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The Optimal Way to Increase Cash Holdings: From a Market Perspective

- a study of various ways to increase cash holdings and their implications on market value during economic boom and recession

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ABSTRACT

Title: The optimal way to increase cash holdings: From a market perspective - a study of various ways to increase cash holdings and their implications on market value during economic boom and recession

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Keywords: Cash holdings, R&D, CAPEX, Dividends, market value, excess cash

Purpose: The main purpose of this paper is to identify a relationship between different approaches to accumulate cash and companies' market values between periods of different economic conditions. Our thesis contributes with information that helps firm managers decide how to increase cash holdings.

Methodology: Quantitative approach using panel data regressions and cluster analysis.

Theoretical Perspective: Excess cash holdings, determinants of cash holdings, motives of R&D, motives of dividends, motives of CAPEX, agency theory, cost of capital

Empirical foundation: 1701 U.S. listed firms that existed during 2001-2011

Conclusions: We come to the conclusion that firms increase their cash holdings by decreasing investments in research and development, reduce capital expenditures and diminish dividend payments. Further, we also come to the conclusion that the market values these cash accumulating approaches differently depending on current economic condition. Cuts in dividends are kindly looked upon by the market throughout the periods, meanwhile cuts in capital expenditures are most favorable during the crisis and cuts in research and development has the least negative impact on the market value in the post crisis years.

List of abbreviations

ADR - American depositary receipt

CAPEX - Capital expenditures

CF - Cash flow

CFR - Cash flow riskiness

CPX - Capital expenditures

CS - Cross-section

DIV - Dividend

EBIT - Earnings before interest and taxes

FD - Financial distress

G - Sales growth

GDI - Gross domestic income

GDP - Gross domestic product

M&A - Mergers and acquisitions

MB - Market-to-book

MV - Market value

NPV - Net present value

Prob. - Probability

RD - Research and development

R&D - Research and development

SME - Small and medium- sized enterprises

WC - Working capital

XC - Excess cash

Contents

1.0 Introduction

In this chapter we present the background and problem discussion of the thesis. We also state our purpose and question formulation as well as give the reader a brief thesis outline.

1.1 Background

At the end of 2007 the world's financial markets were hit by the worst crisis since the great depression. When the US housing bubble eventually burst in 2007 it created an uncertainty on the global markets that limited borrowing and made the capital markets inaccessible. The mistrust between banks created a credit crunch that would limit the ability for firms to finance their operations, as well as limit consumers' ability to purchase products on credit. Suddenly no one had any money to spend. (Mizen, 2008)

A firm's thoughts regarding liquid assets change in times of financial crisis. This became apparent in the 2007-2009 financial crisis when the financial distress costs increased and firms had limited access to the credit markets. Gale and Yorulmazer (2011) show that the banks cut their lending supply overall and froze the internal lending market between banks just in order to strengthen their liquidity positions. If there is any point in time cash, and other liquid assets should be more valuable, it is in times of economic crisis.

There are several reasons for a firm to hold cash and other liquid assets, among others there are transaction-, precautionary- and agency cost motives.(Opler, 1999; Jensen, 1976) The amount of liquid assets has also proven to be an effective signaling tool, to both possible investors as well as creditors, and can therefore impact a firm's ability to raise capital and lower the cost this capital will be raised at. (Culp, 2006)

The financial crisis forced corporate managers to react to a situation more severe than they were used to. With a few years retrospect we want to analyze how firms reacted to the new reality when it comes to cash holdings, expense management and capital budgeting. We also want to find out how the investors rated that reaction by looking at the US stock-markets. Can we identify any differences in the firms' market values based on what they did to their expenses (R&D, CAPEX and Dividend) during and after the crisis?

1.2 Problem discussion

Song and Lee (2012) concludes that Asian firms increased their cash holdings during and after the 1998 Asian financial crisis by decreasing investment expenses. They argue that the

reason behind these cuts and cash accumulation was that the market actors' demand function changed due to the crisis. Han and Qui (2007) come to a similar conclusion in their research; they conclude that financially constrained firms increase their cash holdings and decrease their investment expenses due to the increasing volatility in the firms' cash flows. Campello, Graham and Harveys (2010) survey also continue on this pattern when they show evidence of US firms cutting investment expenses during the financial crisis of 2008.

Even though Simutin's (2010) research tells us otherwise, that cash is not value creating in crisis times, most previous research indicate that firms believe that increased cash holdings are important to tackle the market uncertainties during and after a financial crisis. With the highly limited access to the restrictive capital markets and external capital, a reallocation within the firm is necessary. The most natural expenses to cut would be investments in research and development, capital expenditures and dividend payments. But how would cuts in these items affect the market's view of the company? While Pettit (2007) gives plenty of reasons to hold cash, researchers like Griliches (1986) and Piergiovanni and Santorelli (2010) give us reasons to keep up the above mentioned expenses. This creates a dilemma. While there is research that come to the conclusion that the benefit of cash increases during a financial crisis and at the same time research that conclude that firms indeed increase their cash holdings on behalf of investments there is nothing substantial (to our knowledge) of how you can increase cash during a crisis in the, from the investors perspective, optimal way. We want to investigate how US firms handled this situation during the financial crisis. Did their cash holdings change? If so, did firms change their level of cash holdings by changing their capital expenditures, research and development costs or dividend payments? How did the market react to these changes?

With the hypothesis, based on the above mentioned literature, that firms do increase their cash holdings during a crisis by cutting other expenses we want to see how the market reacts to these decisions. What is the optimal way to increase cash holdings during and after a financial crisis (from the market's perspective)?

1.3 Purpose

This paper's main purpose is to analyze cash holdings and expenditure/investment cuts from a market's perspective to see how firms, if needed, can increase their cash holdings by cuttings the mentioned items with minimum negative effects on their market value.

We want to investigate which expenses the firm reduces when it increases its cash holdings; is it R&D expenses, capital expenditures, dividend payments or a mixture of them all? Further we want to examine the impact of the cost cutting and if it matters how the firm chooses to reduce their expenses considering their market value. Will we see different results? We also want to gather the most prominent knowledge in the field of "cash holdings" and create a comprehensive overview for the reader to use in future decision-making or research.

We believe that it is of substantial importance for firms to know how the expenditure, investment and payout changes they make during a crisis will impact their market value. Consequently we also believe that the work would be useful for corporate decision makers in future crisis. We combine methods previously used by Opler et al. (1999), Song and Lee (2012) and Simutin (2010) for a more complete conclusion of how the firm can increase its cash holdings in an, from the markets point of view, optimal way. To our knowledge, there has been no previous research with the purpose to show all these results combined.

1.4 Question formulation

1. How did US firms' cash holdings change during and after the economic downturn?
2. How did the changes in cash holdings impact the capital expenditures, research and development and dividend payments during the different periods?
3. If there was any impact; does the market prefer any particular change over the other and do these preferences change depending on the economic condition?

1.5 Thesis outline

In Chapter two the literature review can be found where we present previous research in our field of work. The literature review is meant to give the reader a good understanding for the field and what other researchers have concluded before us. It is categorized as "Cash", "Dividends" and "Research and Development and Capital expenditures". Chapter three brings up the methodological framework. In this chapter we discuss in detail what we are going to do, what sample we used, exclusions and how we secured reliability in our analysis and regressions. In Chapter four we finally present our findings in the three steps that our thesis is built on. In Chapter five we go on to apply previous literature to our findings and analyze the results. In Chapter six we summarize the thesis findings and present a conclusion as well as suggestions for further research.

2.0 Litterateur Overview

In this chapter we present previous research that is relevant to our field of work. It is meant to give the reader the basic knowledge that we have based this thesis on. The litterateur overview is organized into three chapters; "Cash", "Dividends" and "Research and Development and Capital expenditures". After each chapter we try to summarize the previous findings and connect it to our thesis.

2.1 Cash

Extensive research have been done in the cash field by various researchers. We have identified several motives to hold, or not to hold, cash in the previous research. Among others; flexibility, risk financing, volatility, growth support and avoiding financial distress costs are matters that influence the cash holdings positively. Meanwhile, agency costs of managerial incentives, opportunity cost of cash and the "cookie-jar dilemma" are matters that influence the cash holdings in a negative and reducing way. In this part we discuss these motives in more detail to get a better understanding of the theoretical determinants of cash holdings.

Risk financing and buffer against volatility

Culp's analysis of cash takes a risk management perspective. He calls stock piling and accumulation of cash a sort of risk financing. This is done by firms to make sure that they will have sufficient liquid assets to be able to meet all their obligations (for example dividend payments). He lists several benefits and disadvantages to doing so. The main advantage of risk financing is that it gives the firm more financial flexibility in bad times. In particular, firms with a high degree of intangible assets and firms acting in high-growth branches tend to benefit the most from this increase in financial flexibility. The reason behind this is that the firms' capital structures already make it hard to borrow money at decent rates, and in bad times this could get even harder (Culp, p.131).

However, Culp also argues that cash reserves not are the most efficient way to create credibility because of the cookie jar problem. Instead he names captives as an example of a more efficient way to finance risk (Culp, p.132).

Han and Qiu's (2007) research conclude that the impact of cash flow volatility on a firm's cash holdings depends on its financial constraints. This means that a financially constrained company will increase its cash holdings to handle increased volatility in its cash flows. This connection cannot be seen with unconstrained firms. Further, they conclude that a firm's

optimal level for cash holdings change depending on the level of volatility on the market and that this volatility and cash bunkering influences investments negatively; that there is a negative correlation between investments and cash flow volatility. As a solution for this, they suggest to hedge the cash flows. The reduced cash flow uncertainty would also reduce the motivation to hold large amounts of cash for precautionary reasons. This means that hedging and precautionary cash holdings can be seen as substitutes to each other. The optimal level of hedging and precautionary cash holdings can be determined at the point where the marginal benefit of one extra dollar for hedging equals the marginal benefit of one extra dollar for precautionary cash holdings. The correlation between future investment opportunities and future cash flows may also have an impact on the trade-off between hedging and precautionary cash holdings. Bates et al. (2009) findings show that the average cash ratio increased for US firms between 1980 and 2006. Nonetheless, the peak was reached in 2004. The findings indicate that this increase is stronger among non-dividend paying firms and firms that operate in industries with the largest increase in idiosyncratic volatility. The main reasons for this increase in cash ratios is that inventories have fallen, cash flow risks for firms have increased, cash flow risk for firms has increased, capital expenditures have fallen and R&D expenditures have increased. They show evidence that the increase in cash flow risk has to do with the widely studied increase in idiosyncratic risk during this period. Recent evidence of a decrease in idiosyncratic risk should therefore lead firms to reduce their cash holdings and may be the explanation to why the cash ratio peaked in 2004.

Transaction costs

It is costly to raise funds regardless if the firm chooses to sell semi liquid assets or if the firm turns to the external capital markets. Information asymmetry is one reason behind these costs, which would be nonexistent in a perfect capital market. These cost disadvantages of raising funds would give a firm incentives to fund its activities and needs internally, all in line with the well-established pecking-order theory. Firms with good credit ratings or credit lines outstanding would therefore hold less cash as these costs shrinks. Firms with high conversion cycles and high liquidity in their assets would also hold less cash, as it is easier and cheaper for them to raise capital. (Opler et al., 1999)

Cash as a competitive advantage and a signaling tool

Pettit states that firms that hold great amounts of cash gain competitive advantages (Pettit, 2007). In times of crisis when the markets are stressed, the different actors are more likely to lower their prices and engage in competitive pricing. Firms that have large cash holdings can

last longer with weak margins and later on gain market shares from the non-survivors of the price war. Another competitive advantage is the increased bargaining power the cash holding firms have. Especially in crisis times, when the credit markets are constrained, cash payments have a greater value; the bargaining power toward the supply lines increase which strengthens the cash holding firms' position. Culp (2006) also brings up the adverse selection problem that arises with imperfect information as a gateway to strengthen its position through cash management; by stockpiling cash the firm creates credibility for itself and averts some of the financial distress costs.

