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Corporate Cash Holdings

An empirical comparison of Norwegian public and private firms

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Abstract

Analyzing Norwegian firms, we find that public firms hold more cash and have lower operating performance, compared to private firms. These results indicate presence of agency costs in public firms, which lead to cash hoarding, as managers value the flexibility cash provides. We find evidence that excess cash has a negative effect on performance. The result is robust towards different measures of performance, and implicates that shareholders in public firms should pay more attention to the firm's cash policy. When competition is low, cash has a negative effect on performance, while there is no significant effect when competition is high. This indicates support for holding excess cash in competitive industries.

Contents

1. Introduction

The main goal of this thesis is to examine differences in cash holdings between public and private firms and detect agency problems affecting cash levels in public firms. The motivation behind our choice of subject is both our interest in finance and managerial decisions, and the wish to understand the recent international trend in rising cash holdings. Research on private firms is interesting, as private firms contribute to the majority of the economy and is relatively under-analyzed. We perform our analyses on Norwegian data, as Norway is a highly developed country with access to detailed data on private firms.

First, we analyze the determinants of corporate cash holdings, with focus on differences between public and private firms. Being public provides easier access to external capital, which should decrease precautionary cash holdings. However, a greater separation between shareholders and managers in public firms may lead to agency costs, which may affect cash holdings. We use the assumption of less agency costs in private firms to identify how agency costs affect cash holdings in public firms.

Second, we investigate differences between public and private firms' speed of adjustments (SOA) to a target cash level. We differentiate between the case of excess cash and cash shortfall, to get insight in how managers in public and private firms respectively adjust cash levels in these two conditions. This analysis provides further insight in how agency costs affect cash policies in public firms. Third, we analyze differences in how public and private firms disgorge excess cash. With agency costs, managers have different incentives in the use of excess cash, which makes this analysis useful in detecting agency costs.

Further, we look at performance, measured by Return on Assets (ROA). We focus on both investigating differences between public and private firms, and analyze how cash, and particularly excess cash, affects performance. We also analyze cash holdings' effect on investment.

Finally, we create a new matched sample based on Herfindahl-Hirschman index (HHI), which measure market concentration, and analyze how HHI affects the results on cash holdings and performance. There are two main reasons why this approach adds value to our thesis. First, competition disciplines managers, which potentially reduce agency costs. Second, this analysis detect whether there exists product market competition motives for holding cash.

Access to data on private firms have gotten more extensive internationally, which increases research on the field. Prior research concludes that private firms have higher borrowing costs (Saunders & Steffen, 2011), rely mostly on debt financing (Brav, 2009), pay out choppier dividends (Michaely & Roberts, 2012), invest more (Asker, Farre-Mensa, & Ljungquist, 2014) and hold less cash (Gao, Harford, & Li, 2013). Comparative research on cash holdings in Norwegian public and private firms have not been previously published.

We find that public firms on average hold more cash than their private counterparts do. The difference varies between samples and with the amount of control variables. Nonetheless, public firms have on average at least 10% more cash than private firms do. In the years 2000-2007, public firms have on average 20% more cash, while in the years from 2008-2012, we find no significant differences. We believe that the difference before 2008 is due to agency costs, as agency costs is the only motive that predicts higher cash holdings for public firms. The differences between public and private firms becomes more ambiguous when matching on HHI. Further, we find evidence that size correlates negatively with cash level. Consequently, there are economies of scale related to cash holdings

Private firms have better performance than public firms do. We find evidence that cash negatively affect performance for public firms, and indications of the same relationship for private firms. This result suggests that many firms hold too much cash, and this cash holding is particularly an issue for public firms. These results are robust towards different measures of performance. Cash has a stronger negative effect on performance when competition is low, even though cash level on average is lower in that case. This result indicates existence of product market competition arguments for holding excess cash.

To sum up the main findings in this thesis, public firms have higher cash holdings than their private counterparts do. From a shareholder perspective, there are no rational arguments for this difference. Excess cash has a negative effect on performance. Consequently, the results have implications for shareholders, particularly in public firms, who have incentives to pay more attention to the firm’s cash policy.

2. Theories on cash holding

Cash is an important component of a firm's assets, and it is thus important to understand the different motives for holding cash both from a governance perspective and from a management perspective. We will focus on the general theories on cash holdings in this section, while we get more specific when we build our hypotheses. In a perfect capital market as Miller & Modigliani proposed, there is no reason to hold excess cash. A firm can then raise cash frictionless. Nevertheless, firms have increased cash holdings the last decades. The cash-to-asset ratio for American firms has more than doubled from 10.5% in 1980 to 23.2% in 2006 (Bates, Kahle, & Stulz, 2009). They argue that the increase in cash holding is due to higher cash flow volatility, less capital expenditures, less working capital and higher R&D expenditures, which are precautionary arguments. With the increase in cash holdings, the academic interest has increased accordingly. The trend of increased cash holdings was extended after the financial crisis and strongest in multinational R&D intensive firms (Pinkowitz, Stulz, & Williamson, 2013). There are four main motives for holding cash, the transaction motive, precautionary motive, agency motive and tax motive (Bates, Kahle, & Stulz, 2009). We will further include theory on competition motives. Our main goal is to detect how agency costs affect cash levels in public firms.

Managers will optimize cash level based on the different motives. In all the motives described except the agency motive, there is alignment between the interests of shareholders and managers. The agency motive represents differences in interest, which will decrease shareholder value.

2.1 The transaction motive

A firm needs operating cash for the daily activities as capital inflows and outflows do not always correspond in time. There are transaction costs related to converting a non-financial asset into cash to perform payments. Operating cash is the minimum of cash needed for any rational firm. Cash holdings above operating cash is defined as excess cash. If a firm is short on cash, it has to either raise funds in the capital market, sell assets or renegotiate financial contracts, which causes transaction costs. On the other hand, holding too much cash increase opportunity costs, since cash can be invested in projects that are more profitable. By

minimizing the sum of transaction costs and opportunity costs of holding cash, one can derive the optimal amount of cash for a given firm (Baumol, 1952; Orr & Miller, 1966).

The transaction cost depends on a firm's debt rating, collateral, cash-flow uncertainty and the length of the cash conversion cycles (Opler, Pinkowitz, Stulz, & Williamson, 1999). Large firms will hold less cash relative to assets than smaller firms do, due to economies of scale to cash holdings (Mulligan, 1997). We assume the transaction demand for cash will decrease over time for all firms because financial intermediaries become more effective in handling transactions. The need for operating cash by firms is also decreasing as cash management has become more efficient. Firms also decrease working capital because they hold less inventory (Bates, Kahle, & Stulz, 2009). We would expect private firms to have equal or higher optimal cash level based on transaction motives due to less access to external capital for private firms, compared to public firms.

2.2 The precautionary motive

Cash holding works as a risk management tool. Firms will hold cash to protect themselves against cash flow shocks. These shocks can force firms to drop valuable investments due to dry or expensive external capital markets. Under the financial crisis, firms experienced the value of internal cash when capital markets tightened, as high cash holdings provide a valuable hedge against financial frictions. Precautionary demand for cash has been studied as early as in Keynes (1936). Opler et al. (1999) find that firms with strong growth opportunities, riskier cash flows and poor access to external capital hold more cash. Financially constrained firms put a greater value on cash than those with fewer frictions (Faulkender & Wang, 2006; Pinkowitz & Williamson, 2007; Han & Qiu, 2007). They also save a greater portion of their cash when raising external capital (Almeida, Campello, & Weisbach, 2005; Denis & Sibilkov, 2009). The stock market value cash holdings higher when firms are less diversified (Tong, 2011). Absence of bond ratings or ratings below investment grade are associated with higher cash levels (Opler, Pinkowitz, Stulz, & Williamson, 1999). Bates et al. (2009) find partial explanation for the increase in cash holding in public firms by precautionary motives.

Liquidity has a premium and being short on liquid assets is costly for a firm. The firm may need to cut back on investments and dividends or sell assets (Bates, Kahle, & Stulz, 2009). Ehling and Haushalter (2014) find differences in cash holdings based on size under macroeconomic or industry shocks. Large firms use additional debt, while small firms reduce

liabilities. During the shock, small firms with more cash outperformed small firms with less cash. They show that the value of cash is largest in negative market conditions.

There has been an increase in supply of derivatives and improvements in forecasting and control. This suggests a decrease in precautionary demand for cash. On the other hand, there has been an increase in idiosyncratic risk, which is unhedgeable and thus increases the precautionary demand (Campbell, Lettau, Burton, & Xu, 2001; Irvine & Pontiff, 2008). Cash is an alternative to derivatives, since it reduces downside exposure, while keeping the upside. Cash holdings are associated with industry cash flow volatility and are used to reduce underinvestment when external capital is costly and growth opportunities are present (Harford J. , 1999; Kim, Mauer, & Sherman, 1998; Partch & Mikkelson, 2003). Harford et al. (2006) find that firms with high cash holdings are more likely to maintain investment in industry downturns. Acharya et al. (2005) find that financially constrained firms with low correlation between operating cash flows and investment opportunities, save cash instead of paying back debt. This implies that cash is more than negative debt, and thus has precautionary propositions. Lins et al. (2010) find different purposes for excess cash and lines of credit. While excess cash guards against future cash flow shocks in downturns, lines of credit is an option to exploit future business opportunities in good times. Cash is commonly used to manage risk in private firms, which often lack the expertise needed to use financial derivatives (Ehling & Haushalter, 2014). We assume that private firms have a higher precautionary demand for cash since they have less access to external capital markets, and thus incentives for higher cash holdings, compared to public firms.

2.3 The agency motive

Managers are traditionally assumed to maximize shareholder value without pursuing own objectives. Agency costs arise when the interest of managers diverge from those of shareholders. In the *free cash flow hypothesis*, Jensen (1986) argue that entrenched managers retain cash rather than pay dividends to shareholders when the firm has poor investment opportunities. With an increase in free cash flow, agency costs increase. When shareholders have low influence over management, the management will stockpile more of the generated cash flow (Harford, Mansi, & Maxwell, 2008). The challenge for shareholders is to provide enough internal slack to avoid underinvestment, while not facilitate for overinvestment (Stulz, 1990). The point made was that internal funds are key conflicts between owners and

management. Agency problems are assumed to be larger in public firms, with more asymmetric information between shareholders and management, and less possibility and incentive for monitoring the management, since ownership is usually more dispersed and the shares are more liquid (Asker, Farre-Mensa, & Ljungquist, 2014). As a minor shareholder you can either express concerns at the general meeting or sell your shares.

