.0896***	-0.1595***	0.4207***
lnAge	-0.5277***	-0.3043***	-0.8349***	-0.5226***	-0.3041***	-0.8368***
LEV	0.4135***	0.5880***	-0.2650***	0.4013***	0.5948***	-0.2676***
Low_tax(CASH ETR)	0.3849***	0.1157***	0.2436***			
Mid_Low_tax(CASH ETR)	0.4961***	0.0406***	0.3036***			
Mid_High_tax(CASH ETR)	0.1775***	-0.0106***	0.0814***			
Low_tax(GAAP ETR)				0.1913***	0.1023***	0.1540***
Mid_Low_tax(GAAP ETR)				0.1565***	0.0074*	0.1516***
Mid_High_tax(GAAP ETR)				0.0592**	-0.0012	0.0239
Cons	-8.6248***	-6.3082***	-6.7752***	-8.4116***	-6.2405***	-6.5959***
R^2	0.0539	0.2905	0.0583	0.0504	0.2896	0.0571
N	162 031	190 098	179 914	162 031	190 098	179 914

^ Regression estimated using year- and firm-fixed effects, and robust standard errors.
**** significant at 99%*
*** significant at 97,5%*
** significant at 95%*

6.2 Financial crisis effect

Our approach identifies the effects of tax avoidance on investments of domestic Norwegian firms in the period from 2006 to 2015. An event that had a massive impact on the business landscape in this period was of course the 2008 and 2009 financial crisis. Richardson, Taylor and Lanis (2015) found that the extent of corporate tax avoidance increased significantly during the global economic crisis. They postulated that the need to conserve capital or to meet the minimum capital needs of the firm is especially important in periods of financial distress so that the

firm can maintain credit ratings, meet the requirements of debt covenants or to continue as a going concern. Furthermore, they argue that in times of distress the benefits from tax avoidance activities, in the form of increased cash flows outweigh the risks. With this in mind, we conduct a robustness test to rule out the potential impact of the financial crisis. We check to which extent the results might be driven by the after-financial-crisis sample period 2009-2015, to make sure the financial crisis did not induce abnormal investment behavior as suggested by Egger, Ehrhardt and Keuschnigg (2014). Based on EEK's method we use the same variable definitions and source of data as in our baseline model, but run the regression including only a cross section of data for the pre-Financial-Crisis years 2001-2007. As mentioned earlier, the period prior to the financial crisis also includes changes to the Norwegian tax code from 2004 to 2006. These changes can potentially have altered firm investment behavior, and we are aware that the results might be misinterpreted. The corresponding results are presented in table 8.

Table 8: Robust test regression - Financial crisis effect

Variables	INV 1	INV 2	INV 3	INV 1	INV 2	INV 3
GAAP ETR				-0.2412***	-0.2047***	-0.2741***
CASH ETR	-0.0523	-0.0730***	-0.0023			
Rev. growth	0.0886***	0.1012***	0.0965***	0.0893***	0.1018***	0.0970***
ROA	0.0492	0.5933***	0.5449***	0.0625	0.6091***	0.5464***
POR	0.0066	-0.0244***	0.0041	0.0074	-0.0245***	0.0064
lnTA	0.7322***	0.6226***	0.8344***	0.7324***	0.6227***	0.8341***
Slack	-0.1360	-0.0609	-4.2501***	-0.1399	-0.0657	-4.2509***
Tang	3.5685***	-0.1479***	-0.3444***	3.5692***	-0.1475***	-0.3441***
lnAge	-0.2691***	-0.2866***	-0.4870***	-0.2692***	-0.2865***	-0.4877***
LEV	0.0425	0.2754***	-0.3401***	0.0416	0.2753***	-0.3415***
Cons	-11.7350***	-9.1561***	-9.6998***	-11.6916***	-9.1268***	-9.6247***
R^2	0.0535	0.2274	0.0676	0.0536	0.2278	0.0677
N	110 456	121 396	117 493	110 456	121 396	117 493

^ Regression estimated using year- and firm-fixed effects, and robust standard errors.
*** *significant at 99%*
** *significant at 97,5%*
* *significant at 95%*

Relative to the results discussed in previous sections, the effects of all GAAP-ETR tax avoidance measures included in the model remains qualitatively largely unchanged. The CASH-ETR measure however, is negative yet insignificant in

predicting INV1 and INV3, but significant when predicting INV2. We have found that 4 out of 6 tax avoidance measures are statistically significant ($p<0.01$) in predicting investments in the 2001-2007 period. The results support our main findings, by lowering the likelihood of the results being driven by abnormal investment behavior induced by the financial crisis.