Avoiding underinvestment problems and gaining flexibility

Ozkan and Ozkan (2003) find that growth opportunities (measured as high market-to-book ratios) have a significant positive impact on cash holdings, which is explained by the fact that companies with great growth opportunities would have hard times finding themselves in a situation where they have to reject a positive NPV project because of a cash shortage. Costs are higher for these expansive firms; therefore they want to avoid possible financial distress. There is also a hypothesis that high market-to-book firms have higher agency costs; hence they would like to use internal funds and not external. They also find evidence for a negative relation between higher debt ratios (higher leverage) and cash holdings. Higher leverage can be seen as a proxy for the firm's ability to issue debt. With the ability to issue debt the need for internal fund decreases. The negative coefficient may also indicate that the cost of holding cash is higher for these firms; meanwhile, the positive coefficient they get between firm size and cash holdings may indicate that larger firms are better at generating cash flows (and profits) which means that they can accumulate more cash. Campello, Graham and Harvey (2010) has surveyed 1050 CFOs in the USA, Europe and Asia to see if their firms were credit constrained during the financial crisis of 2007. Their results show that the crisis indeed had an impact, although unequally, on the firms real investments. They show that during the crisis, financially constrained firms planned to cut their investments and R&D more than financially unconstrained firms. They also find out that constrained firms had to cut their dividends and burn a sizable amount of their cash reserves. More alarmingly, the constrained firms also had to turn down positive NPV projects which would weaken them in the future.

Agency costs of managerial incentives

The management's interests can differ from those of the shareholders. It may accumulate cash just because it is risk averse or wants to pursue its own objectives. By having access to cash, the management can pursue investments that the capital market would refuse to finance. This

is also known as the Cookie-jar problem; the management doesn't have any major difficulties spending the cash reserves on projects not necessarily beneficial for the firm. By avoiding the monitoring by the capital markets, these costs can have an adverse effect on the firm value. Also worth noting, is that they state that these costs are bigger for companies with large market-to-book ratios (Opler et al., 1999).

The impact of agency cost of debt

The agency cost of debt problem arises when the interests of the shareholders differ from those of the debt holders. These firms have strong incentives to involve asset substitution in the debt relationship. The costs associated with this problem make it more expensive or even impossible for these firms to take on more debt, which in turn gives a big incentive to hold greater amounts of cash and liquid assets. (Jensen, 1976)

Jensen (1986) talks about the link and the balance between the agency costs of managerial incentives and the agency cost of debt. Large cash holdings and free cash flow may give the managers incentives to invest in unprofitable projects that are of no benefit for the shareholders. Increasing leverage would be the solution to this problem, however with an increased leverage comes other disadvantages in form of higher costs when the agency cost of debt rises and the cost for bankruptcy increases. He concludes that the optimal debt/equity ratio is reached when the marginal cost of debt just offsets the marginal benefit. The control function of debt is less important for small expansive firms, since they usually have to reach out to the market for financing more often (meaning that they will be monitored by the shareholders instead of the debt holders). Meanwhile, the control function is even more important for large, mature firms in mature industries.

Opportunity cost of cash

Pettit brings up the opportunity cost of capital as one disadvantage of holding cash (Pettit, 2007). As cash has a net present value equal to zero, it can never earn its cost of capital. Jacobs and Shivdasani (2012) also bring up the importance of calculating the cost of capital correctly and taking it into considerations when firms do their capital budgeting. Jacob and Shivdasani states that the cash holdings are at record heights and that these holdings impacts the expenditures decisions as the investments predictions for 2013 are flat.

How much is enough?

While most previous studies show rational reasons to hold cash, they don't give a clear answer to how much a firm should hold. Pettit speaks of a decapitalization strategy to find a balance

between different stakeholders and fulfilling their competing needs. In practice this means that the firm should have sufficient operating liquidity and dry powder for growth, while enhancing both credit profiles as well as stock returns (Pettit, p.97). He also argues that the required cash balance for adequate operating liquidity is getting lower. This is a result of reduced leverage among US listed firms and increased future prospects of company cash flows (Pettit, p.99). Pettit also mentions the different tools which the firms use when deciding upon how much liquid assets they should hold. Among the more common-used methods we find industry-benchmarking and rules of thumb; two percent of revenues, six months of fixed costs, 12 months of R&D expenses or the cost of two fabrication plants (Pettit, p.100). Understandably it is hard to decide on one rule that works for all firms since they operate in different environments. As Culp (2006) noted earlier, a firm with a high degree of intangible assets might benefit more from holding cash than a firm with another type of asset-structure.

Martínez-Sola, García-Teruel and Martínez-Solanos' research (2013) take the discussion one step further when they investigate if there is an optimal level of cash for firms. They use a sample consisting of 472 listed US companies. With their findings they argue that there is in fact an optimal level of cash, 14% of total assets for the US industrial firms in the sample, and being over or below this amount has a negative impact on firm value.

Opler et al. (1999) have done extensive research in the determinants of corporate cash holdings among listed US firms, as well as how firms change these holdings over time. Their paper gives a clear picture of the cash holding firms' characteristics. The firms who have difficulties accessing the external financing market are shown to hold large amounts of capital; mainly firms with strong growth opportunities, firms with riskier activities or smaller firms. The authors also found that the sample firms worked towards fixed cash holding levels, that they adjusted upwards or downwards soon after a deviation from the fixed level. On the other side we have large firms, or firms with stable credit ratings who hold less cash. Like Pettit (2007) and Culp (2006), these results indicate that firms use liquid asset holdings as a way to ensure that they can keep investing even when cash flows run too low or when outside capital is too expensive.

Song and Lee (2012) continuous to build on Opler et al.'s (1999) research when they investigate how the liquid asset holdings of East-Asian firms changed during and after the Asian financial crisis in 1998. In their paper they show how the median cash ratio stayed stable for the most part of the 1990's to suddenly increase after the crisis in 1997-1998. The

findings also pointed out that the increase in cash holdings is not explained by changes in firm characteristics but instead by changes in the firms' demand function for cash. The sample firms have an increased sensitivity to cash flow risks in the post-crisis period and this is the main explaining factor behind their increased cash holdings. The effects on firms' cash holding policies can also be seen long after the crisis has ended, in that they have adopted a more conservative view on investments and liquid asset holdings in the post-crisis years (fewer investments and more cash holdings). These findings match earlier mentioned findings; that firms like to hold more liquid assets the riskier their future cash flows are.

Finally Simutin (2010) documents that excess cash holdings have a positive relationship with future stock returns. He also show, contrary to the intuition that cash holdings are value increasing in financial downturns, that stocks of firms with large amounts of excess cash actually underperform in these times compared to other firms with less excess cash. Even if cash is less risky compared to assets in place he is still able to show that the market betas of cash holding firms are larger than those of non-cash holding firms. On the contrary to Song and Lee (2012), Simutin (2010) show that firms with excess cash holdings increase their future investment rate. This, he states, mean that firms build cash reserves in anticipation of future investment opportunities. These firms have larger market betas which show that these firms' growth opportunities also make them more risky. In downturns these growth opportunities become less valuable, which result in the lower stock returns, however in times of expansions they can instead use their superior cash reserves to invest, which leads to higher stock returns in good times. While some of Simutin's research goes against other researchers' findings, this still shows that riskier firms tend to hold more cash.

2.1.1 Theory analysis and connection to Thesis

Following Culp's risk financing motive, we should be able to see increasing cash holdings used as buffers as the external financing alternatives are restrained in crisis times. In the same manner, we should be able to see smaller cash holdings in the years previous and after the crisis as the cash flow volatility and the economic uncertainty decreases and the external capital markets are less constrained. If we follow Pettit's dry powder for growth reasoning and the opportunity cost of cash, where the cash is used for acquisitions and other fire sales in economic downturns, we should see an accumulation of cash holdings during stable years, the years previous the crisis and after the crisis, and diminishing cash holdings during the crisis years.

Pettit's argument that the required cash balance, to maintain stable liquidity in operations, is lower due to bigger future prospects of cash flow and reduced cash flow volatility, could be worth nothing today. It is worth noting that this is a pre-2008 crisis perspective and may not be applicable on today's economic environment.

Song and Lee show that the demand function for cash has risen since the East Asian crisis. In our sample, we should be able to see an increase of cash holdings during the crisis and post-crisis years compared to the pre-crisis years. As they state that the cash holding policies has permanently changed since the crisis, we shouldn't see an adjustment downwards to the pre-crisis cash holding levels as Opler et al.'s studies indicate.

Simutin's findings, that excess cash holding are inhibitory during financial downturns could be in line with Pettit's reasoning regarding dry powder for growth and opportunity cost of capital. If firms bunker cash during times when there are many good opportunities for good acquisitions and investments, they lose some of the main advantages of large cash holdings. That Simutin also finds that the firms with large cash holdings often have larger betas, is in line with Opler et al.'s findings in cash determinants; that small firms with high cash flow volatility and limited access to the capital markets often hold larger amounts of cash to fund their investments. That firms with high cash holdings actually increase their investments could also be due to the cookie jar problem. If Simutin (2010) is correct, our study will show that the investment rate is independent, or even positively correlated with the size of the cash holdings.

According to Han and Qui's (2007) research; that constrained firms would increase their cash holdings, we should see an increase in excess cash during the crisis since more firms would be financially constrained. This should be on behalf of investments according to Cambello et al. (2010) survey of 1050 CFOs in the United States. Bates et al.'s (2009) findings that the peak in increasing cash holdings was reached in 2004 and that the idiosyncratic risk on the market is decreasing might instead lead us to believe that cash holdings will continue to decrease throughout our timeframe. However the crisis and the risk that followed it, should reverse this pattern back to the old structure before the decrease in idiosyncratic risk. We should also find that market-to-book ratio has a positive impact on liquid asset holdings in step 1 based on Ozkan and Ozkans (2003) research.

2.2 Dividends

Decreasing dividends

Dividends are a way to redistribute capital that doesn't earn its cost of capital within the firm to the shareholders. Previous studies indicate that dividend reductions often result in a negative share price reaction by the market. The dividend-omitting firms in Chritisie's (1994) report were met with abnormal returns of -6.94 % in average, which is a strong sign of the markets view of omitting dividends. (Ogden, p.488)

Charitou et al. find that the negative reaction is more negative for firms that first occur a loss and reduce their dividend payments following an established pattern of positive earnings and dividend payments than firms with lesser establish positive earnings and dividend payouts (Charitou, Lambertides and Theodoulou, 2011). Charitou et al. (2010) also show that managers are more reluctant to changing their dividend payment pattern the more consistent their patterns have been. However it is also a matter of how persistent they think that their earnings difficulties will be. Due to this, dividend payments will be reduced only if management believes that the earnings difficulties will be persistent enough to make a dividend cut worthwhile. This means that dividend reductions explain more of future earnings the longer the pattern of earnings and dividend payments has been going on before the drop in earnings and the more substantially dividends and earnings are reduced.

The financial crisis appeared quite sudden and there were few people that really expected the heavy economic downturn. There could be differences in the market reactions when it comes to how the dividend reduction is made. Mature companies with low growth prospects, which the analysts already counts with future dividend cuts, could have a different reaction by the market when they cut their dividends than the high growth company has when it does the same. Chemmanur and Tian (2012) investigated if there is any difference between the market reactions of a prepared dividends cut and an unprepared one. They show evidence of there being a positive effect on both the preparation day and on the announcement day of the dividend cut compared to the announcement day of the non-prepared dividend cut. They also show that the firms who prepare the market are often firms who are in temporary financial difficulties but with good long-term growth prospects while the firms who don't prepare the markets of dividend cuts are firms with weaker long-term prospects. This also leads to the conclusion that the firms who prepare the markets also do better when it comes to future stock returns. In the same way as dividend reductions or omissions are viewed as negative signals by the market, Mahmood, Fayyaz and Ghaffari (2011) show that there is a significant

connection between dividend announcements and positive returns which can be considered as evidence of weak form of market efficiency.