There are different theories of agency costs, and how they affect cash holdings and investment. The *empire building theory* states that managers have an incentive to increase firm size regardless of the investment profitability (Stein J. C., 2003). This empire building oppose the interests of shareholders, who value profitability. Managers will spend all available funds on investment projects (Jensen, 1986). This theory predicts higher investment, while the predictions of cash holdings is ambiguous. Cash level will be cyclical for a given firm, depending on whether the cash is stocked in wait for or recently spent on investments. Managers spend cash on acquisitions or capital expenditures that reduce firm value rather than pay out dividends (Harford, Mansi, & Maxwell, 2008; Richardson, 2006). These activities, increase CEO compensation, even if it destroys shareholder value (Harford & Lee, 2007).

The *quiet life theory* by Bertrand and Mullainathan (2003) states that managers may be prone to inertia and passivity when making difficult decisions. Managers that want to enjoy the quiet life will have an incentive to stock cash as a buffer to avoid making tough decisions (Gao, Harford, & Li, 2013). This is different from precautionary motives because this relates to the manager's personal preference rather than the best interest for the firm's shareholders.

The theory of *short-termism* states that managers are too focused on short-term goals, prioritizing next quarters reporting over long term shareholder value (Narayanan, 1985). Even if it increases market value in the short-term, it may lead to underinvestment, less use of cash and a lower share price in the long-term.

To sum up the different theories on agency cost, both the free cash flow hypothesis and the quiet life theory have clear predictions of a positive correlation between agency costs and cash holdings. The theory of short-termism suggests underinvestment, which may lead to higher cash level, but the relationship is more ambiguous. The empire building theory predicts a more cyclical cash level for firms affected by agency costs, but on average no clear trend. We build our hypotheses on the assumption that agency costs leads to higher cash level.

Corporate governance can differ both on country-level and firm-level. On a country-level, Dittmar et al. (2003) find that firms in countries with weak legal investor protection hold more cash than firms in countries with stronger investor protection. The market value of a firm's cash holding is valued lower in these countries (Dittmar, Marth-Smith, & Servaes, 2003; Pinkowitz, Stulz, & Williamson, 2006). However, on a firm-level, Harford et al (2008) find that firms with weak shareholder rights spend more cash.

There are several studies trying to identify agency costs. Those in favor have been presented, but there are also studies that do not find evidence of agency costs. Mikkelson and Partch (2003) did not find differences in performance between high and low cash holding firms and Bates et al. (2009) explain the differences between the firms with firm characteristics and precautionary motives.

2.4 The tax motive

When a multinational firm has foreign income, a firm can hold cash abroad to delay repatriation tax payments. This will increase cash holdings, especially for firms in countries with high repatriating tax (Foley, Hartzell, Titman, & Twite, 2007). Pinkowitz et al. (2014) analyze the trend in US firms of increase in cash holdings, and explain the increase in cash not by high repatriating tax, but by precautionary motives and increases in R&D investment. We do not have access to data on foreign income, so tax motives are not analyzed in our thesis.

2.5 Product market competition motives

The determinants of corporate cash holdings are developing. Cash holdings have a strategic dimension that may influence product market choices both direct and indirect (Frezard, 2010). Cash holdings as a buffer is effective in avoiding competition, even more effective than low debt (Frezard, 2010). Cash-rich firms with strong balance sheets can compete more aggressively (Bolton & Scharfstein, 1990). They can cut their product prices, extend marketing, relocate or hire workers that are more productive, which can give them a competitive edge. High cash holdings have a signaling effect, as having excess cash on the balance sheet may influence competitors' market behavior. It can prevent entry or capacity expansion from competitors, because the firm has financial muscles to defend its position (Benoit, 1984). Frezard (2010) find that US cash-rich firms gained future market share at the

expense of industry rivals with less cash. Ehling & Haushalter (2014) draw the same conclusion for Norwegian firms.

Cash holdings are important in the management of predation risk (Haushalter, Klasa, & Maxwell, 2007). When financial constraints hinders investment in growth opportunities, predatory threats is more likely to occur (Zingales, 2002; Campello, 2006; Kovenock & Philips, 1997). In downturns, maintaining investment is vital to sustain the firm's market share. This is especially relevant with investment in R&D. Mikkelson and Partch (2003) find that firms with high cash holdings were both more R&D intensive and had a higher operating performance. The market value of cash holdings is also higher in R&D intensive industries (Denis & Sibilkov, 2009; Brown & Petersen, 2011). R&D is difficult to fund externally due to the lack of assets as collateral and asymmetric information about the R&D's value. R&D is mainly funded by volatile sources such as cash flow and stock issues (Brown & Petersen, 2011). R&D intensive firms keep high cash holdings to ensure that they will be able to continue this funding internally, even when affected by shocks (Brown & Petersen, 2011).

There is a substitute relationship between the use of derivatives and cash holdings in a product market context (Haushalter, Klasa, & Maxwell, 2007). Firms with less cash and more debt will use more derivatives to be able to respond to rivals' strategic moves.

All else equal, competition motives should be equal for public and private firms.

3. Hypotheses

Based on the theory on cash holdings and agency costs, we develop four hypotheses for our analysis. The different hypotheses are not alternative hypotheses, but hypotheses for different analyses based on the same initial assumption of higher agency costs in public compared to private firms. We believe any difference in cash level between public and private firms are due to either the transactions motive, precautionary motive or agency problems. The other motives for holding cash should not result in systematic differences between public and private firms. The transaction and precautionary motives predict higher cash holdings for private firms, due to less access to external capital, while the agency motive predicts higher cash holdings for public firms. The observable difference in cash level is the net of the different effects. Higher cash holdings for public firms will confirm the hypothesis of larger agency problems in public firms, as all other motives for cash holdings predicts either higher cash holdings for private firms or no systematic differences. This intuition leads to hypothesis 1, for our analysis of cash holdings.

Hypothesis 1: Public firms hold more cash

Second, we analyze firms' speed of adjustment to a target cash level. We believe a manager preferring high cash holding have incentive to adjust cash level upwards in the case of a cash shortfall, but less incentive to adjust cash level downwards in the case of excess cash. With agency problems in public firms, we believe managers in public firms will adjust cash level downwards slower in the case of excess cash, compared to managers in private firms. In the case of cash shortfall, we believe managers in public firms will adjust cash level upwards faster, or at least equally fast, compared to managers in private firms. This intuition leads to hypothesis 2.

Hypothesis 2: Public firms are slower to adjust cash level downwards in the case of excess cash, but faster to adjust upwards in the case of cash shortfall

Our third analysis addresses the question on how firms disgorge excess cash. We look at increase in dividend payments, investment and debt repayment respectively. The most interesting analysis is on dividend payments. A manager preferring high cash holding have incentive to stock excess cash instead of paying out dividends to shareholders. Consequently,

hypothesis 3 states that managers in public firms are less likely to spend excess cash on dividend payments compared to managers in private firms.

Hypothesis 3: Public firms are less likely to spend excess cash on dividends

Our analysis of performance, measured by Return on Assets (ROA), investigates how cash affects performance. We believe too much cash has a negative effect on ROA, as cash usually generates lower return than the operations do in a well-functioning firm. As agency theory predicts cash holdings above an optimal level for firms affected by agency problems, hypothesis 4 predicts a stronger negative effect from excess cash on performance for public firms than for private firms.

Hypothesis 4: Excess cash have a stronger negative effect on performance for public firms

4. Methodology

4.1 Data and sample

We use Centre for applied research at NHH's (SNF) database on accounting and corporate data for all Norwegian firms and consolidated groups from 1992-2012. The database is available for researchers at SNF and both student and faculty at the Norwegian School of Economics (NHH). SNF is owned by NHH (85%) and the SNF foundation (15%). The data is delivered annually from the Brønnøysund Register Centre via Bisnode D&B Norway AS and in cooperation with Menson Business Economics AS. The database has been exposed to errors and missing values in the reported figures and variability in variable names. Hence, the database is revised and standardized several times. The latest revision took place in 2013, with a small extension in 2014, by Aksel Mjøs, dr. oecon, associate professor at the Department of Finance at NHH, in cooperation with Endre Berner and Marius Olving. The original documentation was initiated by Aksel Mjøs in cooperation with Karoline Øksnes (Berner, Mjøs, & Olving, 2014).

The accounting information contains figures from the income statements and balance sheets. For consolidated groups there are reporting on both the parent companies and the subsidiaries separately, in addition to reporting for the whole group. The subsidiary will act in the best interest of the controlling parent. Hence, we treat the whole group as one entity and thus replace figures for parent company with consolidated figures and delete figures for the subsidiary. The corporate data contains a number of non-accounting variables, such as information about the firm, ownership and industry.

4.2 Cleaning

In the original dataset we have 3,454,096 firm-year observations for 21 years (1992-2012). Following prior work including Opler et al. (1999), Gao et al. (2013), and Asker et al. (2014), we exclude financial firms and foreign firms. Further, we only keep limited liability companies to construct a sample of private firms best suited to compare with the public firms. We only keep observations with positive sales and total assets. We exclude observations with missing values in key variables, such as cash holdings or whether the firm is public. The cleaned full sample consists of 780,571 firm-year observations, 23% of the original observations. There

are 155,566 unique firms and 13 years (2000-2012) of observations. The sample consists of 779,113 private and 1,458 public firm-year observations.

4.3 Matching

According to prior work, such as Harford (1999), and Opler et al. (1999), cash holdings varies between industries and with firm size. Miller and Orr's (1996) model of demand for cash suggests economies of scale in cash holding, and larger firms will thus on average have lower cash ratios. Consequently, we match observations on size and industry, following prior matching procedures from Gao et al. (2013), and Asker et. al. (2014).

We use book value of total assets as size, as we do not have market values for most private firms. To differentiate on industry we use 12 industry groups (Table 3). For each public firm-year observation we find a private match in the same year, same industry and closest in size. We match with replacement. Hence, one private firm-year observation can be a match for several public firm-year observations

The matching procedure result in a matched sample with 1,458 public and 1,458 private firm-year observations. To decide whether this is a good matching procedure, we look at the size distributions before and after the matching, presented in Figure 1. In the first graph, the two size distributions shows that public firms are much larger in our full sample. The second graph shows that the two size distributions are more similar in the matched sample, and we thus believe the matching procedure improves our analysis. The aim is to make the two samples most alike, except for whether the firm is public or private. Consequently, we will use the matched sample in most of our analyses.