6.3 Different scaling variable

To further check the robustness of our results in section 5.1, we use an alternative definition of Investments using a different scaling variable to account for potential scaling effects as suggested by Dobbins and Jacob (2016). Instead of using tangible fixed assets, and total tangible assets as scaling variable for INV1 and INV3 respectively, we use total assets as the scaling variable for all investment measures. When using the alternative specifications of the investment variables, the results are consistent with the baseline specification with regards to both direction and significance. The results substantiate the assumption that tax avoidance has a significantly positive effect on investments.

Table 9: Regression using different scaling variable

Variables	INV 1	INV 2	INV 3	INV 1	INV 2	INV 3
GAAP ETR				-0.0096***	-0.3486***	-0.4728***
CASH ETR	-0.0274***	-0.2015***	-0.3974***			
Rev. growth	0.0029***	0.1135***	0.1293***	0.0030***	0.1144***	0.1311***
ROA	0.0008	0.9492***	1.0688***	0.0028	0.9725***	1.1104***
POR	-0.0016***	-0.0652***	0.0094	-0.0024***	-0.0650***	0.0055
lnTA	-0.0122***	-0.0348	-4.6166***	-0.0138***	-0.0444*	-4.6376***
Slack	0.0344***	0.4286***	0.7217***	0.0341***	0.4303***	0.7210***
Tang	0.4804***	-0.1656***	0.4125***	0.4813***	-0.1618***	0.4227***
lnAge	-0.0268***	-0.3031***	-0.8291***	-0.0266***	-0.3032***	-0.8279***
LEV	0.0276***	0.5917***	-0.2869***	0.0283***	0.5924***	-0.2818***
Cons	-0.5566***	-6.1267***	-6.5929***	-0.5551***	-6.1184***	-6.5649***
R^2	0.2454	0.2891	0.0570	0.2443	0.2897	0.0569
N	190 024	190 023	179 847	190 024	190 023	179 847

^ Regression estimated using year- and firm-fixed effects, and robust standard errors.
**** significant at 99%*
*** significant at 97,5%*
** significant at 95%*

6.4 Balanced vs. unbalanced dataset

Including companies that do not have consecutive data for the entire period may cause problems with unbalanced panel data. The main concern with unbalanced panel data is the question why the data is unbalanced. If observations are missing at random then this is not a problem. However, if the attrition of firms in the data over time is not random, i.e. it is related to idiosyncratic errors, then this sample selection may bias the estimates (Baltagi, 2005).

If we require companies to have data for all ten years in our basic regression, the sample will exclude both startups, and companies going out of business during the period. Companies which are assumed to have the same characteristics in their financial constraints due to bad liquidity and weak earnings (Hovakimian 2009) Using a balanced data set may bias our estimates, since these companies then will be removed because of their characteristics, and not because of randomly missing data.

Running the regression using a balanced data set, the results indicate some problems with significance in the control variables, compared to the unbalanced dataset. However, the results are like those of an unbalanced dataset with respect to our variable of interest, and the problems related to using an unbalanced dataset seems negligible. All effective tax rate measures are homogenous in direction of influence and significance. The difference could be related to the smaller sample size which is on average around 20,000 firm-years, compared to an average of about 180,000 firm-years when using an unbalanced dataset.