Charitou, Lambertides and Theodoulou (2010) also show that managers are more reluctant to change their dividend payment patterns the more consistent these patterns have been. However it is also a matter of how persistent they think that their earnings difficulties will be. Therefore dividend payments will be reduced only if the management believes that the earnings difficulties will be persistent enough to make a dividend cut worthwhile. This means that dividend reductions explain more of future earnings the longer the pattern of earnings and dividend payments has been going on before the drop in earnings and the more substantially dividends and earnings are reduced.

Practical effects by dividends on company value

Ogden (2003) brings up three practical effects which dividends has on the equity:

1. Less internal funds for investment
2. Increased probability that the firm will sell equity to fund investments
3. Dividend payouts increase the total leverage of the firm

The smaller amount of funds available for investments could be both negative and positive. If a company has too much liquid assets the "cookie-jar problem", where the managers take on projects that has a negative net present value could be a concern. For growth companies, with strong needs for flexibility, dividend constraints on the cash flows could be devastating. The pecking order theory states that businesses will use the internally generated funds first, then turn to external financing in form of debt, followed by issuing equity. (Ogden, p.116) As the dividend payouts actually increase the total leverage of the firm, the potential financial distress costs increase and it can become harder for the firm to acquire new debt. The smaller amount of liquid funds, and the higher total leverage make it more probable that the company will issue new equity to fund new projects. This could dilute the ownership and increase the cost of capital for the firm, as the required return on equity in most cases is higher than the cost of debt. In the same manner, Lang and Litzenberger (1988) find that the Principal agent theory can be applied to a firm's dividend policy. They find evidence that increased dividends signals that the over investment problem will be reduced and in that way the firm value gets enhanced. In the other direction, decreased dividends signals that more projects with a negative net present value will be taken on, and thereby the value of the firm will be reduced.

Personal taxes, shareholders' liquidity needs, investment opportunities and transaction costs all affect investors' preferences for dividends. Investors with high income, high tax brackets and with long time-horizons for their investments, would like to minimize the dividend payments to minimize the capital gains and the taxes that comes with those gains. Investors with low income, with low tax brackets and a strong need for periodic payouts and liquidity will try to maximize these payouts. It is very important for companies to know their clientele and their preferences. If a company adopts a dividend policy that is attractive for its investor clientele it can boost its company value. As dividends are being an object of double taxation, both on the firm level and on the shareholders income level, Ogden show that investors will demand a premium that is positively related to the firm's dividend policy (Ogden, p. 478).

Pettit states that the dividend policy of a company affects the marketability of stocks, but that dividend levels don't affect the firm valuation, as there are no correlation between multiples and yield and if there is any correlation; it is negative. Since it is mostly mature companies with low growth opportunities that have high dividend levels, valuation is actually negative correlated with the dividend yields. (Pettit , p. 165) In the opposite way; Fama and French found that after analyzing the pricing of US firms between 1965-1992 a positive relation between dividends and firm value could be identified, which is inconsistent with the view that the tax-effects is value destroying. (Ogden, p. 480)

Dividends as a signaling tool

Information asymmetry is a market imperfection that could make it difficult for companies to signal their true strength to the market, which affects their company value. Dividends could act as a tool to communicate the strength (and even weaknesses of the company). (Ogden, p. 484) Aggarwal, Cao and Chens's (2012) research shows that dividends work better as a signaling tool for firms operating in a poor information environment. He uses a sample of ADR firms traded in the US. These firms don't have the same capability to share information to its investors and therefore signaling through dividend payments become an important tool. However this effect quickly declines for firms with better ways of sharing information.

In their studies of the East Asian firms before, during and after the financial crisis, Song and Lee (2012) found that the Asian firms reduced their dividends payments during the financial crisis, but reinstated them shortly after indicating that the crisis had no long term effect on the dividend policy.

2.2.1 Theory analysis and connection to thesis

The previous research strongly state that the market's reactions on dividends reductions are negative. However, none of the work that are made takes into account the economic conditions during the time of the dividend reductions. Following the old theory, we should be able to see negative market reactions in form of a weaker market value of a dividend reducing firm, but we can't solely rely on previous work when it comes to cutting dividends in the time of financial crisis. The work done by Charitou et al. (2011) state that the market reactions are more negative if a company has a previous, strong pattern of dividends payouts. The financial crisis occurred after many years of strong growth; even the strongest of companies received a hit by the macro economic conditions. In our studies, cutting the dividends after years of growth and stable dividends policies should result in a strong negative market reaction. At the same time, the same authors find that managers are reluctant to change their dividend policy if their previous pattern of policy is strong. If this is correct, we should see fewer dividend reductions in our sample. Also the studies made by Thomas, Chemmanur and Tian (2012) shows that the market reacts more negatively if it is not prepared for the dividend cut, which should show as stronger negative market reactions in the crisis years than in the boom- and recovery years.

When it comes to the practical impact of dividends on the valuation of a company; the previous work point in different directions. Pettit (2007) states that the valuation is negative in the correlation with dividend policy, meanwhile Fama and French state the opposite. Ogden states that a firm can boost its firm value by adopting a dividend policy which attracts the shareholder clientele. If the market reactions are different between companies after a dividend cut (due to different clientele) there will be hard to find any clear indication of the markets preferences in our regression model. If the dividend policy is a strong signaling tool that could help relatively strong firms back on track, we would see few dividend cuts or a fast reinstating of the old dividend policy after a dividend cut.

Overall, the previous research indicate that dividend cuts are not to prefer but at the same time Song and Lee (2011) show us that firms actually reduce their dividends in crisis time, but that this is only temporary and that the East Asian crisis had no long term effect on the dividend policy.

2.3 Research and Development & Capital expenditures

Increasing cash-holdings on the behalf of investments

As mentioned before, Song and Lee's (2012) research show that East-Asian firms tended to increase their cash-holdings during and after the 1998 Asian financial crisis. They did so by decreasing investment expenses (CAPEX and M&A). It also shows possible evidence that dividend paying firms increase their cash-holdings by decreasing investment expenses more than non-dividend paying firms. Although the difference is small, this could indicate that dividends are stickier and therefore harder to decrease when needed, instead dividend paying firms need to decrease other things more than non-dividends paying firms.

Bargeron, Lehn, and Zutters (2010) research investigate how US firms changed their view on capital structure after the Sarbane-Oxley act (SOX) was implemented in 2002. They came to the conclusion that after SOX was implemented, the risk-seeking behavior decreased among US firms. Just like the East-Asian firms in Song and Lee's research (2012) this resulted in an increase in the firms' cash-holdings, and once again, this cash was taken from the investments in R&D and CAPEX which decreased post-SOX. These findings give us a pattern that shows that firms that want to decrease risk often aim to increase liquid assets, with reallocations of capital as a result.

Duchin et al. (2010) find that corporate investments decline during the financial crisis of 2007. They come to the conclusion that the greatest declines can be seen among firms with low cash reserves, financially constrained firms or firms that operates in industries historically dependent of external financing.

Value of R&D and CAPEX

Other research show that both R&D and CAPEX investments are important for firm value as well as improving future earnings. Increasing cash by decreasing these two kinds of investments could have negative impacts for the firm in the future. Sueyoshi and Goto (2010) come to the conclusion that R&D expenses have an impact on Japanese firms' market values. However the amount of impact varies between industries. More mature firms' market values seem to have a more significant connection to the R&D expenses than newer firms' values. Although Griliches (1986) did not investigate the connection between R&D investments and firm value, he found that US firms R&D expenditures supported productivity growth and that the investments, in average, earned high returns. He also found that the basic research was

influencing the productivity more than other types of R&D. As market value often is defined as the NPV of all future revenues, R&D increases should lead to a higher market value.

Piergiovanni and Santorelli (2010) also found positive effects of R&D and CAPEX investments. They conclude that the capital expenditures are a major driver of new knowledge creation (measured as filings for new patents) and that R&D and capital expenditures are two complementary forces that work together as determinants for the whole innovation process. They bring up the importance of a well balanced mix of both R&D and Capital expenditure investments; a firm needs both to prosper.

Difficulties of reducing R&D and CAPEX

The positive effects that come from R&D and CAPEX investments must be compared to the benefits of holding cash when the firm makes the decision of which route to go. However, these evidence show that it is no easy decision to make. Baum (2012) continues to state difficulties with reducing the R&D expenditures. As the R&D often is rooted in human capital, cutting down these investments would result in loosing important human capital to other firms and competitors. One interesting note in Baums (2012) research is that firms make bigger cash managerial changes when planning for future R&D expenditures than when they are planning for capital expenditures. They explain this with the fact that the R&D investments often result in intangible assets that cannot be put as a security for future external financing. Their findings show evidence that firms with future R&D expenditures actually bunker and accumulate their cash holdings.

Lower asset tangibility on R&D investments compared to CAPEX investments makes them more expensive to finance using external capital, compared to CAPEX. This makes it more important for R&D heavy firms to have cash reserves as a buffer against future shocks to cash flows. (Bates, 2009)

2.3.1 Theory analysis and connection to thesis

The evidence above show that when firms need to decrease financial risk they tend to increase their liquid asset holdings which then results in decreasing investments (Song & Lee, 2012; Bargeron, Lehn & Zutters, 2010). Since we are analyzing the US firms during a time of crisis we expect to see the same kind of results as Song and Lee (2012) did. If the sample firms increase their cash holdings, they will have to decrease either R&D investments, CAPEX investments or dividends payments. Duchin et al.'s (2010) findings that corporate investments decline during the financial crisis of 2007 also draws us to this conclusion.

This theory section has given clear indications that a firm's value and future profitability can take damage if investments are decreased (Sueyoshi & Goto, 2010; Griliches, 1986; Piergiovanni & Santorelli, 2010). When we in the analysis finally analyze what impact a decrease in any of these three will have on the market value of the firm, we hope to see a clear result that either matches these theories and earlier research or that it does not. However the hypothesis is that we will see a decrease in the firms' market values if they decided to decrease investments which would hurt the company in the long run.

Finally Baum (2012) speaks of the difficulties with decreasing the firms R&D expenses; that the firms with important human capital risk to lose it to competitors. This indicates that R&D is, similarly to dividends, quite sticky which means that it is harder to decrease without a negative impact on the firm. This could mean that, out of the three (R&D, CAPEX and Dividends), CAPEX investments could actually be the easiest one to decrease when the need to build cash reserves is large. If this is the case it will surely be seen in our analysis.

3.0 Choice of method

In this chapter we present the methodological framework used in our thesis. We discuss what we are going to do, what sample we used, exclusions and how we secured reliability in our analysis and regressions. We also discuss all the performed tests in detail and why they are important to our findings.

Since we examine the financial crisis effect on excess cash holdings, on the investment activities and the consequences of these effects on the market value of the companies, a quantitative method is strongly preferred instead of a qualitative method. The quantitative method has in earlier studies been the one most frequently used (Opler et al.,1999; Simutin, 2010; Song & Lee, 2012) and makes it possible for us to make the needed statistical tests and regressions. A panel data regression is preferred as it allows us to analyze the variations both from a time and from a cross-sectional dimension. In this way panel data has a greater ability to capture the behavior of the observations in the sample (Hsiao, 2007). As we want to measure differences between time periods (one period defined as more than one year) and the behavior of the US firms in general, it is hard to argue for a more suited analysis method.

3.1 Sample

Our sample consists of 1701 American firms that have been in business since 2000 to at least year 2011. These are the years before, during and shortly after the latest financial crisis. Year 2011 is the latest year which DataStream can provide enough satisfactory data for. The firms are listed on either Nasdaq, NYSE or NYSE Alternext (former NYSE Amex). The firms in the sample range from all sizes across all industries except for those excluded under the exclusion part. From this sample we extract the yearly data we need for our empirical statistic tests.