4.4 Descriptive Statistics

Table 1 presents summary statistics for our variables for public, private and matched private firms. The variables are either collected directly or calculated based on data from the SNF database. All continuous variables except Sales growth are winsorized at the 1% and 99% level to reduce impact from outliers. Sales growth is winsorized at the 5% and 95% level, due to unrealistic outliers that we consider being errors in the reported figures. We test the differences in means between public and private firms for all variables in the matched sample using a Hotelling's T^2 test. Table 2 presents a technical description of the construction of the

variables, linked back to SNF's original notations. The following section present a more practical discussion of the descriptive statistics.

$Cash$ is the sum of cash and marketable securities scaled by total assets. We include marketable securities, as we consider it an equivalent to excess cash. These liquid investments are unrelated to the firm's operations and can easily be transferred into cash. Cash is on average 1.78 percentage points higher for public firms than for private firms in our matched sample, and the difference is significant. Figure 3 provides the development in mean cash holdings for the firms in our matched sample. Cash is significantly higher for public firms in the years leading up to the financial crisis in 2007/2008, but the difference is marginal in the years thereafter. Cash is higher for private firms in our full sample, due to many small firms with high cash levels. When controlling for size, public firms have higher cash levels in both samples.

$Total\ assets$ is the book value of total assets, as we do not have market values for private firms. Naturally, total assets are significantly higher for public firms in the full sample. Hence, we perform the matching in order to get a more comparable sample. $Sales\ growth$ is percentage change in sales, and is higher for private firms in the matched sample, but the difference is not significant. $Cash\ flow$ is earnings after interest and taxes, but before depreciation, scaled by total assets. Cash flow is significantly higher for private firms in both samples. $Cash\ flow\ volatility$ is the standard deviation of the cash flow for each firm within the time-period. Private firms have significantly higher cash flow volatility than public firms in the full sample, but lower cash flow volatility in the matched sample. The large difference in the full sample is probably due to a higher cash flow volatility in smaller firms.

$Gross\ investments$ is the change in fixed assets plus depreciation, scaled by total assets. This includes both capital expenditures, and mergers and acquisitions, as the database does not provide separate information on these items. Gross investment is significantly higher for private firms in the matched sample. ROA is EBITDA (Earnings before interest, tax, depreciation and amortization) over total assets at the beginning of the year. ROA is 7.85 percentage points higher for private firms in the matched sample. The large difference is economically interesting and we will discuss this further under Regression 4.

$Net\ working\ capital$ (NWC) is the sum of accounts receivable and inventory, less accounts payable and other operating current liabilities, scaled by total assets. Operating cash is not

included in NWC. Ideally, one should include operating cash in NWC and use excess cash as the cash variable (Koller, Goedhart, & Wessels, 2010). We have no information about operating cash, and thus find it most reasonable to include all cash in the cash variable. A normal level of operating cash may vary between industries, but we will control for this by using industry fixed effects in our analysis. In our matched sample, NWC is 2.63 percentage points higher for private firms. $Current\ liabilities$ is the sum of all financial liabilities with less than one year to maturity scaled by total assets, and is higher for private firms. We believe that current liabilities positively affect cash level, since current liabilities increase the need for liquidity. $R\&D$ (Research and Development) is the change in capitalized development, as research is not allowed to capitalize in Norway, scaled by total assets. Ideally, we want to use R&D expenditures as a variable, since firms with much R&D expenditures often hold more cash (Pinkowits, Stulz, & Williamson, 2012), but our database only provides the balance figures. R&D is marginally higher for public firms. $Leverage$ is the debt ratio, computed as total financial debt over total assets. Private firms have on average significantly higher leverage.

$Public\ debt$ is a dummy that takes the value 1 if the firm has outstanding publicly traded debt. A higher share of public firms have public debt compared to private firms. $Dividends$ is a dummy on whether the firm paid dividends in the current year. Interestingly, more of our private firms in the matched sample pay dividend. We see that public firms are on average 6.6 years older than the matched private firms are.

When comparing private firms in the full sample with private firms in the matched sample, the matched private firms are on average larger, older with lower cash ratio and lower ROA.

4.5 Regressions

To perform our analysis we run several OLS (ordinary least square) regressions. All regressions in this thesis have heteroscedasticity-robust standard errors.

4.5.1 Cash holding

Our base regression is the determination of cash level. We have the natural logarithm (ln) to cash level as the dependent variable. Using ln enables us to see the percentage difference in cash level between public and private firms. We include control variables we believe have an

effect on the cash level. The selection is based on cash theories and prior work from Gao et. al. (2013). We include industry and year fixed effects to control for industry and time variation.

Regression 1; Cash level:

$$Ln(Cash) = \alpha + \beta_1 Public + \beta_2 Ln(Total\ assets) + \beta_3 Cash\ flow + \beta_4 Cash\ flow\ volatility + \beta_5 Sales\ growth + \beta_6 Leverage + \beta_7 Public\ debt + \beta_8 Net\ working\ capital + \beta_9 Gross\ investments + \beta_{10} Dividend + \beta_{11} R\&D + \beta_{12} Ln(Firm\ age) + \beta_{13} Current\ liabilities + Industry\ \&\ Year\ FEs + \varepsilon$$

Hypothesis 1 predicts higher cash level in public firms than in private firms, e.g. a positive value for β_1. In that case, the agency effect is stronger than the transaction and precautionary effects. Consequently, we can conclude that agency costs leads to higher cash level for public firms. If cash level is higher for private firms, there might be agency problems, but we cannot conclude. There is always a possibility that other factors explains this difference, but our matching procedure and control variables minimize this risk.

4.5.2 Speed of adjustment (SOA)

The second set of regressions aims to analyze differences in how fast public and private firms adjust cash level to a target level (Cash*). $Cash^*$ is a proxy for the optimal cash level for a firm with its given characteristics, and is predicted from regression 1 on private firms (Column 8). This methodology is based on Gao et al. (2013) and the assumption that private firms face less agency problems and thus have a more optimal cash level. A potential problem with this approach is that the precautionary demand for cash is higher for private firms, which is imposed on public firms and may overestimate public firms' need for precautionary cash holdings.

Regression 2; Speed of adjustment:

$$\Delta Cash = \alpha + \beta_1 (Cash* - L.cash) + \beta_2 Public \times (Cash* - L.cash) + \beta_3 Public + \varepsilon$$

$(Cash* - L.cash)$ measures the discrepancy between a firm's current cash level and next year's target cash level. The coefficient β1 will measure at which speed a private firm adjusts toward the target, based on the need to adjust. B_2 measures the difference in SOA between public and private firms. We will analyze how SOA differs in the case of cash shortfall and

excess cash, by dividing the sample into different subsamples based on the degree of discrepancy between lagged cash and target cash.

Without agency issues, we expect public firms to be able to adjust upward faster in the case of cash shortfall, due to easier access to external capital. Adjusting down if excess cash is more ambiguous, but we have no reason to believe that private firms should be able to adjust faster. Hypothesis 2 predicts β_2 to be negative in the case of excess cash, but positive in the case of cash shortfall.

4.5.3 Disgorging excess cash

As an extension to the SOA-analysis, we analyze the use of excess cash. If a firm wants to disgorge excess cash, there are three main options. To increase investment, debt repayment or dividends. Consequently, we look at how these three categories differs between public and private firms. As dependent variables we use dummies taking the value 1 if the firm increased payout, investment or debt repayment respectively, in the current year. In Investment we include both capex, M&A and R&D investments. We control for size, cash flow, volatility, sales growth, dividends, leverage, firm age, and include industry and year fixed effects.

Regression 3; Disgorging excess cash

$$Y = \alpha + \beta_1 Public + \beta_2 Ln(Total\ assets) + \beta_3 Cash\ flow + \beta_4 Cash\ flow\ volatility + \beta_5 Sales\ growth + \beta_6 Dividends + \beta_7 Leverage + \beta_8 Ln(Firm\ age) + Industry\ \&\ Year\ FEs + \varepsilon$$

Y = Increase payout, investment and debt repayment respectively

The methodology is based on Gao et. al. (2013). Our motivation for this analysis is to detect any agency problems that may affect the disgorging of excess cash. Hypothesis 1 predicts a negative β_1 for the payout regression, which means a lower probability for increase in dividend payments for public firms compared to private firms. Corporate finance theory states that debt has a disciplining effect on managers. Hence, a manager searching for more flexibility may have incentives to spend excess cash on debt repayment, but this prediction is more ambiguous.

4.5.4 Performance

We analyze how cash holdings affects performance, and how this effect differs in public and private firms. We use ROA as measure of performance. ROA is calculated as EBITDA over total assets. EBITDA is widely used in corporate finance (Berk & DeMarzo, 2014), and we believe it is the most proper measure of earnings. EBITDA is the earnings from the operations, but is not affected by differences in depreciation policies and capital structure.

Regression 4:

$$ROA = \alpha + \beta_1 Public + \beta_2 L.Cash + \beta_3 L.Cash \times Public + \beta_4 Ln(Total\ assets) + \beta_5 Ln(Firm\ age) + Industry\ \&\ Year\ FEs + \varepsilon$$

Cash is in lagged to avoid a relationship where cash is a result of current year's EBITDA. We control for size and age. As a robustness check we also run the regression with ROCE (Return on capital employed) as the dependent variable. ROCE is calculated as EBIT (Earnings before interest and tax) over capital employed. Capital employed is the sum of equity and debt, or total assets less current liabilities.

There may be more risk attached to private firm's share price and liquidity, compared to public firms. However, there is no reason to expect differences in operational risk and return between public and private firms when controlling for industry and size. Whether cash in general has a positive effect on ROA is not clear, but we believe too much cash can have a negative effect on ROA. Hence, we create a subsample with the 25% percentile of highest cash level to investigate differences between the overall sample and high cash sample. Hypothesis 4 predicts that excess cash has a stronger negative effect on public firm's performance, compared to private firm's performance. This intuition is based on the assumptions of higher cash levels in public firms, due to agency costs, and that excess cash destroys value. For our regression, hypothesis 4 suggests a negative value for β_3.