Table 10: Robustness test regression - Balanced vs. unbalanced dataset

Variables	INV 1	INV 2	INV 3	INV 1	INV 2	INV 3
GAAP ETR				-0.8463***	-0.1899***	-0.6581***
CASH ETR	-1.0290***	-0.1346***	-0.4327***			
Rev. growth	0.2938***	0.1915***	0.1460**	0.3032***	0.1930***	0.1517***
ROA	0.5180**	0.6303***	1.0830***	0.5651***	0.6399***	1.1154***
POR	-0.0238	-0.0315***	-0.0193	-0.0363	-0.0316***	-0.0186
lnTA	0.0626	0.2049***	0.2553***	0.0598	0.2055***	0.2575***
Slack	-0.1786	-0.0720***	-2.5280***	-0.2258	-0.0756***	-2.5394***
Tang	3.1638***	-0.1037***	0.8901***	3.1885***	-0.0996***	0.9032***
lnAge	-0.5188***	-0.1237***	-0.4947***	-0.5129***	-0.1237***	-0.4947***
LEV	0.2407	0.2937***	-0.1303	0.2506	0.2934***	-0.1315
Cons	0.4162	-2.9040***	-1.1073	0.4110	-2.9010***	-1.0900
R^2	0.0407	0.3375	0.0522	0.0385	0.3373	0.0523
N	19 219	21 189	20 562	19 219	21 189	20 562

^ Regression estimated using year- and firm-fixed effects, and robust standard errors.
*** *significant at 99%*
** *significant at 97,5%*
* *significant at 95%*

6.5 Alternative measures of internal liquidity

To further check the robustness of our results, we run the same regression as in section 5.2 using two alternative measures that cover a company's internal liquidity. The first alternative measure is cash and equivalents, which is defined as cash at hand plus securities readily convertible. The second, is working capital less the book value of inventories (WCLI) as it is measured by Fazzari et. al. (1988). Both variables are measured at time t, and deflated by the firm's total assets.

As we see from the tables below the results remain almost the same for all three liquidity measures. This underpins our conclusion in section 5.2, that higher liquidity firms invest more and have a larger investment sensitivity towards changes in effective tax rates.

Table 11: *Cash and Equivalents/Total Assets* as internal liquidity measure

Variables	INV 1	INV 2	INV 3	INV 1	INV 2	INV 3
GAAP ETR				-0.0836	-0.2485***	-0.2289
CASH ETR	-0.4987***	0.1551***	-0.2735***			
Rev. growth	0.1832***	0.1134***	0.1285***	0.1872***	0.1143***	0.1303***
ROA	0.4415***	0.9484***	1.0299***	0.5345***	0.9743***	1.0813***
POR	-0.0403*	-0.0650***	0.0035	-0.0570***	-0.0646***	-0.0003
lnTA	-0.5376***	-0.0338	-5.1564***	-0.5927***	-0.0468*	-5.1851***
Slack	0.5757***	0.4286***	0.7253***	0.5663***	0.4299***	0.7235***
Tang	5.0270***	-0.1674***	0.3422**	5.0466***	-0.1654***	0.3488**
lnAge	-0.5178***	-0.3032***	-0.8281***	-0.5130***	-0.3033***	-0.8268***
LEV	0.3948***	0.5939***	-0.2576***	0.4135***	0.5956***	-0.2509***
G_liq_2	0.2996***	0.0200***	0.4691***	0.3911***	0.0512***	0.5463***
G_liq_2 x GAAP ETR				-0.9766***	-0.2338***	-0.6577***
G_liq_2 x CASH ETR	-0.6056***	-0.1046***	-0.3389***			
Cons	-8.4527***	-6.1351***	-6.5984***	-8.4164***	-6.1324***	-6.5801***
R^2	0.0516	0.2893	0.0589	0.0506	0.2902	0.0588
N	161 978	190 023	179 847	161 978	190 023	179 847

^ Regression estimated using year- and firm-fixed effects, and robust standard errors.