3.2 Time frame

Since the mid-70s there has been a broadly accepted view of how to define a recession. Julius Shishkin (1974) wrote a list with rules of thumb of which to use when defining an economic regression. One of the most fundamental rules on how to identify a regression was that there had to be two consistent negative quarters of GDP-growth. (O'Donoghue, n.d.)

However, this view has nowadays become more unpopular, since it appears to be too shallow. Shishkin's rules of thumb didn't identify the regression 2001, which only consisted of one quarter of negative GDP growth but resulted in a loss of 2.7 million jobs. NBER (the National

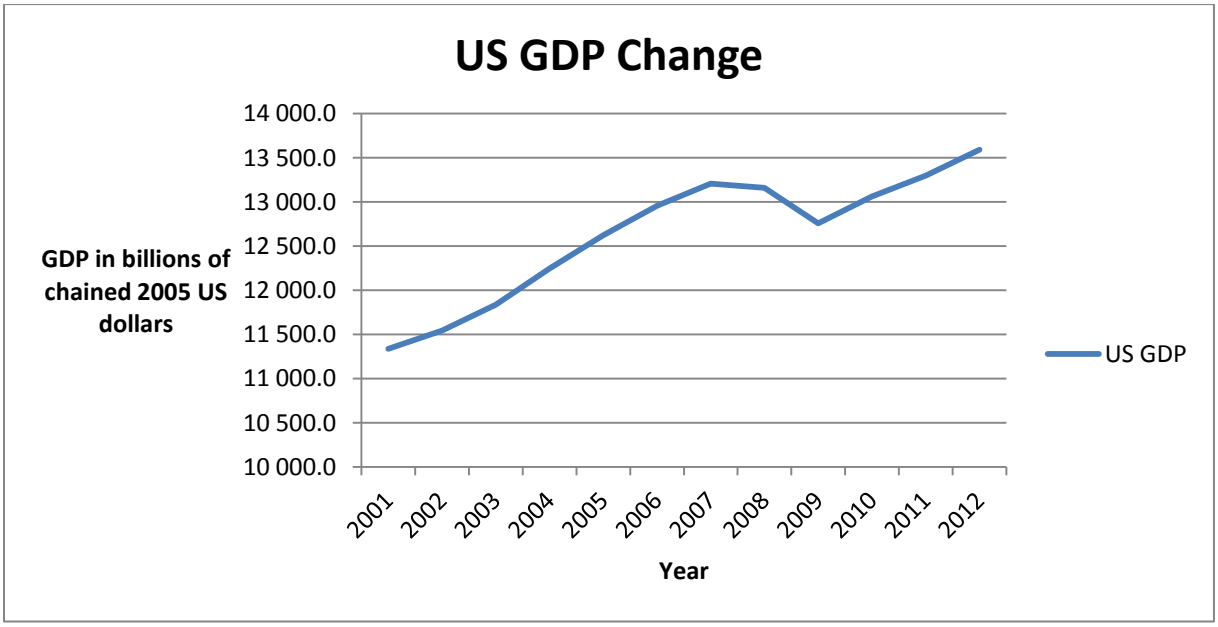
Bureau of Economic Research) has a broader perspective of how to identify a recession. NBER Business cycle committee doesn't have any fixed definition of an economic recession. The committee:

> "*Examines and compares the behavior of various measures of broad activity: real GDP measured on the product and income sides, economy-wide employment, and real income. The Committee may also consider: Indicators that do not cover the entire economy, such as real sales and the Federal Reserve's index of industrial production (IP). A well-defined peak or trough in real sales or IP might help to determine the overall peak or trough dates particularly if the economy-wide indicators are in conflict or do not have well-defined peaks or troughs*." (NBER, 2010)

The committee define the financial crisis to reach between the period December 2007 until June 2009 after analyzing:

> *"Macroeconomic advisers' monthly GDP, The Stock-Watson index of monthly GDP, Their index of monthly GDI, An average of their two indexes of monthly GDP and GDI, Real manufacturing and trade sales, index of Industrial Production, Real personal income less transfers, Aggregate hours of work in the total economy, Payroll survey employment and Household survey employment."* (NBER, 2010)

Graph 1 US GDP change between 2001 and 2012, data gathered from Bureau of Economic Analysis.



As both the thumb rules made by Shishkin, the NBER view and the visual GDP peaks in Graph 1 indicate a quite clear start and ending of the crisis, we have chosen to determine the crisis years to last between December 2007 and June 2009.

3.3 Exclusions

All financial and utilities firms (SIC-code 6000-6999) are excluded from the sample. The reason for this is that these firms may have to hold cash in order to meet capital requirements stated by the law. Therefore, keeping these firms in the sample could lead to misleading results. We also exclude firms that were not present at the beginning of the analyzed time period as well as firms that have seized to exist during the time period. This could lead to potential survivor bias, however we discuss why this is not a problem in our thesis in the limitation section. Firms with any missing yearly data have also been excluded.

3.4 Sample assumptions

For firms that have not reported any R&D expenses or paid dividends we have assumed that these values are 0. We controlled this assumption with 20 companies' financial statements to be sure that the missing data really meant that they had not reported it in their financial statement, which was correct in every case.

3.5 Regression

Step1.

As the need for cash vary substantially between industries and firms based on factors such as size and nature of business, we need to take this into account when calculating the cash richness of a firm. The regression formula for measuring cash holdings has been constructed by Opler et al. (1999) and has been widely used and accepted in previous research in the field of work (Simutin, 2010; Song & Lee, 2012). By comparing the regressions estimated "normal values" with the companies' actual cash holdings we can estimate the amount of excess cash. We can then construct a table with the mean excess cash holdings for every period and compare these to the mean changes in R&D-ratio, CAPEX-ratio and dividend-ratio.

Regression Formula:

$$C_{i\tau} = \alpha_{0t} + \beta_{1t}MB_{i\tau} + \beta_{2t}Size_{i\tau} + \beta_{3t}CPX_{i\tau} + \beta_{4t}WC_{i\tau} + \beta_{5t}L_{i\tau} + \beta_{6t}RD_{i\tau} + \beta_{7t}CF_{i\tau} + \beta_{8t}\sigma_{i\tau}^{IND} + \beta_{9t}DIV_{i\tau} + \varepsilon_{i\tau}$$

Dependent variable:

Liquid asset holding: As the dependent variable we use liquid asset holdings. This variable is calculated by dividing cash and cash equivalents with total book value of assets minus cash and cash equivalents (hereafter referred to as net assets).

C = Cash and cash equivalents / (Total book value of assets - cash and cash equivalents)

Independent variables:

MB-ratio: The book value of assets does not take into account if the firm has many positive NPV projects in the future. To get the likelihood that a firm will have growth opportunities in the future we need to use the market-to-book ratio of the company's assets. This is calculated by taking the book value of assets, less the book value of equity, plus the market value of equity, divided by net assets.

MB = (Book value of assets - Book value of equity + Market value of equity) / Net assets

Cash flow: The cash flows are calculated by taking EBIT plus depreciation minus taxes, interest and common dividends.

CF = EBIT + Depreciation - taxes - interest - common dividends

Liquid asset substitutes: To measure liquid asset substitutes we use working capital minus cash and cash equivalents divided by net assets.

WC = (WC - Cash and cash equivalents) / Net assets

Financial distress costs: R&D expenses are divided by sales in order to measure the potential financial distress costs.

RD = R&D expenses / Sales

Firm Size: Firm size is measured by taking the natural logarithm of the book value of assets in 2011 dollars.

Size = LN (Book value of assets)

CAPEX: We get capital expenditures by dividing capital expenditures by net assets.

CPX = CAPEX / Net assets

Financial leverage: To calculate the financial leverage for each firm we divide the total debt with the total book value of assets.

L = Total debt / Total book value of assets

Cash flow riskiness: As a measure of cash flow riskiness we use the industry sigma. This is computed by calculating the standard deviation of each individual firm's cash flows (as defined above) over an 11 year period. The firms are then divided into industries using their 2-digit Sic-codes and the average value for each industry is the industry sigma.

Dividend dummies: Finally a dummy variable is also used in the regression model to show firms who pay dividends. We have assigned the number 1 to firms that do pay dividends and a 0 to firms that do not.

Step 2.

Regression formulas:

$$RD_{i\tau} = \alpha_{0t} + \beta_{1t}XC_{i\tau} + \beta_{2t}MB_{i\tau} + \beta_{3t}EBIT_{i\tau} + \beta_{4t}G_{i\tau}$$

$$CPX_{i\tau} = \alpha_{0t} + \beta_{1t}XC_{i\tau} + \beta_{2t}MB_{i\tau} + \beta_{3t}EBIT_{i\tau} + \beta_{4t}G_{i\tau}$$

$$DIV_{i\tau} = \alpha_{0t} + \beta_{1t}XC_{i\tau} + \beta_{2t}MB_{i\tau} + \beta_{3t}EBIT_{i\tau} + \beta_{4t}G_{i\tau}$$

To determine the relationship between excess cash holdings and the R&D-ratio, dividend-ratio and CAPEX-ratio during the three different periods (Pre-crisis, Crisis, Post-crisis) we need to make nine additional regression models. We use the same regression model, modified with our own dependent variables, as Song and Lee (2012) use for measuring the cash-ratios impact on investment. The dependent variables in these three functions are: R&D expenses divided by assets, Dividend payments divided by revenues and CAPEX divided by assets. As the independent variables we use EBIT-ratio (EBIT divided by assets), Market-to-book ratio (as described above), excess cash (which we get from step 1) and sales growth. We divide the samples into the three periods: 2001-2007 for Pre-crisis, 2008-2009 for Crisis and 2010-2011 for Post-crisis.

Step 3. Regressions and cluster construction

As we want to measure the impact of changes in R&D, CAPEX and dividends to the market value, we put these variables in relation to the market value. Simutin (2010) shows mainly three other factors that explain total stock returns. As the market value of a company is the

predicted present value of all future cash flows from the company, we use the same variables; Market-to-book ratio, Size and Beta as the other explaining variables for the market value. These are the variables which "Fama- French three factor model" also takes into account when calculating the expected return for a stock (Fama & French, 1992). We then do panel data regressions for all periods; previous, during and after the financial crisis to see which of the different ways to bunker cash is preferred by the market and if this differs between the different periods of economic activity. As we want to see how the market reacts to a certain action, we meassure the change in market value against the changes in the explaining variables.

Regression formula:

$$\Delta MV_{i\tau} = \alpha_{0t} + \beta_{1t}\Delta RD_{i\tau} + \beta_{2t}\Delta CPX_{i\tau} + \beta_{3t}\Delta DIV_{i\tau} + \beta_{4t}\Delta MB_{i\tau} + \beta_{5t}\Delta Size_{i\tau} + \beta_{6t}Beta_{i\tau}$$

To complete the regression results and be able to analyze some characteristic, we cluster the firms using the changes in the examined variables (R&D, dividends, capital expenditures or a mixture of more than one) as determinants of cluster inherency.

The clusters:

1. Companies with pure R&D reductions
2. Companies with R&D and CAPEX reductions
3. Companies that have reduced R&D, CAPEX and dividends
4. Companies that have reduced R&D and dividends
5. Companies with pure CAPEX reductions
6. Companies that have reduced both dividends and CAPEX
7. Companies that have no cut downs, only increases in the expenditures
8. Companies with pure dividend reductions

We calculate the average beta, Market-to-book ratio and size for all clusters.

NOTE: Beta is calculated on yearly data for all the companies against the Nasdaq index. The Nasdaq stock exchange is big enough to not be too affected by individual big companies, in that way we don't risk to measure each company movements against one dominating company.