4.5.5 Investment level

We further analyze how cash holdings affect investment level. Our focus is to investigate how cash is a determination of investment level, and how it differs between public and private firms. For investment level we use gross investment as the dependent variable. Gross investment is the change in fixed assets plus depreciation. We believe gross investment is a

better measure than net investment as gross investment provide the actual investment spending for the year. Gross investment includes both capex and M&A, as these items are not reported separately in our dataset.

Regression 5; Investment level:

$$Gross\ investment = \alpha + \beta_1 Public + \beta_2 L.Cash + \beta_3 L.Cash \times Public + \beta_4 Ln(Total\ assets) + \beta_5 Sales\ growth + \beta_6 Ln(Firm\ age) + Industry\ \&\ Year\ FEs + \varepsilon$$

We control for size, sales growth and age. Sales growth is often used as a proxy for investment opportunities, for example in Michaely and Roberts (2012) and Asker et. al. (2014). We use cash in lagged to avoid a relationship where cash is a result of current year's investments. One should expect public firms to be able to invest more, due to easier access to external capital. However, Asker et. al. (2014) find evidence that American public firms invest less than their private counterparts do, and relate this to agency problems and short-term focused managers. These findings are consistent with Stein (1989), and the theory of myopic behavior by managers in public firms.

How one should expect cash level and agency costs to affect investment level is more ambiguous. For an empire-building manager, the correlation between cash and investment is expected to vary with time. We may observe a positive correlation in a period where the manager uses last period's excess cash on overinvestments. In a period where the manager is stocking cash in wait for large investments, we may observe a negative correlation. If the goal itself is high cash holdings, suggested by the free cash flow hypothesis and the quiet life theory, there may be a negative correlation as managers will forego potential investments in order to stock cash. As agency theories do not provide a clear prediction of cash's effect on investment level, we do not create a separate hypothesis for regression 5.

4.7 HHI-matched sample

The Herfindahl-Hirschman index (HHI) measures industry competition and is calculated:

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

S_i is market share for firm i. A higher HHI means a more concentrated market, e.g. less competition. We calculate HHI in our full sample based on two-digit industry codes, and construct a new matched sample based on HHI. For each public firm-year observation, we look for a private match with the same HHI, same year and closest in size. This procedure provides a matched sample with 1,217 public and 1,217 private firm-year observations. The sample is divided further into three equally sized subsamples based on HHI, labeled High-, Medium- and Low competition respectively.

We have two motives for incorporating HHI in our research. First, as discussed by Giroud and Mueller (2010), competition might mitigate agency problems and managerial slack. If this is the case, we should expect less difference in cash level between public and private firms in highly competitive industries, given hypothesis 1. We thus expect a positive relationship between HHI and cash level for public firms. Consequently, we run regression 1 in the HHI-matched sample and include HHI as an independent variable and in interaction with cash.

Second, as described in the theory section, there are potential product market competition motives to hold cash. Consequently, it is interesting to investigate how cash holdings affect performance in the three subsamples. We run regression 5 in the HHI-matched sample and included HHI as an independent variable. If excess cash has a positive effect on performance in competitive industries, we expect either higher cash levels or a more positive effect on ROA from cash holdings, compared to less competitive industries.

5. Results

5.1 Cash holding

In the first regression (Table 4) we analyze how different factors affect cash holdings, with focus on the Public variable. In the full sample we find significant differences in cash holdings between public and private firms, both when controlling for size only (Column 1) and when controlling for other variables (Column 2). The coefficient for the Public variable is 0.636 in the full sample. This indicates that public firms hold 89%($e^{(0,636)} - 1$) more cash than private firms do, which is a notable difference. In the matched sample we still find higher cash holdings in public firms (Columns 3-4), but the difference is smaller than in the full sample. This is natural, because public firms are on average larger than private firms are, and the differences in firm characteristics are thus larger in the whole sample. The coefficient for Public in the matched sample is 0.096, which means that public firms hold 10% $\left(e^{(0,096)} - 1\right)$ more cash than their private counterparts do. This result is consistent with research from the US (Gao, Harford, & Li, 2013), where public firms hold between 48% and 55% more cash than private firms do. Since both transaction and precautionary motives for holding cash are perceived higher for private firms, we attribute this difference to agency costs. When we split the sample into a pre-financial crisis sample (Column 5) and a during/after sample (Column 6), we find significant differences between public and private firms before the crisis, but no significant differences from 2008 onwards. From Figure 3 we see that the differences in cash holdings disappear in 2008 and are marginal in the years thereafter. We believe this is due to less room for managerial slack under and after the crisis. Another potential explanation is that private firms have become more concerned with precautionary actions after the crisis.

Other interesting variables are also affecting cash holdings. The coefficient for total assets, leverage and current liabilities are significant in most of the regressions. Larger firms have lower cash levels than smaller firms, in line with the economics of scale argument (Mulligan, 1997). Higher leverage decrease cash holdings, and the effect is strongest in the matched sample. Highly levered firms pay back debt instead of stocking cash, which decrease the risk attributed to capital structure. The coefficient for net working capital is negative and significant at the 1% level in all regressions, which supports the theory that cash is used as collateral when NWC is low. Current liabilities affect cash negatively. We would expect

current liabilities to correlate positively with cash holdings, as current liabilities increase the need for liquidity.

We also regress cash holdings on public and private firms separately (Column 7 and 8). This separation shows that dividends and firm age have opposing effects on cash holdings. Dividends have a large negative effect on public firms' cash level, but a small positive effect on private firms' cash level. A potential explanation is that private firms only pay dividends when cash flow is sufficient, but public firms smooth dividends when cash is needed elsewhere, as supported by Michaely & Roberts (2012). Firm age affects cash differently. Private firms hold less cash when age increases, but an opposite relationship for public firms. Older firms have in general less growth opportunities, less capital need and a positive cash flow. Hence, we would assume that older firms have less incentive for holding cash reserves, as seen in private firms. Public firms hold more cash when age increase, which indicates higher agency costs in older public firms. Cash holdings and cash flow volatility correlate negatively for private firms, opposite off our assumption. We would expect higher volatility in cash flow to cause higher cash holdings as a precautionary action. We run a Chow test to check whether the coefficients are significantly different between the public and private firms in the matched sample (Column 9). All the mentioned coefficients, except leverage are significantly different.

We find support for hypothesis 1, that public firms hold more cash than private firms do. This indicates agency problems in public firms, as neither of the other motives predict higher cash holdings for public firms. The observed difference is a conservative projection of agency cost's effect on cash level in public firms, as transactions and precautionary motives predict lower cash levels for public firms and we only observe the net effect. When analyzing the coefficients related to precautionary demand, such as cash flow volatility, R&D and size, we do not find evidence of demand for precautionary cash.

5.2 Speed of adjustment

This regression (Table 6) measures how fast firms adjust their cash level to an estimated optimal level. The coefficient for (Cash* - L.Cash) is positive (0.339), while the coefficient for Public x (Cash* - L.Cash) is negative (-0.097), both significant at the 1% level. This indicates that both public and private firms actively adjust cash holdings towards the optimal level. Public firms are marginally slower to adjust to the optimal level than private firms are.

There may be issues with heterogeneity between public and private firms. One issue could be asymmetric costs related to adjusting the cash level, both when building or depleting the cash holdings towards the optimal level. The sample is divided into quartiles based on discrepancies between lagged cash and target cash level. The more interesting analysis is for the subsample with most excess cash (P25) and highest cash shortfall (P75), as managers may have different incentives to adjust in these two cases. By using the top and bottom quartile, our analysis is less prone to errors in our modelled optimal cash, since it is hard to predict the optimal cash level.

There are significant differences in the speed of the adjustment in the excess cash subsample. The coefficient for (Cash – Lagged Cash) is positive (0,269) and significant at the 1% level. The coefficient for Public x (Cash* - Lagged Cash) is negative (-0,140) and significant at the 10% level. This variable cancels out some of the effect of the former variable, which indicates that private firms adjust faster. This result is in line with Gao et al. (2013), and supports hypothesis 2, as managers in public firms are more reluctant to adjust down cash level.

Private firms also adjust their cash level faster than their public counterparts do in a cash shortfall. The coefficients for (Cash – Lagged Cash) is positive$(0{,}619)$ and significant at the 1% level. In contrast to Gao et al.'s (2013) findings, the coefficient for Public x (Cash* - Lagged Cash) is negative$(-0{,}491)$ and significant at the 1% level. The coefficients almost cancel each other out for public firms. This means that private firms explain most of the coefficient for (Cash – Lagged Cash). Hence, public firms have a lower level of adjustment. This result contradicts hypothesis 2. A potential explanation is that public firms have less need to adjust up because the optimal cash level for public firms is lower than for a private counterpart with the same characteristics.

5.3 Disgorging Cash

Table 7 presents the results for regression 3. There is no significant difference in dividend payment between public and private firms (Column 1). This result does not provide support to hypothesis 3. Our analysis on increase in investment shows no significant difference between public and private firms (Column 2). Public firms are more likely to spend excess cash on debt repayment (Column 3), which may be explained by agency costs. Managers seeking flexibility will have incentive to decrease debt level, as high debt has a disciplining

effect on management. However, debt repayment is often a result of long-term agreements with the creditors, and not a year-by-year strategic choice, and thus we cannot be too conclusive.

5.4 Performance

Table 8 presents a simple T^2 test for comparing means in ROA. We create a subsample, high cash, which is the firms with the top 25% percentile cash levels. The rest of the sample is labeled low cash. There are 371 public and 359 private firms in the high cash subsample, so the allocation of private versus public is sufficiently even. Two trends are clear. ROA is significantly lower for public firms and high cash firms.

The results from regression 4, with ROA as dependent variable, are presented in Table 9. Table 10 presents the same analysis with ROCE as the dependent variable. From column 1, we observe a negative effect from cash on ROA. One standard deviation increase in cash level results in 0.85 percentage points (0.223*0.038) decrease in ROA. With ROCE as dependent variable, the corresponding coefficient is insignificant. In all cases, both size and firm age have a positive effect on performance.

Column 2 shows that public firms have on average 9.3 percentage points lower ROA than their private counterparts have. The difference is significant at the 1% level and a difference of 9.3 percentage points is major in an economic sense. In our matched sample, public firms have higher cash flow volatility than private firms do, with 16.98% compared to 15.10%. Consequently, we can conclude that private firms have a significantly better risk-adjusted operating performance, compared to public firms. The difference is 15.7% and significant at the 1% level, when using ROCE as the dependent variable. Accordingly, the conclusion is robust, and in line with research on UK firms (Akguc & Choi, 2013).