**** significant at 99%*

*** significant at 97,5%*

** significant at 95%*

Table 12: *Working capital/Total assets* as internal liquidity measure

Variables	INV 1	INV 2	INV 3	INV 1	INV 2	INV 3
GAAP ETR				-0.0557	-0.2121***	0.0401
CASH ETR	-0.5069***	-0.1545***	-0.2691***			
Rev. growth	0.1834***	0.1134***	0.1292***	0.1872***	0.1143***	0.1308***
ROA	0.4606***	0.9488***	1.0569***	0.5465***	0.9741***	1.1032***
POR	-0.0393*	-0.0653***	0.0050	-0.0558***	-0.0650***	0.0006
lnTA	-0.3264**	-0.0442	-4.5578***	-0.3972***	-0.0649***	-4.6233***
Slack	0.5770***	0.4288***	0.7231***	0.5663***	0.4300***	0.7202***
Tang	5.0719***	-0.1675***	0.4003***	5.0874***	-0.1677***	0.3917***
lnAge	-0.5198***	-0.3033***	-0.8295***	-0.5143***	-0.3034***	-0.8280***
LEV	0.3970***	0.5961***	-0.3270***	0.4181***	0.5995***	-0.3126***
G_liq_3	0.1381***	0.0247***	-0.0004	0.2279***	0.0663***	0.1820***
G_liq_3 x GAAP ETR				-0.8461***	-0.2572***	-1.0041***
G_liq_3 x CASH ETR	-0.5161***	-0.0938***	-0.2659**			
Cons	-8.5200***	-6.1401***	-6.6153***	-8.4685***	-6.1415***	-6.6297***
R^2	0.0513	0.2892	0.0571	0.0503	0.2902	0.0573
N	161 978	190 023	179 847	161 978	190 023	179 847

^ Regression estimated using year- and firm-fixed effects, and robust standard errors.
**** significant at 99%*
*** significant at 97,5%*
** significant at 95%*

7.0 Conclusion

In our thesis, we have gathered data from the CCGR database with accounting data for Norwegian firms from 2006 to 2015, to test the relationship between tax and investments. In contrast from previous research, we look at the relationship from a different perspective by focusing on tax avoidance rather than the statutory tax rate. In addition, we have tested the effect of tax avoidance on the relationship between liquidity and investment-sensitivity. Our evidence suggests that when firms increase their tax avoidance, they also invest more. Adding to Dobbins and Jacob's (2016) research, that lowered tax rates irrespective of origin, induce higher investments. We also document that companies classified as having good liquidity respond more strongly to changes in effective tax rates. Using different measures of tax avoidance and investments in addition to several robustness tests, we ensure the credibility of our results. Thus, we conclude that firm investment decisions are sensitive to changes in effective tax rates due to tax avoidance, and that liquidity is relevant for the investment-sensitivity of companies with regards to tax avoidance. For example, a company classified as having good liquidity, seems to decrease their investment level more when the effective tax rate increases compared to a company classified as having bad liquidity. Possibly, this effect relates to such companies relying more on internal funding for investments despite the availability of cheap external funds (Kaplan and Zingales 1995).

Although we have tried to cover all bases in the research design, we acknowledge that our results have their limitations. First, the way we measure investments could be somewhat generalizing, due to lack of access to cash flow statements for most companies in our sample. Future research might be able to measure this more accurately by using only listed companies which are required to disclose cash flow statements. Second, our measure of liquidity might not capture whether a company is liquidity constrained due to the different variations in financial structures between industries and companies. Finally, we also acknowledge that there could be a reverse causality relation between tax avoidance and investments, which might cause problems with our OLS regressions. Further research might deal with this potential problem by using a two stage least square analysis with an instrumental variable.