3.7 Reliability and validity of the method

Our methodology is based on earlier papers that have proven to be reliable (Opler, 1999; Song & Lee, 2012; Simutin, 2010). Robust tests have been done in these studies to ensure that they are reliable and valid. Exclusions in our sample have been done only when we have found reasons to do so in the theory used in previous papers. This ensures that we won't lose reliability by doing so. We have also used well-known and reliable computer software and databases when gathering our data and performing our tests. The data is gathered from DataStream and the statistical tests and regressions are done in E-views. Both of these are well recognized and have been well-used by researchers in the past.

To further ensure the reliability of our models we need to test our regressions for potential pooling problems. The simplest way to test our data would be to estimate a pooled regression on all observations together, however, by doing so we would assume no heterogeneity and no time specificity. To assume that eg. the cash holdings of a firm in year t would be completely independent and have no relation to the cash holdings at t-1, would not be appropriate.

Heteroscedasticity

When examining cross sectional data regarding companies there is a big risk for heteroscedasticity; that the residuals are correlated with the explaining variables. Our first regression which estimates a regression for the firms' cash holdings, the residuals are most likely to be higher for large sized firm than for a SME firm. E-views has no built in function to test panel data for heteroscedasticity which forces us to make the Breusch-Pagan test manually. In table A2 in appendix section 8.2.1 our result for regression 1 is presented.

Table A2 shows a regression with the squared residuals as the dependant variable and the original explaining variable on the independent side of the regression. As we can see the significance level is far below the 95 % limit. This tells us that there is in fact heteroscedasticity in our model and that we need to use robust standard errors in our test. These Breusch-Pagan tests are made for all of the independent regressions as we can see in section 8.2 of the Appendix. They show strong signs of heteroscedasticity in almost every regression with the exceptions beung table A12 and A14. Both Yamano (2009) and Schmidheiny (2009) argues that in practice it is hard to estimate the structure of heteroscedasticity and therefore it is safer to use robust standard errors even if the sample is homoscedastic. This is the case due to the fact that even in a homoscedastic sample the robust standard errors would just become ordinary OLS standars errors. Woolridge (p.277, 2005)

also argues that if the sample is large you can always use the robust standard errors. But for the sake of it we have decided to include the OLS standard error tests in Appendix section 8.8 for the tests without heteroscedasticity. However, these strong signs lead us to the conclusion that the use of robust standard errors is preferred for the most unbiased results in our regressions, even if we trade away some efficiency in the model.

Allowing for heterogeneity and time-specificity in our sample

Using large samples with different industries raise the potential problem of heterogeneity in the sample; that the units in the sample differ in characteristics from each other which is shown as correlations between the explaining variables and non-constant error terms. We also need to take time-specificity into account; that time periods differ in characteristics from each other and affect the variables and error terms.

To see whether we need to use fixed or random effects in the cross-section and period dimension when doing our regressions we have made likelihood-ratio and Hausman tests. The likelihood-ratio test tests if we need to take any effects into account at all and an example can be seen in table A15 in appendix section 8.3.1. As we can see in table A15 the significance of 0.00 means that we reject the null hypothesis and confirm that we have significant heterogeneity (i.e. that the pooled regression is miss-specified). This means that we need to take either random or fixed effects into account for our regression. To test which of these two we should use we set up a Hausman test as can be seen in table A40 in appendix section 8.4.1. The significance of 0.00 in table A40 means that the null hypothesis (that a random effect model is well-specified) is rejected and that we should use fixed effects in the cross-section tab. The same tests are then committed for the period tab. All Likelihood-ratio tests and Hausman tests can be seen in Appendix section 8.3 and 8.4.

Since most of our tests show that we should use fixed effects in both cross-section and period we use this as often as we can. The exception is when we have a non-time dependent variable (like cash flow riskiness in step 1) which prevents us from using fixed effects in the cross-section tab. The hausman test is also impossible to make for the period-dimension on our crisis and post-crisis samples since there are not enough periods in the sample. In these cases we have used fixed effects. In general the idea of the Hausman test is that one will use the random effects estimate until the Hausman test rejects it. However in practice the failure to reject would mean that fixed effects and random effects are close enough for it to not matter

which one you use (Woolridge, p.499). This leads us to the conclusion that we can use the fixed effects in every period even if we (according to the Hausman test) could use random effects if we wanted to.

Multicollinearity

Multicollinearity is an important issue to take into consideration when dealing with multiple regression analysis and refers to high correlations between the explanatory variables in the regression. (Alkan & Attakan, 2013) By using the rule of thumb that the critical values for multicollinearity is 0.7 we can't find any indications of problematic correlations between the explaining variables in the first regression which can be seen in Table A56 in appendix section 8.5.1. We made these correlation matrixes for all of the regressions and couldn't find any problematic correlations which can be seen in Appendix section 8.5.

Normality tests

To test for normality in our model we used a set of normality tests. As can be seen in appendix 8.6 all of the models reject the null-hypothesis; that the residuals are normally distributed. Although due to the very large size of the sample this shouldn't imply any problem for our analysis.

Interpretation of the beta coefficient

In step three, where we measure the examined variables different effect on the market value, we need to interpret the beta-coefficient for each variable. As the examined explaining variables and the dependent variable is measured and given in percentages, we do not need to standardize the coefficients (as you need when measuring impact between explaining variables given in different units and scale). In this way we can simply look at the beta-coefficients and compare their impacts on the dependent variable.

Interpretation of the significance levels

To accept or reject the null-hypothesis you can use different significance or confidence levels. The most common limits for the significance level is 1% (prob.=0.01), 5% (prob.=0.05) and 10% (prob. 0.1). (Cowles & Davis, 1982) In this thesis we will only use the 5% significance level (95% confidence level).

Exclusion of outliers

Outliers are extreme observations that deviate strongly from the other observation in the sample and can affect and distort the regressions and the analyses results. To detect the outliers we calculated the Z-score for all variables. We used the common rule of thumb

described by Martin (2007); to exclude all observations with a Z-score higher than 3.29 or lower than -3.29. By doing this, the means and medians of the sample are drawn together.

Other adjustments to the sample

In step 3 when calculating the market value increase we needed to adjust for the inflation impact. We adjusted all market values with the US CPI (consumer price index) gathered from the Bureau of Labor Statistics.

Limitations

Since all of our data is collected from DataStream this puts a natural limitation to our sample's size. We also need to have all the information for every company for every year that we want to analyze. This means that firms that did not survive from 2000-2011 have been removed which creates a risk for survival bias when we only analyze the results from those that have survived. However Simutin (2010) come to the conclusion that his results do not change very much when removing non-survivors (from a sample of all firms) which indicates that survival bias should not be a problem in our analysis either.

4.0 Empirical findings

In this chapter we present our findings from the regressions and tables. This chapter is organized into three main chapters; Step 1 findings, Step 2 findings and Step 3 findings. For an analysis of these findings please turn to Chapter 5.

4.1 Step 1 findings

By taking all the needed actions to insure the reliability of the model we end up with the regression model presented in table 1. We will try to clarify what the different correlation coefficients indicate:

Table 1 Regression for step 1 with liquid asset holdings as the dependent variable, with periodical fixed effects and robust standard errors (white cross-section). The regression describes the whole period and is used to get excess cash. For a more detailed version please see Table A77 in appendix section 8.9.

Variable	Liquid asset holdings
C	-2.431763
Prob.	*0.0000*
CAPEX	0.381414
Prob.	*0.0000*
CASH FLOW	-0.231863
Prob.	*0.0000*
CASH FLOW RISKINESS	1.431077
Prob.	*0.0000*
DIVIDEND DUMMY	-0.500813
Prob.	*0.0000*
FINANCIAL DISTRESS	0.000622
Prob.	0.0644
FIRM SIZE	0.079215
Prob.	0.0000
LEVERAGE	-0.368775
Prob.	0.0000
MARKET TO BOOK	0.005624
Prob.	0.0000
WC	-0.190632
Prob.	0.0000
Adjusted R-square	0.29066
Prob(F-statistic)	0.0000
N	18136
Firm dummy	No
Period dummy	Yes
Robust standard errors	Yes

Description of coefficients in Table 1

CAPEX (+) – The positive correlation coefficient show that firms with higher capital expenditures hold more cash.

Cash flow (-) – Firms with high cash flows hold less cash.

Cash flow riskiness (+) – Firms within an industry with high volatility in cash flows hold more cash.

Dividends (-) – Firms that pay dividends hold less cash

Financial distress (+) – Firms with high financial distress costs hold more cash. However, this impact is not significant at the 95 % limit.

Firm size (+) – Large firms hold more cash. This could be an indication that bigger and mature firms don't strive after WACC minimization.

Leverage (+) – Firms with high leverage hold more cash, which contradicts the research who states that firms with good opportunities to issue debt hold less cash.

Market-to-book (+) – Firms with higher market-to-book ratio hold more cash as a high market-to-book ratio indicate larger growth opportunities and the flexibility motive of cash increases in impact.

Working capital (-) – Firms with large rates of working capital hold less cash.

Table 2 Describes the mean change of the variables over the three periods. A more detailed version can be found in Appendix section 8.7.

	Pre-crisis		*Crisis*		*Post-crisis*
Variable	**Means**		**Means**		**Means**
EXCESS CASH	-2.534805		-2.259277		-2.218522
Prob.	*0.0000*		*0.0000*		*0.0000*
FIRM SIZE	12.61921		12.92025		13.02968
Prob.	*0.0000*		*0.0249*		*0.0000*
WC	-0.176818		-0.137169		-0.128627
Prob.	*0.0000*		*0.0000*		*0.0000*
MARKET TO BOOK	11.82866		6.954343		8.628751
Prob.	*0.0000*		*0.0000*		*0.0000*
LEVERAGE	0.913149		0.920419		0.890464
Prob.	*0.0000*		*0.0000*		*0.0000*
FINANCIAL DISTRESS	1.497416		0.85304		2.13792
Prob.	*0.0000*		*0.0000*		*0.0000*
DIVIDENDS	0.418425		0.711562		0.512372
Prob.	*0.0000*		*0.0000*		*0.0000*
CASHFLOW RISKINESS	0.45082		0.451535		0.452364
Prob.	*0.0000*		*0.0000*		*0.0000*
CASH FLOW	0.159311		0.078189		0.184351
Prob.	*0.0000*		*0.0000*		*0.0000*
CAPEX	0.370134		0.350526		0.336878
Prob.	*0.0000*		*0.0000*		*0.0000*

Table 3 A detailed table of R&D-ratio, CAPEX-ratio and Dividend-ratio over the three periods. The table also shows the mean change in the three variables over the analyzed periods.