Column 3 shows that the difference in ROA between public and private is lower (7.3 percentage points) when we include cash as a control variable. The difference is still significant at the 1% level. Cash seems to explain some of the difference in performance between public and private firms. Cash has a negative impact on ROA, but there is no significant difference between public and private on how cash affects ROA. In column 4, we use High cash as a dummy variable instead of cash as a continuous variable. Still, the coefficient for Public is significantly negative. Private firms in the high cash subsample have

a lower ROA than private firms in general, while for public firms the difference is larger. Hence, we can conclude that high cash levels seems to have a negative effect on both public and private firms. High cash level has a significantly stronger negative impact on public firms, compared to private firms. This conclusion is robust when using ROCE as dependent variable, and supports hypothesis 4.

How much one standard deviation increase in cash affects performance can be very different for a firm with low cash holding, than for a firm with excess cash. An increase in cash might be positive for a firm with cash shortfall, but negative for a firm with excess cash. The observed coefficient is the net of these two types of conditions. We are most interested in investigating excess cash's effect on ROA. Hence, we perform the same analyzes in the High cash subsample. In column 5, we observe a stronger negative relationship between cash level and ROA, compared to the whole sample. One standard deviation increase in cash level will decrease ROA by 3.96 percentage points (0.477*0.083). The relationship is almost the same when using ROCE as dependent variable. Public firms in the high cash sample has on average 10.7 percentage points lower ROA than their private counterparts have (Column 6). This difference is 18.9 percentage points when looking at ROCE. All these coefficients are significant at the 1% level.

From column 5 and 6, we can conclude that both the negative effect on ROA from cash level and the difference between public and private firms are larger in the high cash subsample compared to the whole matched sample. However, in column 7, when including both public, cash and interactions, the public dummy variable is marginal and insignificant. Cash is negative and significant at the 5% level. One standard deviation increase in cash level will decrease ROA by 4.67 percentage points (0.321*0.136). The coefficient for the interaction between cash and public is negative, but insignificant. When looking at ROCE, we observe the opposite. The coefficient for Cash is insignificant, but the coefficient for the interaction variable is significant. The coefficient for Public is still insignificant.

We find clear evidence that private firms have better performance than public firms do, and this difference is larger in the high cash subsample. This difference is economically interesting and should be subject to further research. However, in the high cash subsample, the difference seems to be explained by cash level, and not by public versus private itself. We can conclude that cash level has a negative effect on ROA for public firms in the high cash sample. For private firms the relationship is a little more ambiguous, as the coefficient in the ROCE

regression is insignificant. These results support hypothesis 4. Excess cash have a stronger negative effect on performance for public firms.

Another potential explanation is that cash creates return that is not included in ROA. Direct return from cash is included as financial income. Hence, we include financial income in the ROA calculation (Table 11). The conclusions are not affected by this adjustment. For the whole sample (Column 1), the coefficients for Public and Cash is still negative and significant. For the high cash subsample (Column 3), the coefficient for Cash is negative and significant at the 5% level. Column 2 provides evidence that firms in the high cash subsample have lower performance, and that this negative effect is strongest for public firms. Hence, we can conclude that the financial income cash provides does not make up for the reduction in operational return. Consequently, there are clear indications that firms in the high cash subsample hold too much cash. The cash ratios in the subsample varies from 21% to 87%, and this seems high according to traditional financial theories on optimal cash holding. The problem is larger for public firms.

5.5 Investment level

Table 12 presents the means in gross investment. We divide the sample into public versus private and high cash versus low cash. High cash is the top 25% percentile. We observe that investment level is significantly higher for private firms. There are no significant differences between low cash and high cash.

Regression 5 (Table 13) shows how cash holdings affect investment and how it differs between public and private firms. Cash holdings do not affect investment significantly (Column 1). Controlled for investment opportunities, cash holdings should not affect investment for a rational firm. Private firms have 8.3 percentage points higher investment level than public firms do (Column 2). The result is significant at the 1% level. Public firms have easier access to external capital, and should thus be able to invest more. Agency costs in public firms is a possible explanation, as managers with short-term goals may forego profitable investments in order to boost current earnings. This conclusion is in line with Asker et al. (2014). When interacting high cash and public, we see that public firms with high cash holdings have lower investment levels. When we analyze the high cash subsample, we find no significant differences between public and private firms or on cash's effect on investment level.

The control variables provide the predicted results. Firms invest less with age, because older firms already have previous large investments. Sales growth has a positive effect on investments towards all investment regressions. This relationship is expected, as sales growth is a commonly used proxy for investment opportunities.

5.6 HHI-matched sample

5.6.1 Cash holding

Table 14 presents the results from the cash level regressions in the HHI-matched sample. Column 1 shows that HHI alone has no significant effect on cash level. In column 2, the coefficient for Public is negative and significant at the 1% level. While the coefficient for HHI is negative and insignificant, the interaction variable for HHI and public is strongly positive and significant. Accordingly, public firms seem to have higher cash levels when there is less competition. If we believe agency problems cause the difference between public and private firms, these results are in line with Giroud and Mueller's (2010) findings that competition mitigates agency costs. If we look at the mean values of cash in the three subsamples (Table 15), cash increases with competition, which is the opposite of the coefficient in column 2. However, we emphasize results from the regressions over a simple mean comparison, as the regression includes important control variables. Private firms have higher cash levels in the medium competition subsample, compared to the high- and low competition subsamples. Cash holding theories does not support this finding, thus we find no meaningful explanation.

Column 3-5 (Table 14) shows the determinants of cash level with different degrees of competition. It is hard to give a good conclusion from these results. In both the high- and low competition subsample, the coefficient for Public is positive, but insignificant. In the medium competition subsample, cash level is significantly lower for public firms. To sum up, it seems like HHI can be a partial explanation of the differences in cash levels, but there is no evidence of a clear relationship. We cannot conclude that competition mitigates agency costs, based on these results.

5.6.2 Performance

Table 16 presents the results from the performance regressions in the HHI-matched sample. Column 1 shows that HHI has a negative effect on ROA, which is significant at the 1% level.

One standard deviation increase in HHI will decrease ROA by 0.36 percentage points (0.121*0.030). Two opposing effects determinate the coefficient for HHI. First, all else equal, increased competition will on average lead to lower return. Second, market concentration is potentially a result of profitability, meaning that there are many competitors in industries with the potential of high return. We observe the net effect, and the second effect seems to be strongest in our case.

Column 2 includes Public as a separate variable and in interaction with HHI. The coefficient for Public is -0.105. The coefficient for HHI is -0.184, while the coefficient for the interaction between HHI and public is 0.115, This means that both public and private firms have higher ROA when competition increase, but private firm's ROA are more sensitive to HHI. The three coefficients are all significant at the 1% level.

Column 3-5 shows the results when dividing the sample into the three subsamples high-, medium- and low competition. We observe two interesting results. First, the difference in ROA between public and private firms decreases with less competition. This corresponds to the results in column 2. Second, cash level has a stronger negative effect on ROA when competition is lower. With high competition, cash has no significant effect on ROA. For medium competition, the coefficient for Cash is negative and significant at the 1% level. One standard deviation increase in cash will decrease ROA by 0.70 percentage points. For high cash, the negative effect is stronger and significant at the 1% level. One standard deviation increase in cash will reduce ROA by 1.26 percentage points (0.207*0.061). Table 17 shows that the average cash level is lower in the low competition subsample, compared to the two other subsamples. Consequently, even though firms on average have lower cash levels when competition is low, the negative effect of cash on ROA is stronger, compared to medium competition.

The findings on cash level's effect on ROA in column 3-5 gives support to product market competition arguments discussed in the theory section, stating that a high cash level may have a strategic benefit when competition is high. We do not find direct evidence that cash is positive with high competition, but that cash has a clear negative effect on ROA when competition is low. This relationship can also be a result of managerial slack in lack of competition, which leads to a less efficient use of cash. Accordingly, we can conclude that there are better arguments for holding excess cash in highly competitive markets.

6. Conclusion

Using accounting and corporate data for Norwegian firms from 2000 to 2012, we match on industry and size, and compare Norwegian public and private firms' cash holdings. Public firms hold on average more cash than their private counterparts do. This finding supports the hypothesis stating that agency problems in public firms lead to higher cash levels as managers value the flexibility cash provides. Further, we find evidence that public firms have lower performance, compared to private firms.

Excess cash has a negative effect on performance, measured by ROA. Firms within the top 25% percentile of cash levels have a significant lower ROA compared to the rest of the sample. Excess cash affects both public and private firms negatively, but the effect is stronger for public firms. This result is robust towards different measures of performance, and provides further support to the hypothesis of agency problems in public firms. Cash has a stronger negative effect on performance when competition is low. This indicates support to product market competition arguments for holding excess cash in competitive industries.

The main findings implicates that firms with excessive cash holdings should pay out more of the cash as dividends, as excess cash has a negative effect on performance. This is particularly a problem in public firms. Consequently, shareholders in public firms should pay closer attention to the firm's cash policy.