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9.0 Appendix

Table 13: Regression estimated using lagged versions of CASH and GAAP-ETR

Variables	INV 1	INV 2	INV 3	INV 1	INV 2	INV 3
GAAP ETR				0.4003***	-0.0377*	0.1883
CASH ETR	0.4610***	0.0282***	0.3683***			
Rev. growth	0.1436***	0.0677***	0.0672***	0.1442***	0.0674***	0.0669***
ROA	0.3943***	0.8093***	0.9543***	0.4001***	0.8113***	0.9628***
POR	-0.0599***	-0.0608***	0.0019	-0.0602***	-0.0609***	0.0015
lnTA	0.6355***	0.4642***	0.7779***	0.6326***	0.4646***	0.7771***
Slack	-0.2388	-0.0485**	-4.3727***	-0.2442	-0.0487**	-4.3755***
Tang	4.9542***	-0.1596***	0.3782**	4.9345***	-0.1613***	0.3636**
lnAge	-0.4330***	-0.1578***	-0.7167***	-0.4252***	-0.1574***	-0.7107***
LEV	0.3487***	0.5129***	-0.2708***	0.3492***	0.5131***	-0.2694***
Cons	-9.9165***	-7.0631***	-8.1155***	-9.8644***	-7.0539***	-8.0693***
R^2	0.0463	0.2813	0.0536	0.0459	0.2812	0.0533
N	138 296	160 070	152 794	138 296	160 070	152 794

^ Regression estimated using year- and firm-fixed effects, and robust standard errors.
*** *significant at 99%*
** *significant at 97,5%*
* *significant at 95%*

Table 14: Regression estimated using lagged versions of all independent variables.

Variables	INV 1	INV 2	INV 3	INV 1	INV 2	INV 3
GAAP ETR				0.2109	0.1042***	0.1036
CASH ETR	-0.0034	0.0585***	0.0374			
Rev. growth	-0.0017	-0.0050**	-0.0055	-0.0019	-0.0053***	-0.0057
ROA	0.2806***	0.0301*	0.1921*	0.2766***	0.0240	0.1877*
POR	-0.0534**	-0.0131***	-0.1436***	-0.0573***	-0.0133***	-0.1444***
lnTA	-0.7378***	-0.6362***	-0.8175***	-0.7404***	-0.6368***	-0.8182***
Slack	0.1980	-0.0681***	5.5547***	0.1957	-0.0650***	5.5565***
Tang	-7.1538***	0.0783***	-1.3341***	-7.1518***	0.0773***	-1.3344***
lnAge	-0.1509***	0.0170*	-0.1194***	-0.1488***	0.0169*	-0.1192***
LEV	-0.2227*	-0.2165***	0.2731***	-0.2195*	-0.2161***	0.2739***
Cons	14.8113***	10.2504***	11.3888***	14.7945***	10.2495***	11.3835***
R^2	0.0841	0.2411	0.0941	0.0842	0.2412	0.0941
N	132 770	152 622	146 122	132 770	152 622	146 122

^ Regression estimated using year- and firm-fixed effects, and robust standard errors.
*** *significant at 99%*
** *significant at 97,5%*
* *significant at 95%*

Table 15: Regressions estimated using lagged versions of control variables.

Variables	INV 1	INV 2	INV 3	INV 1	INV 2	INV 3
GAAP ETR				-0.4428***	0.0419**	-0.4476***
CASH ETR	-0.8671***	-0.0877***	-0.6135***			
Rev. growth	-0.0020	-0.0052**	-0.0054	-0.0019	-0.0052**	-0.0057
ROA	0.3628***	0.0341**	0.2456***	0.3062***	0.0239	0.2147**
POR	-0.0506**	-0.0108***	-0.1398***	-0.0530**	-0.0112***	-0.1415***
lnTA	-0.7075***	-0.6333***	-0.7977***	-0.7313***	-0.6364***	-0.8122***
Slack	0.2153	-0.0614***	5.5703***	0.2066	-0.0637***	5.5672***
Tang	-7.1187***	0.0799***	-1.3095***	-7.1416***	0.0765***	-1.3212***
lnAge	-0.1385***	0.0169*	-0.1108**	-0.1484***	0.0156	-0.1176***
LEV	-0.2733***	-0.2215***	0.2373***	-0.2258*	-0.2173***	0.2686***
Cons	14.5104***	10.2377***	11.2091***	14.7995***	10.2602***	11.4058***
R^2	0.0860	0.2416	0.0952	0.0843	0.2409	0.0944
N	132 697	152 508	146 016	132 697	152 508	146 016

^ Regression estimated using year- and firm-fixed effects, and robust standard errors.
*** *significant at 99%*
** *significant at 97,5%*
* *significant at 95%*