	Pre-crisis			*Crisis*			*Post-crisis*		
	R&D RATIO	CAPEX RATIO	DIV RATIO	R&D RATIO	CAPEX RATIO	DIV RATIO	R&D RATIO	CAPEX RATIO	DIV RATIO
Mean	0.258206	0.391765	0.027016	0.241977	0.37552	0.026338	0.2215	0.346096	0.025922
Median	0.000142	0.139987	0.000148	0.000108	0.119845	0.000852	0.000137	0.113817	0.000893
Maximum	16.14353	6.462806	48.33333	16.21767	6.385214	3.436709	16.0343	6.394033	2.198864
Minimum	2.38E-08	0.0000002	5.8E-09	0.000000024	0.000000201	6.84E-09	2.07E-08	0.000000646	7.34E-09
Std. Dev.	1.165019	0.71912	0.486695	1.112893	0.703125	0.119238	1.00351	0.665965	0.102451
Skewness	8.482165	4.031157	87.77179	9.187015	4.119175	15.13245	9.45944	4.456967	11.5982
Kurtosis	85.90277	23.14491	8381.147	100.5232	24.32146	320.0211	106.5495	27.83193	174.5034
Jarque-Bera	3532889	231838.8	3.48E+10	1386981	73647.2	14367601	1561416	98118.68	4243128
Probability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sum	3057.413	4629.876	321.3291	817.8827	1270.385	89.54829	749.1145	1170.843	88.13387
Sum Sq. Dev.	16070.08	6110.972	2817.116	4184.995	1672.011	48.32627	3404.773	1499.947	35.6764
Observations	11841	11818	11894	3380	3383	3400	3382	3383	3400

4.1.1 Regression summary

If we look at the descriptive Table 2 (or the more detailed version in Appendix section 8.7.1) we can see that the firms in the sample increased their excess cash holdings throughout the periods. The excess cash increases from -2,53 in the pre-crisis period to -2,25 during the crisis years and settles at a -2,21 limit in the post-crisis period. We also see that the leverage is on a quite stable level throughout the periods. The table also show how the capital expenditures are reduced parallel to the increased excess cash holdings from period to period. If we look at the dividend dummy variable, we can actually see that more firms pay dividends in the post-crisis period compared to the pre-crisis period, but that alone does not tell us if the firms pay more or less in dividends. Table 3 contains more detailed information for R&D-ratio, CAPEX-ratio and dividend-ratio for every period without any dependency exclusion from any of the other variables. The results from Table 2 indicates that excess cash holdings are impacted by the new economic conditions and that the effect most likely is permanent and not only of a short term character. We can see that the firms are keeping their leverage and Debt-to-equity ratio at a constant level, indicating that the newly generated cash holdings aren't a result of externally raised funds, but instead internally generated and redistributed. The detailed table for dividends, R&D and CAPEX (Table 3) strengthens this perception by showing that all of these variables are reduced in the post-crisis period compared to the pre-crisis period.

4.2 Step 2 findings

In step two we try to find out the typical characteristics of an R&D-, CAPEX-, and dividend heavy firm before, during and after the crisis.

Table 4 The regressions with R&D-ratio as the dependent variable for all three periods, with periodical and cross-sectional fixed effects and robust standard errors (white cross-section). For a more detailed version please see Table A78-A80 in appendix section 8.9.

	R&D-ratio		
Variable	**Pre-crisis**	**Crisis**	**Post-crisis**
C	0.342594	0.152791	0.221056
Prob.	*0.0000*	*0.0000*	*0.0000*
EXCESS CASH	0.038772	0.0010	-0.015834
Prob.	*0.0026*	*0.0000*	*0.0000*
EBIT RATIO	-0.03383	-0.034811	-0.110121
Prob.	*0.0000*	*0.0000*	*0.0000*
MB RATIO	0.000705	0.014703	-0.00062
Prob.	*0.2940*	*0.0000*	*0.0000*
SALES GROWTH	-0.000106	-0.000105	-0.036845
Prob.	*0.0818*	*0.0000*	*0.0000*
Adjusted R-square	0.738285	0.89303	0.845921
Prob(F-statistic)	0.0000	0.0000	0.0000
N	11641	3340	3343
Firm dummy	Yes	Yes	Yes
Period dummy	Yes	Yes	Yes
Robust standard errors	Yes	Yes	Yes

Description of coefficients in table 4, pre-crisis

Excess cash (+) – Increases in excess cash result in a R&D-ratio increase.

EBIT-ratio (-) – Increases in EBIT-ratio result in a R&D-ratio decrease.

Market-to-Book (+) – As the variable has a very low significance level it is hard to estimate the real impact from this variable on the R&D-ratio.

Sales growth (-) – As the variable has a very low significance level it is hard to estimate the real impact from this variable on the R&D-ratio.

Description of coefficients in table 4, crisis

Excess cash (+) – Increases in excess cash result in a R&D-ratio increase.

EBIT-ratio (-) – Increases in EBIT-ratio result in a R&D-ratio decrease.

Market-to-Book (+) – Increases in the market-to-book ratio result in a R&D-ratio increase.

Sales growth (-) – Increases in sales growth result in a R&D-ratio decrease.

Description of coefficients in table 4, post-crisis

Excess cash (-) – Increases in excess cash result in a R&D-ratio decrease.

EBIT-ratio (-) – Increases in EBIT-ratio result in a R&D-ratio decrease.

Market-to-Book (-) – Increases in the market-to-book ratio result in a R&D-ratio decrease.

Sales growth (-) – Increases in sales growth result in a R&D-ratio decrease.

4.2.1 R&D-ratio regression summary

If we start this summary by looking at the findings in table 4 and the regression for the R&D-ratio before the crisis, we can see that it will be impacted positively by excess cash as well as market-to-book ratio while EBIT-ratio and sales growth has a negative impact. However the impacts of the market-to-book ratio and sales growth are not significant. The directions of the coefficients do not change during the crisis, although all of them are significant in this period. In the post-crisis period the market-to-book ratio as well as excess cash changes to having a negative impact on R&D-ratio.

Table 5 The regressions with CAPEX-ratio as the dependent variable for all three periods, with periodical and cross-sectional fixed effects and robust standard errors (white cross-section). For a more detailed version please see Table A81-A83 in appendix section 8.9.

	Capex-ratio		
Variable	**Pre-crisis**	**Crisis**	**Post-crisis**
C	0.347133	0.310382	0.320385
Prob.	*0.0000*	*0.0000*	*0.0000*
EXCESS CASH	-0.013472	-0.032398	-0.010952
Prob.	*0.0647*	*0.0000*	*0.0000*
EBIT RATIO	-0.005067	-0.000734	0.005829
Prob.	*0.0048*	*0.0000*	*0.0000*
MB RATIO	0.000336	-0.002384	-0.000577
Prob.	*0.2974*	*0.0000*	*0.0000*
SALES GROWTH	3.63E-05	1.90E-05	0.028295
Prob.	*0.0000*	*0.0000*	*0.0000*
Adjusted R-square	0.72493	0.765788	0.866384
Prob(F-statistic)	0.0000	0.0000	0.0000
N	11641	3340	3343
Firm dummy	Yes	Yes	Yes
Period dummy	Yes	Yes	Yes
Robust standard errors	Yes	Yes	Yes

Description of coefficients in table 5, pre-crisis

Excess cash (-) – Increases in excess cash result in a CAPEX-ratio decrease.

EBIT-ratio (-) – Increases in EBIT-ratio result in a CAPEX-ratio decrease.

Market-to-Book (+) – As the variable has a very low significant level it is hard to estimate the real impact from this variable on the CAPEX-ratio.

Sales growth (+) – As the variable has a very low significant level it is hard to estimate the real impact from this variable on the CAPEX-ratio.

Description of coefficients in table 5, crisis

Excess cash (-) – Increases in excess cash result in a CAPEX-ratio decrease.

EBIT-ratio (-) – Increases in EBIT-ratio result in a CAPEX-ratio decrease.

Market-to-Book (-) – Increases in market-to-book result in a CAPEX-ratio decrease.

Sales growth (+) – Increases in sales growth result in a CAPEX-ratio increase.

Description of coefficients in table 5, post-crisis

Excess cash (-) – Increases in excess cash result in a CAPEX-ratio decrease.

EBIT-ratio (+) – Increases in EBIT-ratio result in a CAPEX-ratio increase.

Market-to-Book (-) – Increases in market-to-book result in a CAPEX-ratio decrease.

Sales growth (+) – Increases in sales growth result in a CAPEX-ratio increase.

4.2.2 CAPEX-ratio regression summary

If we look at the findings in table 5 we can see that during the pre-crisis period the market-to-book ratio and sales growth have positive impacts on the firms' CAPEX-ratio. The two other variables, with a negative effect on CAPEX, are excess cash and EBIT-ratio. However, we fail to see any significant connection between CAPEX-ratio and market-to-book ratio or sales growth during the pre-crisis time. When the crisis starts we see that the market-to-book ratio shifts to having a negative impact and all variables now have significant impacts on thr CAPEX-ratio. After the crisis the EBIT-ratio changes to having a positive coefficient. All variables are still significant.

Table 6 The regressions with dividend-ratio as the dependent variable for all three periods, with periodical and cross-sectional fixed effects and robust standard errors (white cross-section). For a more detailed version please see Table A84-A86 in appendix section 8.9.

	Dividend-ratio		
Variable	**Pre-crisis**	**Crisis**	**Post-crisis**
C	-31.90684	0.041379	-0.013011
Prob.	*0.2501*	*0.0000*	*0.0000*
EXCESS CASH	-13.37807	0.005563	-0.015611
Prob.	*0.2404*	*0.0000*	*0.0000*
EBIT RATIO	0.98992	-0.001978	0.01134
Prob.	*0.1598*	*0.0000*	*0.0000*
MB RATIO	-0.055574	-0.000607	0.000469
Prob.	*0.2972*	*0.0000*	*0.0000*
SALES GROWTH	0.00207	-0.000132	-0.016349
Prob.	*0.5465*	*0.0000*	*0.0000*
Adjusted R-square	0.061064	0.67972	0.796398
Prob(F-statistic)	0.0000	0.0000	0.0000
N	11641	3340	3343
Firm dummy	Yes	Yes	Yes
Period dummy	Yes	Yes	Yes
Robust standard errors	Yes	Yes	Yes

Description of coefficients in table 6, pre-crisis

Excess cash (-) – As the variable has a very low significance level it is hard to estimate the real impact from this variable on the dividend-ratio.

EBIT-ratio (+) – As the variable has a very low significance level it is hard to estimate the real impact from this variable on the dividend-ratio.

Market-to-Book (-) – As the variable has a very low significance level it is hard to estimate the real impact from this variable on the dividend-ratio.

Sales growth (+) – As the variable has a very low significance level it is hard to estimate the real impact from this variable on the dividend-ratio.

Description of coefficients in table 6, crisis

Excess cash (+) – Increases in excess cash result in a dividend-ratio increase.

EBIT-ratio (-) – Increases in EBIT-ratio result in a dividend-ratio decrease.

Market-to-Book (-) – Increases in market-to-book results in a dividend-ratio decrease.

Sales growth (-) – Increases in sales growth result in a dividend-ratio decrease.

Description of coefficients in table 6, post-crisis

Excess cash (-) – Increases in excess cash result in a dividend-ratio decrease.

EBIT-ratio (+) – Increases in EBIT-ratio result in a dividend-ratio increase.

Market-to-Book (+) – Increases in market-to-book result in a dividend-ratio increase.

Sales growth (-) – Increases in sales growth result in a dividend-ratio decrease.

4.2.3 Dividend-ratio regression summary

The findings in Table 6 show that in the pre-crisis period the dividend-ratio has a positive connection to EBIT-ratio and sales growth while excess cash and a negative correlation with the market-to-book ratio. However none of the variables are significant at the 5 % significance level. During the crisis the excess cash variable changes to having a positive coefficient while EBIT-ratio and sales growth both change to having a negative one. In this period all variables have significant impacts on the dependant variable. After the crisis the only two variables with negative impacts on the dividend-ratio are sales growth and excess cash. All variables still have significant impacts.

4.3 Step 3 findings

Table 7 The regressions with changes in the market value as the dependent variable for all three periods, with periodical fixed effects and robust standard errors (white cross-section). All variables are measured as percentage changes from the previous year. For a more detailed version please see Table A87-A89 in appendix section 8.9.

	Market value				
Variable	Pre-crisis		Crisis		Post-crisis
C	0.142971		0.030954		0.063247
Prob.	0.0000		0.6610		0.0000
RD	1.68E-06		-1.04E-06		9.47E-07
Prob.	0.7130		0.0204		0.0078
CAPEX	-1.19E-06		-9.59E-05		4.84E-06
Prob.	0.4922		0.1094		0.0000
DIV	-8.32E-07		-1.54E-06		-1.57E-06
Prob.	0.0415		0.0159		0.0000
MB	0.001096		0.125327		0.000244
Prob.	0.0482		0.0000		0.0000
SIZE	1.005805		3.439391		4.572419
Prob.	0.0000		0.0000		0.0000
BETA	-0.007943		0.050674		0.001011
Prob.	0.6541		0.4734		0.9005
Adjusted R-square	0.657232		0.432946		0.206415
Prob (F-statistic)	0.0000		0.0000		0.0000
N	11799		3323		3295
Firm dummy	No		No		No
Period dummy	Yes		Yes		Yes
Robust standard errors	Yes		Yes		Yes

Description of coefficients in table 7, pre-crisis

R&D (+) – As the variable has a very low significant level it is hard to estimate the real impact from this variable on the market value

CAPEX (-) – As for the R&D, the variable has a very low significant level and it is hard to estimate the real impact from this variable on the market value

Dividends (-) – Increases in dividend payments are in the long run perceived negative by the market and results in a lower market value.