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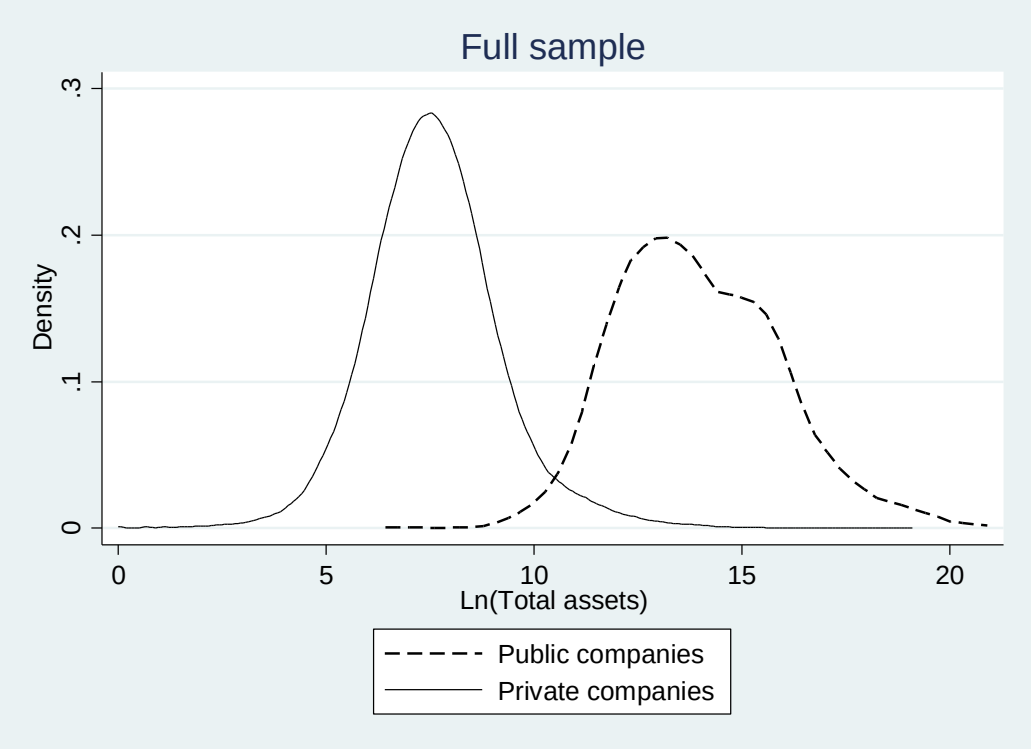
8. Appendix

Figure 1: Size distributions for public and private firms



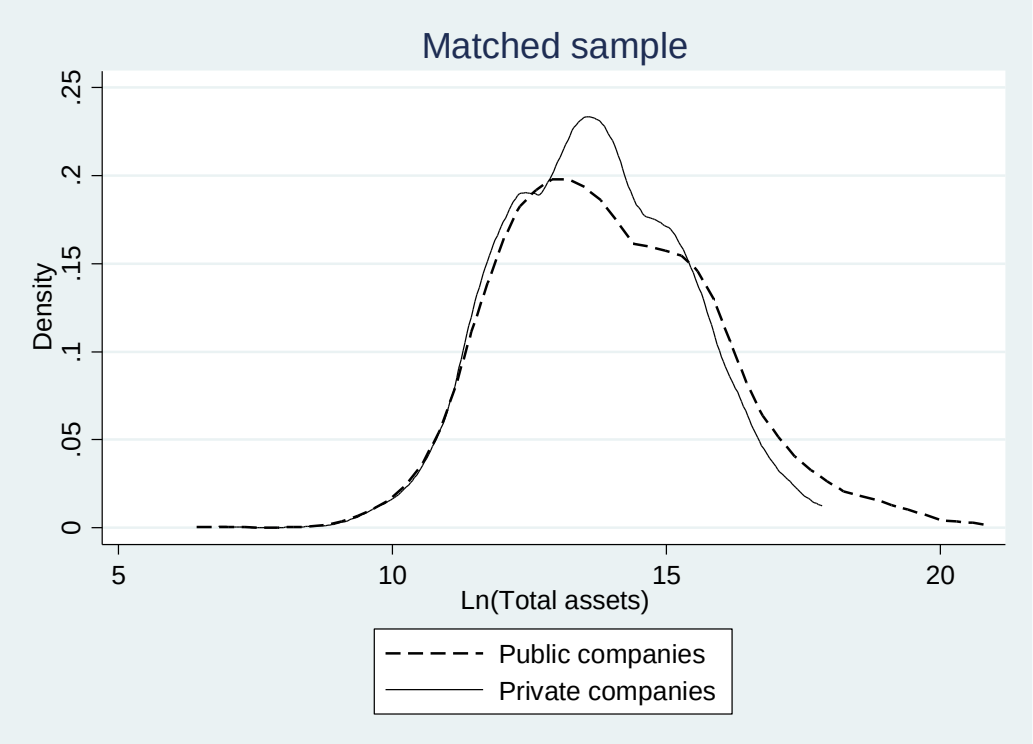


Figure 2: Correlation matrix

This table present correlation matrix for the independent variables used in regression 1.

	Total assets	Sales growth	Cash flow	CF volatility	Gross inv.	NWC	Cur. liab.	R&D	Leverage	Public debt	Dividends	Age
Total assets	1											
Sales growth	-0.02	1										
Cash flow	0.09	-0.10	1									
Cash flow volatility	-0.09	0.19	-0.32	1								
Gross investment	0.01	0.40	-0.07	0.23	1							
Net working capital	-0.08	-0.06	0.17	-0.08	-0.07	1						
Current liabilities	-0.12	-0.02	-0.04	0.11	-0.01	0.00	1					
R&D	0.03	0.05	-0.15	0.09	-0.01	-0.07	-0.05	1				
Leverage	0.04	0.05	0.00	-0.11	0.10	-0.10	-0.51	-0.07	1			
Public debt	0.19	-0.04	-0.03	0.01	-0.01	-0.10	-0.14	0.05	0.19	1		
Dividends	-0.03	-0.06	0.18	-0.06	-0.06	0.07	-0.01	-0.07	-0.06	-0.05	1	
Age	0.21	-0.09	0.11	-0.16	-0.07	-0.04	-0.12	-0.11	0.05	0.11	0.07	1

Figure 3: Development in cash holdings

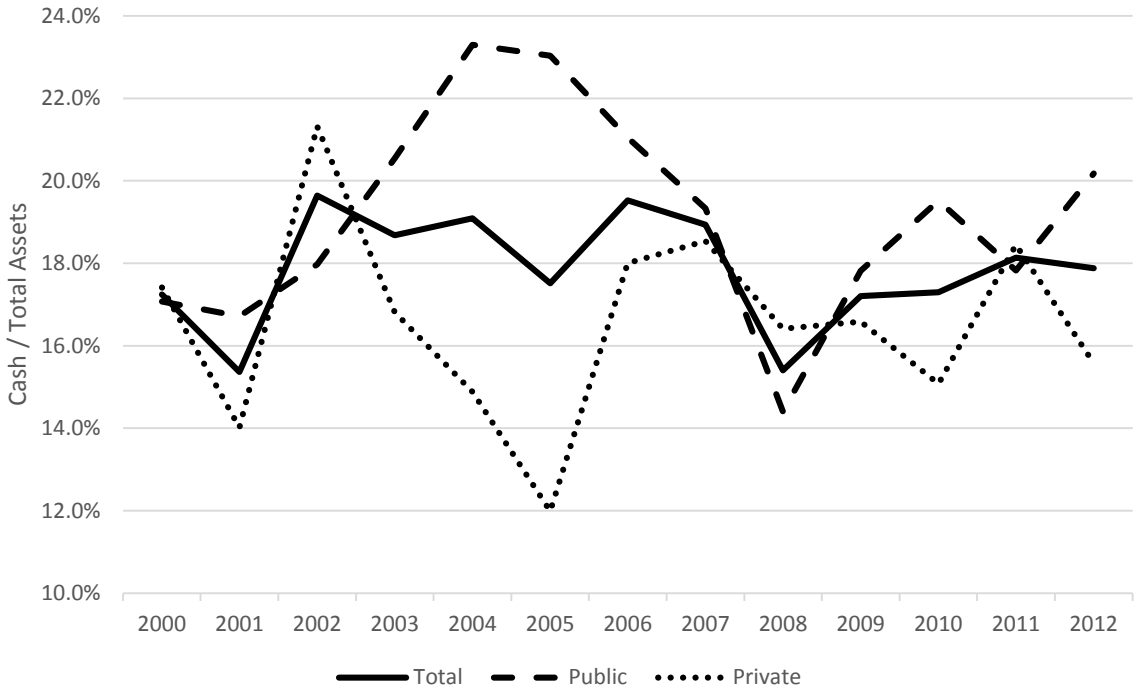


Table 1: Descriptive statistics

This table provides descriptive statistics for private firms (full and matched sample) and public firms. All continous variables are winsorized at the 1% and 99% level, execpt for Sales growth that is winsorized at the 5% and 95% level. ***, ** and * is statistical significance in the differnece in mean (Hotelling's T-square test) at a 1%, 5% and 10 % level respectively. See Appendix 2 for how variables are constructed.

	Private firms, full sample			
Variable	Observations	Mean	Median	Std. Dev.
Cash	779,113	30.40%	22.60%	27.29%
Total assets	779,113	8,850	1,867	27,917
Sales growth	779,113	15.24%	3.85%	54.93%
Cash flow	779,113	5.97%	8.48%	29.92%
Cash flow volatility	779,113	32.81%	12.97%	81.52%
Gross investment	779,113	5.78%	0.00%	18.69%
ROA	779,113	17.34%	12.95%	33.49%
Net working capital	779,113	3.76%	5.60%	41.94%
Current liabilities	779,113	57.39%	51.52%	47.66%
R&D	779,113	-0.01%	0.00%	0.26%
Leverage	779,113	20.65%	2.13%	31.69%
Public debt	779,113	0.00	0	0.07
Dividends	779,113	0.26	0	0.44
Age	779,113	11.7	9	11.1

	Public firms				Matched private firms				Difference in mean
Variable	Observations	Mean	Median	Std. Dev.	Observations	Mean	Median	Std. Dev.	(Public - Private)
Cash	1,458	17.91%	11.00%	19.07%	1,458	16.13%	10.02%	17.71%	1.78%***
Total assets	1,458	6,584,119	929,416	16,690,000	1,458	3,048,246	837,259	6,601,559	3,535,873***
Sales growth	1,458	32.66%	8.47%	91.91%	1,458	34.82%	7.77%	95.16%	-2.16%
Cash flow	1,458	0.65%	4.56%	18.64%	1,458	7.17%	6.36%	10.69%	-6.52%***
Cash flow volatility	1,458	16.98%	9.20%	25.75%	1,458	15.10%	7.22%	31.31%	1.88%*
Gross investment	1,458	13.91%	4.97%	50.86%	1,458	23.18%	4.60%	86.50%	-9.27%***
ROA	1,458	4.11%	7.48%	26.92%	1,458	11.96%	9.94%	22.78%	-7.85%***
Net working capital	1,458	7.84%	4.92%	17.58%	1,458	10.47%	6.38%	19.71%	-2.63%***
Current liabilities	1,458	30.34%	26.70%	19.21%	1,458	33.02%	29.31%	22.89%	-2.68%***
R&D	1,458	0.44%	0.00%	4.51%	1,458	0.39%	0.00%	3.58%	0.05%
Leverage	1,458	20.50%	16.40%	19.82%	1,458	27.89%	22.67%	24.67%	-7.39%***
Public debt	1,458	0.12	0	0.33	1,458	0.03	0	0.17	0.09***
Dividends	1,458	0.04	0	0.20	1,458	0.13	0	0.34	-0.09***
Age	1,458	29.4	15	33.6	1,458	22.8	14	25.8	6.6***

Table 2: Construction of variables

Original variable names from the SNF database in brackets.