Market-to-Book (+) – Increases in the market to book ratio results in a market value increase.

Size (+) - Changes in size has a significant strong and positive correlation with market value.

Beta (-) – The effect of beta is hard to estimate as this variable is strongly insignificant and the null hypothesis cannot be rejected. Due to this model, there is no proof that the beta influences changes in market value.

Description of coefficients in table 7, crisis

R&D (-) – Indicates that increases in R&D during the crisis years are perceived negative by the market and result in a reduced market value.

CAPEX (-) – Indicates that increases in capital expenditures have a negative impact on the market value, however this impact is not significant at the 5 % significance level.

Dividends (-) – Increases in dividend payments are perceived negative by the market and result in a lower market value.

Market-to-Book (+) – Increases in the market to book ratio result in a market value increase.

Size (+) - Changes in size has a significant strong and positive correlation with market value.

Beta (+) – As in the pre-crisis regression, the effect of beta is hard to estimate as the variable is strongly insignificant and the null hypothesis cannot be rejected. There is no proof that beta affects the market value.

Description of coefficients in table 7, post-crisis

R&D (+) – In this period R&D has a significant and positive correlation with the market value.

CAPEX (+) – CAPEX increases has, as the R&D variable a positive and significant correlation with the market value.

Dividends (-) – Increases in dividend payments are in the long run perceived negative by the market and result in a lower market value.

Market-to-Book (+) – Increases in the market to book ratio result in a market value increase.

Size (+) - Changes in size have a significant strong and positive correlation with market value.

Beta (+) – As in the previous regressions, we cannot prove any correlation between beta and market value changes. The variable is not significant at the 5% significance level.

4.3.1 Regression summary

As we can see in table 7, both R&D and CAPEX change impact between the different periods; from being strongly uncorrelated and insignificant during the pre-crisis years to be negative during the crisis years and positive during the post-crisis years. The dividend impact seems to have a significant negative impact on the market value throughout the different regressions and time periods. We can also see that the change in market-to-book ratio and change in size variables have a positive impact on the market value throughout the periods, but we cannot prove any correlation between the beta and market reactions. That R&D and CAPEX change both significance and impact during the different periods show that the markets view on expenditure reduction is depending on the economic state and condition. The market-to-book and size variables remain positive throughout the periods indicating that the market looks positively on increased growth prospects independent from economic conditions, but has the strongest impact during periods of limited positive investment opportunities.

Table 8 Shows the means in the variables as well as number of firms for the eight clusters used in the pre-crisis period.

		Pre-crisis						
Cluster		R&D	CAPEX	DIV	BETA	MB	SIZE	MV
1	Mean	-0.424100	219.368711	8168.556478	0.770990	13.446566	12.915700	5.308293
	N	176	176	172	174	176	176	174
2	Mean	0.429627	-0.418819	11992.949930	0.942102	16.958963	13.297335	2.267500
	N	262	262	259	260	262	262	262
3	Mean	-0.502887	-0.437933	-0.482814	1.141572	16.506658	12.409563	12.876658
	N	426	426	426	421	426	426	424
4	Mean	-0.497180	82.862026	-0.516508	0.966719	8.435821	11.891960	6.854034
	N	285	284	285	285	284	285	285
5	Mean	929.906378	-0.466280	7622.836632	1.536931	27.985584	12.500442	0.876955
	N	145	145	143	145	145	145	145
6	Mean	2285.163472	-0.404164	-0.423082	1.325419	30.038714	12.398462	1.398203
	N	153	154	154	154	154	154	154
7	Mean	1923.753625	6.679670	6151.988015	1.021095	15.858673	12.807852	11.027826
	N	124	127	124	128	127	128	128
8	Mean	1339.582041	34.668033	-0.461808	1.338390	10.432506	12.327084	5.063118
	N	125	125	125	125	125	125	125
Total	Mean	524.714924	39.374567	3769.906477	1.099399	16.621212	12.542940	6.669278
	N	1696	1699	1688	1692	1699	1701	1697

Table 9 Shows the means in the variables as well as number of firms for the eight clusters used in the crisis period.

		Crisis						
Cluster		**R&D**	**CAPEX**	**DIV**	**BETA**	**MB**	**SIZE**	**MV**
1	**Mean**	-0.129140	49.335240	0.252077	1.058342	1.029171	13.374251	0.403637
	N	74	73	73	74	74	74	74
2	**Mean**	-0.189920	-0.399638	13.855126	1.099732	1.549866	13.277236	0.723449
	N	289	289	289	288	288	289	284
3	**Mean**	-0.221747	-0.411394	-0.293517	1.103381	2.051691	12.524937	0.871673
	N	239	239	239	236	236	239	235
4	**Mean**	-0.223434	0.711705	-0.282926	1.477132	2.738566	12.076108	0.917513
	N	67	67	67	66	66	67	67
5	**Mean**	13.540020	-0.361559	105.552989	1.018179	3.009890	12.888931	0.617080
	N	420	422	421	421	421	422	419
6	**Mean**	19.959498	-0.391230	-0.387403	0.993007	3.496503	12.787539	0.839397
	N	191	194	194	193	193	194	193
7	**Mean**	32.414599	0.919732	94.438110	1.178904	4.057916	12.906973	0.425052
	N	298	299	298	297	296	299	297
8	**Mean**	0.596326	0.980647	-0.290877	1.169373	4.588960	12.625087	0.705392
	N	117	117	117	117	117	116	116
Total	**Mean**	11.266066	2.115645	44.996821	1.099399	2.878278	12.866460	0.670784
	N	1695	1700	1698	1692	1691	1700	1685

Table 10 Shows the means in the variables as well as number of firms for the eight clusters used in the post-crisis period.

		Post-crisis						
Cluster		**R&D**	**CAPEX**	**DIV**	**BETA**	**MB**	**SIZE**	**MV**
1	**Mean**	-0.115962	0.711296	1655.987060	0.955190	6.891875	13.451384	-0.067363
	N	201	201	196	200	201	201	200
2	**Mean**	-0.181706	-0.257159	597.017550	1.178666	13.511647	13.182319	-0.050648
	N	153	153	152	152	153	153	153
3	**Mean**	-0.221538	-0.282814	-0.176220	1.095658	10.225015	12.804221	-0.046439
	N	275	275	275	274	275	275	272
4	**Mean**	-0.163673	0.889256	-0.185238	1.034925	7.184870	12.813753	-0.044087
	N	416	416	416	416	416	416	414
5	**Mean**	6.448455	-0.326426	791.009100	1.213502	13.393234	12.471405	-0.224495
	N	91	92	91	91	92	92	92
6	**Mean**	13.962305	-0.261487	-0.170679	1.221290	6.429422	12.681989	-0.058975
	N	93	94	94	93	94	94	93
7	**Mean**	224.184783	0.865654	776.067943	1.067779	15.015079	13.183498	-0.127328
	N	214	214	212	212	215	215	212
8	**Mean**	35.133762	1.053132	-0.145944	1.216029	10.395096	13.101876	-0.081016
	N	254	255	255	254	254	254	255
Total	**Mean**	34.534297	0.467629	385.362444	1.099399	9.975573	12.984770	-0.074450
	N	1697	1700	1691	1692	1700	1700	1691

4.3.3 Step 3 tables summary

In step three we have also divided all the companies into different clusters depending on whether they decreased/increased their R&D, CAPEX and dividend payments during the three different periods. This was done to see how the companies' market values changed depending on how they changed their expenses. The results can be seen in Table 8-10. During the pre-crisis period the four most successful clusters (measured as highest increase/lowest decrease in market value) during this period are cluster 3, 7, 4 and 1. During the other two periods the most successful clusters are 2, 3, 4 and 6.

5.0 Analysis

In this chapter we finally analyze our findings from Chapter 4. We use previous literature as a base for our discussions and come to various conclusions that we summarize in Chapter 6.

5.1 Step 1 analysis

In Table 2 we can see that the firms increase their cash holdings throughout the three different periods. Pettit's (2007) reasoning about cash as "dry powder for growth"; that firms use their cash holdings to support growth when there are opportunities for it, are hard to fit into our findings as the cash ratio are steadily increasing even during the crisis and post-crisis periods. This could be a signal that firms actually reject growth investment and positive NPV projects on the basis that they don't want to use their cash holdings, which makes many of the benefits of holding cash perish.

In opposite to Culp's (2006) risk financing motive we cannot see any recoil downwards to the pre-crisis level of cash in the post-crisis period, even though this is a steadier state with easier access to external capital markets and less volatility. In the same way it is hard to apply Opler et al.'s (1999) reasoning; that firms works toward a fixed cash level, we do not find any data that suggests that the sample companies corrects any deviation from the pre-crisis level of cash. Bates (2009) speaks of a decrease in idiosyncratic risk after 2004 that would, in the long run, lead to lower levels of cash-holdings among firms. However the 2008 crisis might have changed this and made the risk increase again which could be the reason why we see increasing cash holdings once more. However, why the cash holdings don't adjust back to the pre-crisis levels cannot be explained by this, as the risk decreases in the post-crisis period parallel to increases in cash level. This indicates that the change is of a structural and of a long term nature.

Another contradiction in our thesis to Opler et al.'s (1999) findings; that small companies would hold more cash than big companies, as can be seen in Table 1 we find that firm size has a significant and positive correlation with liquid asset holdings, which indicate that bigger firms hold more cash than smaller firms. In most cases the cost of cash is high, which makes the companies weighted cost of capital (WACC) increase. Unlike the smaller firms the large sized firms, in general, have more stable cash flows and greater abilities to hold capital structures with more expensive cost of capital to meet investors' preferences, maintaining a good credit profile or gaining competitive advantages. However, we also find that firms with high market-to-book ratios and cash flow riskiness have significantly big and positive

correlation with liquid asset holdings, indicating that firms with strong growth prospects and risky cash flows hold more cash as a buffer to support the fluctuations in their cash flows.

The question of however the dividend policy is a signaling tool that helps companies "back on track" can also be questioned. We see that the mean dividend ratio decreases in the crisis period but we cannot see any fast reinstatement of the old dividend policy. What we see however, is that more firms pay dividends during and post crisis time, which could be an indication that companies who didn't pay dividends in the pre-crisis years try to use the dividend signaling tool to access the market, meanwhile the companies that have a history of paying dividends reduces their payments. In contradiction to the findings of Song and Lee (2011) we cannot see that the dividend reduction is temporary and adjusted back to pre-crisis levels after the crisis but instead actually decreases even more in the post-crisis years, indicating new, non-temporary and more restricted dividend policies.

As we see in Table 3, our findings are also in line with Campello et al.'s (2010) survey who states that financially constrained firms would be cutting R&D, CAPEX and dividend payments during the crisis, Han and Qiu (2007) that provide evidence that investments would decrease as a result of more cash-flow volatility and Duchin et al. (2010) that come to the conclusion that corporate investments declined during the crisis.

The positive correlation, in Table 1, between the CAPEX variable and liquid asset holdings also strengthens Baum et al's (2012) findings; that CAPEX intensive firms accumulate cash to support their investments to a larger extent than firms that have less intensive investments of this sort. This is also an indication that the problem of managerial incentives and the cookie-jar problem are matters that are needed to be taken into account.