Cash = (Cash [Cash] + Marketable securities [invest]) / Total assets [sumeiend]

Total assets = Total assets [sumeiend]

Sales growth = (Sales [salgsinn] – L.Sales [L.salgsinn]) / L.Sales [L.salgsinn]

Cash flow = (Net income [ordres] + Depreciations & Amortizations [anlvurd] *0.72

Cash flow volatility = Standard deviation of Cash flow within a firm

Gross investment = (Fixed assets [vardrmdl] – L.Fixed assets [L.vardrmdl]) / L.Fixed assets [L.vardrmdl]

ROA = EBITDA [ebitda] / L.Total assets [L.sumeiend]

Net working capital = (Receivables [fordr] + Inventory [varer] – Payables [levgj] – Other current operating liabilities [akgjeld]) / Total assets [sumeiend]

Current liabilities = Current liabilites [kgjeld] / Total assets [sumeiend]

R&D = (Research [fou] + Patents [patent]) / Total assets [sumeiend] - (L.Research [L.fou] + L.Patents [L.patent]) / L.Total assets [L.sumeiend]

Leverage = Long term debt [alanggj] / Total assets [sumeiend]

Public debt (dummy) **=** 1 if outstanding publicly traded debt [obllaan] > 0

Dividends (dummy) **=** 1 if dividends [utb] > 0

Age = Year [aar] – Year of establishment [stiftaar]

Table 3: Industry groups

This table presents how the firms in the matched sample is spread on industry groups

Industry groups:	Observations
Primary industries	59
Oil & Gas	120
Industry	711
Construction	91
Commerce	229
Shipping	290
Transportation/Travel	18
Finance/Insurance	48
Services/Real Estate/Consulting	501
Culture/Media	14
IT/Telecom	353
Total	2,434

Table 4: Regression 1 – Cash level

This table reports the results from regression 1. Industry and year fixed effects are used. All regressions have heteroscedasticity-robust standard errors. ***, ** and * corresponds to statistical significance at a 1%, 5% and 10% level respectively.

Ln(Cash) as dependent variable

	Full sample		Matched sample						
					2000-2007	2008-2012	Public firms	Private firms	F statistic of Chow Test (7)-(8)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Public	0.530***	0.636***	0.331***	0.096*	0.187***	-0.072			
	[0.031]	[0.030]	[0.050]	[0.051]	[0.062]	[0.087]			
Ln(Total assets)	-0.210***	-0.237***	-0.048***	-0.071***	-0.112***	-0.012	-0.107***	0.000	8.00***
	[0.001]	[0.001]	[0.016]	[0.017]	[0.023]	[0.022	[0.019]	[0.028]	
Cash flow		0.418***		0.221	0.571***	-0.367	-0.008	1.223***	6.08**
		[0.007]		[0.162]	[0.194]	[0.288]	[0.168]	[0.409]	
Cash flow volatility		0.001		-0.651***	-0.355***	-1.002***	-0.194	-0.861***	16.14***
		[0.002]		[0.112]	[0.136]	[0.184]	[0.163]	[0.142]	
Sales growth		0.066***		0.024	0.082***	-0.036	0.065*	-0.025	2.48
		[0.003]		[0.027]	[0.030]	[0.054]	[0.035]	[0.039]	
Leverage		-1.421***		-2.411***	-2.339***	-2.529***	-2.331***	-2.182***	0.49
		[0.007]		[0.141]	[0.174]	[0.249]	[0.194]	[0.211]	
Public debt		-0.137***		0.131	0.035	0.217*	0.140	-0.189	4.31**
		[0.024]		[0.090]	[0.130]	[0.117]	[0.099]	[0.179]	
Net working capital		-1.426***		-2.233***	-2.384***	-2.055***	-1.656***	-2.418***	3.85**
		[0.005]		[0.157]	[0.186]	[0.283]	[0.197]	[0.238]	
Gross investment		-0.643***		0.036	0.022	-0.010	0.026	0.086**	0.05
		[0.008]		[0.030]	[0.034]	[0.075]	[0.050]	[0.04]	
Dividend		0.730***		0.055	-0.193	0.279**	-0.794***	0.265***	23.05***
		[0.003]		[0.093]	[0.124]	[0.136]	[0.202]	[0.100]	
R&D		-5.573***		-0.330	-0.566	-0.263	0.033	-1.964*	3.03*
		[0.595]		[0.511]	[0.798]	[0.614]	[0.540]	[1.033]	
Ln(Firm age)		0.016***		-0.012	-0.035	0.053	0.071***	-0.101***	10.41***
		[0.002		[0.021]	[0.027]	[0.035]	[0.026]	[0.034]	
Current liabilities		-1.009***		-1.146***	-1.246***	-1.044***	-1.619***	-0.441*	15.68***
		[0.005]		[0.150]	[0.184]	[0.261]	[0.186]	[0.237]	
Industry & year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Constant	-0.673***	0.741***	-2.606***	-0.428	0.119	-1.492***	-0.482	-1.140**	
	[0.035]	[0.032]	[0.291]	[0.315]	[0.427]	[0.463]	[0.376]	[0.535]	
Observations	780571	780571	2916	2916	1844	1072	1458	1458	
R-squared	7.8%	31.5%	9.1%	24.9%	27.1%	26.7%	29.5%	29.5%	

Table 5: Descriptive statistics, (Cash* - L.Cash)

This table provides descriptive statistics for (Cash* - L.cash)

	Public firms			Private firms		
	Mean	Std. Dev.	Obs.	Mean	Std. Dev.	Obs.
Matched sample	-0.081	0.186	1,458	-0.065	0.154	1,458
Subsample - excess cash:	-0.337	0.18	366	-0.279	0.127	361
Subsample - cash shortfall:	0.085	0.062	374	0.084	0.083	355

Table 6: Regression 2 – Speed of adjustments

This table reports the results from regression 2. Industry and year fixed effects are used. All regressions have heteroscedasticity-robust standard errors. L means one lag. ***, ** and * corresponds to statistical significance at a 1%, 5% and 10% level respectively.

Change in cash ratio (ΔCash) as dependent variable

	Matched sample	Subsample - excess cash: (Cash* - L.Cash) ≤ P25	Subsample - cash shortfall: (Cash* - L.Cash) ≥ P75
	(1)	(2)	(3)
Cash* - L.Cash	0.339***	0.269***	0.619***
	[0.025]	[0.064]	[0.097]
Public × (Cash* - L.Cash)	-0.097***	-0.140*	-0.491***
	[0.032]	[0.075]	[0.139]
Public	-0.002	-0.030	0.046***
	[0.004]	[0.021]	[0.011]
Constant	0.016	-0.003	-0.015**
	[0.003]	[0.016]	[0.007]
Observations	2916	727	729
R-squared	19.8%	4.8%	14.3%

Table 7: Regression 3 – Disgorging excess cash

This table reports the results from regression 3. Industry and year fixed effects are used. All regression are run with heteroscedasticity-robust standard errors. ***, ** and * corresponds to statistical significance at a 1%, 5% and 10% level respectively.

Dependent variable:	Increase payout	Increase investment	Increase debt repayment
	Top 25% percentile of excess cash		
	(1)	(2)	(3)
Public	0.011	0.046	0.060*
	[0.008]	[0.041]	[0.034]
Ln(total assets)	-0.007**	0.0148	0.009
	[0.004]	[0.013]	[0.011]
Cash flow	0.09***	0.117	-0.068
	[0.026]	[0.108]	[0.100]
Cash flow volatility	0.013	-0.093*	-0.148***
	[0.008]	[0.051]	[0.051]
Sales growth	0.01**	0.009	0.074***
	[0.004]	[0.019]	[0.018]
Dividends	0.583***	0.098	0.178***
	[0.068]	[0.075]	[0.066]
Leverage	-0.020	0.044	1.149***
	[0.015]	[0.102]	[0.094]
Ln(Firm age)	-0.007	0.064***	-0.075***
	[0.004]	[0.019]	[0.016]
Industry and year FEs	Yes	Yes	Yes
Constant	0.115**	-0.188	0.294
	[0.055]	[0.257]	[0.185]
Observations	727	727	727
R-squared	0.586	0.149	0.341

Table 8: Mean ROA

This table presents mean in ROA for Public vs. Private and Low cash vs. High cash. ***, ** and * is statistical significance in the differnece in mean (Hotelling's T-square test) at a 1%, 5% and 10 % level respectively.

	Low cash	High cash	Total	Difference (High cash - Low Cash)
Public	5.99%	-1.39%	4.11%	-7.38%***
Private	13.50%	7.23%	11.96%	-6.27%***
Total	9.77%	2.85%	8.03%	-6.92%***
Difference (Private - Public)	7.51%***	8.62%***	7.85%***	

Table 9: Regression 4 – ROA

This table reports the results from regression 4. Industry and year fixed effects are used. All regression are run with heteroscedasticity-robust standard errors. L means one lag. ***, ** and * corresponds to statistical significance at a 1%, 5% and 10% level respectively.

ROA as dependent variable

	Matched sample				Subsample - High cash		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Public		-0.093***	-0.073***	-0.091***		-0.107***	0.013
		[0.009]	[0.013]	[0.009]		[0.023]	[0.070]
L.Cash	-0.223***		-0.165***		-0.477***		-0.321**
	[0.038]		[0.056]		[0.083]		[0.136]
L.Cash × Public			-0.087				-0.257
			[0.075]				[0.167]
High cash				-0.051***			
				[0.016]			
High cash × Public				-0.145***			
				[0.019]			
Ln(total assets)	0.026***	0.032***	0.028***	0.030***	0.044***	0.052***	0.041***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.009]	[0.009]	[0.008]
Ln(Firm age)	0.019***	0.023***	0.024***	0.023***	0.047***	0.055***	0.053***
	[0.004]	[0.004]	[0.004]	[0.004]	[0.011]	[0.011]	[0.011]
Industry and year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.341***	-0.398***	-0.340***	-0.368***	-0.651***	-0.941***	-0.673***
	[0.062]	[0.062]	[0.059]	[0.061]	[0.142]	[0.156]	[0.138]
Observations	2,916	2,916	2,916	2,916	2,916	730	730
R-squared	9.8%	10.7%	12.9%	11.4%	20.8%	18.0%	23.1%

Table 10: Regression 4b – ROCE

This table reports the results from regression 5b. Industry and year fixed effects are used. All regression are run with heteroscedasticity-robust standard errors. L means one lag. ***, ** and * corresponds to statistical significance at a 1%, 5% and 10% level respectively.

ROCE as dependent variable

	Matched sample				Subsample - High cash		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Public		-0.157***	-0.115***	-0.148***		-0.189***	0.027
		[0.013]	[0.018]	[0.014]		[0.031]	[0.082]
L.Cash	-0.068		0.074		-0.403***		-0.111
	[0.047]		[0.057]		[0.100]		[0.138]
L.Cash × Public			-0.229**				-0.482**
			[0.090]				[0.195]
High cash				0.035*			
				[0.018]			
High cash × Public				-0.149***			
				[0.023]			
Ln(total assets)	0.029***	0.033***	0.031***	0.034***	0.043***	0.048***	0.037***
	[0.005]	[0.005]	[0.005]	[0.005]	[0.012]	[0.012]	[0.011]
Ln(Firm age)	0.019***	0.026***	0.027***	0.027***	0.026**	0.040***	0.038***
	[0.005]	[0.005]	[0.005]	[0.005]	[0.013]	[0.013]	[0.013]
Industry and year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.501***	-0.509***	-0.502***	-0.520***	-0.593***	-0.816***	-0.635***
	[0.089]	[0.085]	[0.084]	[0.085]	[0.184]	[0.195]	[0.177]
Observations	2,916	2,916	2,916	2,916	2,916	730	730
R-squared	6.5%	11.4%	11.9%	11.5%	13.5%	16.0%	19.1%

Table 11: Regression 4c – ROA w/financial income

This table reports the results from regression 5c. Industry and year fixed effects are used. All regression are run with heteroscedasticity-robust standard errors. L means one lag. ***, ** and * corresponds to statistical significance at a 1%, 5% and 10% level respectively.

ROA (including financial income) as dependent variable

	Matched sample		Subsample: High cash
	(1)	(1)	(2)
Public	-0.077***	-0.094***	-0.012
	[0.014]	[0.009]	[0.071]
L.Cash	-0.128**		-0.291**
	[0.058]		[0.137]
L.Cash × Public	-0.096		-0.234
	[0.077]		[0.169]
High cash		-0.035**	
		[0.016]	
High cash × Public		-0.140***	
		[0.019]	
Ln(total assets)	0.027***	0.029***	0.043***
	[0.003]	[0.003]	[0.008]
Ln(Firm age)	0.026***	0.026***	0.066***
	[0.004]	[0.004]	[0.011]
Industry and year FEs	Yes	Yes	Yes
Constant	-0.307***	-0.323***	-0.710***
	[0.059]	[0.061]	[0.138]
Observations	2,916	2,916	730
R-squared	12.1%	11.0%	23.4%

Table 12: Mean gross investment

This table presents mean in Gross investment for Public vs. Private and Low cash vs. High cash. ***, ** and * is statistical significance in the differnece in mean (Hotelling's T-square test) at a 1%, 5% and 10 % level respectively.

	Low cash	High cash	Total	Difference (High cash - Low cash)
Public	13.84%	14.11%	13.91%	0.27%
Private	22.50%	25.27%	23.18%	2.27%
Total	18.19%	19.60%	18.54%	1.41%
Difference (Private - Public)	13.38%***	11.16%**	9.27%***	

Table 13: Regression 5 – Investment level

This table reports the results from regression 5. Industry and year fixed effects are used. All regressions have heteroscedasticity-robust standard errors. L means one lag. ***, ** and * corresponds to statistical significance at a 1%, 5% and 10% level respectively.

Gross investment as dependent variable

	Matched sample				Subsample-High Cash	
	(1)	(2)	(3)	(4)	(5)	(6)
Public		-0.083***	-0.078**	-0.064**	-0.030	-0.044
		[0.023]	[0.032]	[0.026]	[0.035]	[0.104]
L.Cash	-0.053		-0.027			0.070
	[0.060]		[0.077]			[0.154]
L.Cash × Public			-0.026			0.030
			[0.097]			[0.207]
High Cash				0.052		
				[0.047]		
High Cash x Public				-0.091**		
				[0.039]		
Ln(total assets)	0.021***	0.024***	0.023***	0.023	0.052***	0.054***
	[0.007]	[0.007]	[0.007]	[0.007]	[0.013]	[0.014]
Sales growth	0.288***	0.287***	0.288***	0.289***	0.094**	0.092**
	[0.037]	[0.037]	[0.037]	[0.037]	[0.046]	[0.046]
Ln(Firm age)	-0.042***	-0.038***	-0.038***	-0.038***	-0.110***	-0.110***
	[0.014]	[0.013]	[0.013]	[0.013]	[0.024]	[0.024]
Industry and year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.139	-0.148	-0.137	-0.160	-0.011	-0.061
	[0.114]	[0.114]	[0.113]	[0.113]	[0.211]	[0.228]
Observations	2916	2916	2916	2916	730	730
R-squared	18.9%	19.2%	19.2%	19.2%	34.5%	34.6%

Table 14: Regression 6a – Cash level (HHI)

This table reports the results from cash level regression in HHI matched sample. Industry and year fixed effects are used. All regressions have heteroscedasticity-robust standard errors. ***, ** and * corresponds to statistical significance at a 1%, 5% and 10% level respectively.

Ln(Cash) as dependent variable

	Matched on HHI (2-digit) and size				
	Matched sample		Subsample: High comp.	Subsample: Medium comp.	Subsample: Low comp.
	(1)	(2)	(3)	(4)	(5)
Public		-0.203***	0.127	-0.341***	0.011
		[0.062]	[0.094]	[0.079]	[0.103]
HHI	0.054	-0.317			
	[0.141]	[0.197]			
HHI × Public		0.740***			
		[0.214]			
Ln(total assets)	-0.099***	-0.100***	-0.145***	0.035	-0.136***
	[0.017]	[0.017]	[0.038]	[0.028]	[0.026]
Cash flow	0.318**	0.245	0.417	-0.207	0.644**
	[0.161]	[0.166]	[0.282]	[0.268]	[0.294]
Cash flow volatility	-0.525***	-0.502***	-0.831***	-0.275	-0.391**
	[0.113]	[0.112]	[0.193]	[0.210]	[0.188]
Sales growth	0.052	0.052	0.000	0.113*	0.063
	[0.035]	[0.034]	[0.053]	[0.065]	[0.065]
Leverage	-2.023***	-2.095***	-1.731***	-2.466***	-1.747***
	[0.145]	[0.152]	[0.277]	[0.261]	[0.297]
Public debt	0.079	0.069	-0.412**	0.068	0.305**
	[0.097]	[0.095]	[0.201]	[0.171]	[0.142]
Net working capital	-1.962***	-1.926***	-1.843***	-1.882***	-2.209***
	[0.133]	[0.136]	[0.265]	[0.224]	[0.221]
Gross investment	0.045	0.045	0.104	-0.169	0.111
	[0.072]	[0.070]	[0.093]	[0.115]	[0.176]
Dividend	-0.027	-0.054	0.177	-0.254	0.043
	[0.088]	[0.091]	[0.171]	[0.164]	[0.152]
R&D	-0.624	-0.648	-1.177	-0.980	0.275
	[0.548]	[0.551]	[0.921]	[1.058]	[0.991]
Ln(Firm age)	0.022	0.029	0.017	0.001	0.023
	[0.022]	[0.022]	[0.043]	[0.033]	[0.042]
Current liabilities	-1.195***	-1.219***	-1.060***	-0.902***	-1.454***
	[0.141]	[0.144]	[0.241]	[0.239]	[0.284]
Industry & year FEs	Yes	Yes	Yes	Yes	Yes
Constant	-0.356	-0.234	-0.145	-2.346***	0.138
	[0.319]	[0.320]	[0.689]	[0.752]	[0.511]
Observations	2,434	2,434	810	812	812
R-squared	24.3%	24.8%	30.8%	27.7%	26.4%

Table 15: Mean cash in HHI-matched sample

This table presents mean cash level in HHI-matched sample.
Public vs. Private and across High, Medium and Low competition

	High comp.	Medium comp.	Low comp.
Public	19.18%	17.80%	16.62%
Private	17.70%	20.37%	15.56%
Total	18.44%	19.29%	16.09%

Table 16: Regression 6b – ROA (HHI)

This table reports the results from ROA regression in HHI matched sample. Industry and year fixed effects are used. All regressions have heteroscedasticity-robust standard errors. L means one lag. ***, ** and * corresponds to statistical significance at a 1%, 5% and 10% level

ROA as the dependent variable

	Matched on HHI (2-digit) and size				
	Matched sample		Subsample: High comp.	Subsample: Medium comp.	Subsample: Low comp.
	(1)	(2)	(3)	(4)	(5)
Public		-0.105***	-0.100***	-0.082***	-0.067***
		[0.011]	[0.016]	[0.014]	[0.015]
HHI	-0.121***	-0.184***			
	[0.030]	[0.035]			
HHI × Public		0.115***			
		[0.041]			
L.Cash	-0.158***	-0.153***	-0.092	-0.162***	-0.207***
	[0.032]	[0.030]	[0.062]	[0.043]	[0.061]
Ln(total assets)	0.026***	0.028***	0.022***	0.033***	0.024***
	[0.003]	[0.003]	[0.007]	[0.006]	[0.005]
Ln(Firm age)	0.008**	0.013***	0.002	0.005	0.025***
	[0.003]	[0.003]	[0.007]	[0.006]	[0.005]
Industry and year FEs	Yes	Yes	Yes	Yes	Yes
Constant	-0.280***	-0.277***	-0.307***	-0.157	-0.298***
	[0.058]	[0.057]	[0.111]	[0.136]	[0.076]
Observations	2,434	2,434	810	812	812
R-squared	10.8%	14.9%	12.6%	19.8%	18.5%

Table 17: Mean ROA in HHI-matched sample

This table presents mean ROA in HHI-matched sample. Public vs. Private and across High, Medium and Low competition

	High comp.	Medium comp.	Low comp.
Public	5.34%	3.22%	6.49%
Private	15.25%	10.42%	11.05%
Total	10.30%	6.83%	8.77%