5.2 Step 2 analysis

5.2.1 Variable analysis

R&D-ratio

The R&D-ratio regression for the pre-crisis period(Table 4) tell us that startup firms with good future growth opportunities (measured as market-to-book ratio) but low current earnings (low EBIT-ratio and negative sales growth) typically tend to increase their R&D-ratio accordingly. This lead us to conclude that the typical high intensive R&D firm is still in the development phase and has not yet started to conduct business that implies revenues, but that they have good predictions to do so. This pattern continuous during the crisis period but after

the post-crisis period the market-to-book ratio shifts to a negative value. This indicates that high market-to-book firms have decreased their investments in R&D in the post crisis period. Parallels can be drawn from the evidence provided by Bergeron and Zutters (2010) regarding US-firms' decreasing risk-seeking behavior post implementation of the Sarbanes-Oxley act (SOX). The increased pressure from internal controls can be compared to the increased monitoring from the investors and lenders, demanding less risky investments which cause the high market-to-book companies to restrict their R&D expenditures. Another reason for this could be that these high growth firms simply can't finance investments in R&D (which is in most cases intangible assets in the form of human capital) to the same extent as in the pre-crisis period. Simply put, the market (lenders as well as investors) might find these investments risky, which would be a reason for the high growth firms to avoid or decrease these kinds of expenses. In the regressions we can also see that the excess cash variable turns from having a positive impact on R&D-ratio before the crisis, to having a smaller positive impact during the crisis and finally turn to having a negative impact in the post-crisis period. These changes indicate that the firms in the pre-crisis period would use their excess cash to investments in R&D. However, in the post-crisis period they would instead decrease R&D expenses to improve their level of excess cash, possibly in an effort to reduce distress costs.

CAPEX-ratio

When instead looking at the regressions for the CAPEX-ratio in Table 5 we can see that they differ some from the R&D-ratio regressions. What is recurrent in every period is that the excess cash is negatively correlated with the capital expenditures; for every penny a company puts in the treasure chest, the investments in CAPEX shrinks with a certain amount. While the results from the R&D regressions indicated that R&D-heavy firms often are small startup firms with low earnings but high possible future earnings, the coefficients for the explaining variables in the pre-crisis CAPEX regression indicate that the CAPEX intensive firms have reached the next level and started doing business and make revenues. The market-to-book ratio and sales growth variables both have positive correlations with the dependent variable during the pre-periods which indicate that the typical CAPEX heavy firm has high growth opportunities. Their current amounts of earnings are low (shown by the low EBIT-ratio) but they are swiftly increasing these earnings with their high sales growth and the need to keep on investing, in order to keep the pace up, is large. We can see an interesting shift during the crisis; the market-to-book ratios correlation coefficient changes and becomes negative. In the post-crisis period the market-to-book ratio coefficient remains negative while the EBIT-ratio

becomes positive. This indicates that the growth opportunities have decreased as a result of the crisis and that this has put investment constraints on the firms; it is mainly companies that have actual earnings (measured as high EBIT-ratio) that can keep investing in CAPEX.

Dividend-ratio

For the dividend-ratio regressions we turn to Table 6. In the pre-crisis period we can't see any significant connections between the dividend-ratio and any of the explaining variables. However looking at the regression for the crisis period, where the coefficients are negative for EBIT, market-to-book and sales growth, lead us to the conclusion that it is mature companies in mature industries with low future growth opportunities who pay out dividends, which is in accordance with Pettit's (2007) previous studies. Many of these mature firms might have a long pattern of paying dividends and therefore it is much harder for them to cut back on these even during a crisis, as Charitou et al. (2010) has shown in their research. After the crisis we see that both the market-to-book ratio and EBIT-ratio shift to having a positive impact on the dividend-ratio. The positive correlation indicates that firms in less mature industries with more growth opportunities start paying dividends. As we saw in Table 2 and 3, the number of dividend paying firms increased, meanwhile the overall dividend-ratio dropped. This could be due to more high market-to-book firms with growth potential using dividends as a signaling tool in the post-crisis years. Ogden (2003) speaks of the importance of signaling in an environment with high information asymmetry, which could be said that the crisis and post-crisis market are and which the constrained growth firms try to mitigate. By observing the relatively low explaining level of the pre-crisis table compared to the crisis and post-crisis table we acknowledge that the influences of the explaining variables increase and are very deterministic in the two later regressions, and that there might be other factors that explain the variation in the dividend ratio in the pre-crisis period. We can also see the same pattern between excess cash and dividend-ratio as we could see between excess cash and R&D-ratio. From having a positive connection during the crisis it changes to having a negative impact on dividend-ratio in the post-crisis period. This once again indicates that firms adopted a more conservative cash holding policy after the crisis where they increased excess cash on behalf of dividend payments.

Overall analysis

Song and Lee (2012) talk about a more conservative approach to cash holdings among firms after a severe financial crisis. We believe that our findings are in line with those thoughts, that firms indeed adopt a more conservative policy which results in increased cash holdings on

behalf of reduced research and development expenses, capital expenditures and dividend payouts. We see that the CAPEX-ratio is negatively affected by increased excess cash holdings throughout the different time periods, that the R&D-ratio coefficient changes from being positive in the pre-crisis period, to be less positive in the crisis period and ending up with a negative value in the post-crisis period. The dividend ratio correlation to excess cash is hard to draw any conclusions from in the pre-crisis period but has a positive and significant impact during the crisis and a negative impact in the post-crisis period.

The accumulation of cash on behalf of these expenditures, especially the R&D and CAPEX, could be seen as strong warning signals. If Griliches (1986) and Piergiovanni and Santorelli's (2010) findings that emphasizes the importance of R&D and CAPEX as high value creators are correct, this could indicate a problem for the future. If the long-term effect of investing in R&D and CAPEX is equal to higher revenues in the future then investing a portion of your current cash-holdings into these items would be strongly rational, as the NPV of cash holdings are very low.

Simutin (2010) find that firms with excess cash increase their future investment rate, which is the opposite to our and Song and Lee's findings. Simutin (2010) argues that the companies build these cash reserves for future investment opportunities, however due to our limited amount of years in the post-crisis period it is hard to determine whether these investment opportunities has occurred yet. With this in mind it is possible that our results would be more in line with Simutin's findings, if the time frame for the post-crisis period was extended.

We can conclude this analysis by saying that the findings in step 2 strengthen the results in step 1; that the R&D and capital expenditures is steadily shrinking over the periods alongside with the accumulation of cash. These findings give rational reasons to investigate step 3; to find out how the market views these expenditure cuts.

5.3 Step 3 analysis

Regression analysis

For step 3 we look at Table 7. That the increased dividend payments seem to have a negative impact throughout the different periods contradicts the findings of Ogden (2003) and Charitou et al. (2010). We do not see any negative reaction in market price when dividends are reduced. Lang and Litzenberger's (1988) theory; that dividend payment reduces the overinvestment problem which is reflected by a higher market value, is hard to apply to our findings. In the same manner we can't find anything that supports the view on dividends as a

strong signaling tool as the market reacts negative to any increase in this type of expenditure. Our findings are more in line with Pettit's (2007) thesis; that if there is any correlation between dividends and firm value it is negative, as there are mostly large sized and mature companies that pay dividends. As we can see in Tables 8-10 the clusters with high size values are least likely to reduce their dividends.

Pre-crisis R&D increases have positive impact on firm value, the market's view during this period is in line with the research made by Sueyoshi and Goto (2010); that R&D have a positive impact on firm value, but the negative coefficient for CAPEX contradicts that part of their findings. Due to the low significance level we cannot draw any bigger conclusions from this. However, during the crisis the market's view regarding these types of expenditures/investments change and the impacts of these variables on the firm value becomes negative. During this type of economic condition, the market seems to prefer a more conservative approach with a reduction of these types of investments. After the crisis the view on these expenditures changes back to being positive again for the firm value. The correlation coefficient for the R&D-variable in the post-crisis period compared to the pre-crisis period is somewhat lower which indicate a bit more restrictive view. The CAPEX correlation is however larger, indicating a stronger belief in performance in this field. Meanwhile the R&D performance is in large extent built on own innovation and progress and is perceived as more risky, CAPEX are safer investments that enhances the firms productivity. With a severe crisis more companies than usual go into bankruptcy and experience different financial difficulties. The survivors of the crisis with economical potential can grow on the behalf of the non-survivor's market share and acquire possible assets at discounted prices. Both CAPEX and R&D expenses can be seen as expenses today for higher earnings in the future, as in line with Sueyoshi and Goto (2010), when there are no imminent threats to the survival of the company, investors once again see these investments as a good long term solution. This can also be an explanation for the negative impact of the dividends at any given time. The rational reason behind dividend payments is that the company itself has no good investment opportunities. During the crisis years, the market's view could be that the companies need to maintain this cash within the companies to strengthen their liquidity, and in the post crisis time the market probably recognize the positive investment opportunities. In the pre-crisis period the case could be as earlier stated, that there are usually mature companies with limited growth opportunities that pay dividends, which makes the correlation with market value negative.

When comparing the coefficients within the same period we can see that the only variable to have a significant impact on the company value is the dividend-ratio. If a company chooses to decrease dividends this would most likely result in a positive market reaction and an increase in market value, meanwhile the outcomes of reduced capital expenditures and investments in research and development are highly uncertain. In the crisis period increases in capital expenditures have the most negative correlation with market value which means that a reduction in this item is viewed most favorable upon by the market. Dividend increases are the variable with the second most negative correlation followed by the R&D ratio. In the post-crisis period all variables except dividend have positive correlations with market value; research and development has the smallest positive correlation and capital expenditures has the highest. This lead us to the conclusion that regardless which economic state, the market always prefer reductions in dividend payments. If the primary target for the company is to maintain a high market value in the crisis times, it should reduce all expenditures and investments, with a focus on the capital expenditures. In the post crisis times they should be aware of negative market reactions if it chooses to reduce anything else than dividend payments. The reduction of capital expenditures is the cut-back that the market looks most heavily negative upon, so if the company has no dividends, wants to maintain a strong market value and have strong incentives to bunker cash, the R&D investments are the item with least negative impact on the firm's market value.

Tables analysis

For the table analysis we look at Tables 8-10. In the pre-crisis period the fact that the cluster that decreased all expenses (number 3) and the cluster that increased all expenses (number 7) can be found on the top four list makes it hard to draw any conclusions from the table. However during and after the crisis it becomes clearer that in times of high distress the companies that decrease their expenses have the highest increase (or lowest decrease) in their market value. During both of these periods cluster 2, 3, 4 and 6 are the top four performing clusters. All these clusters that reduced two or three categories of expenses.

Consistently throughout all periods we can see that the larger firms can be found in clusters that do not reduce dividend payouts. This works well with Pettit's (2007) statement (as well as our own findings in step two) that the companies who pay out dividends are often large, mature companies. Since dividends are "stickier" according to Song and Lee's (2012) research (seen in that dividend paying firms tend to reduce investments more than non-dividend paying firms in time of crisis) than R&D and CAPEX it is only natural that

companies with large dividend payouts decrease other expenses first. This is especially true the longer they have been paying dividends as Charitou et al. (2010) state.

Overall the fact that the best performing clusters are the ones that reduced as many expenses as possible during the crisis works well with both Song and Lee's (2012) and Bargeron et al.'s (2010) findings that companies, when in need of risk reduction, increase cash by decreasing investments and other expenses. The market evidently looks at this risk reducing behavior kindly and we can see that these firms have the highest market value increase (or lowest decrease) during the crisis and post-crisis periods when there is a lot of uncertainty on the market.

Piergiovanni and Santorelli (2010) comes to the conclusion that capital expenditures are value driving for the firms, which we can see evidence of during the pre-crisis period. In this particular period we see that the two worst performing clusters are clusters that have reduced capital expenditures (cluster 5 and 6) and in the four best performing clusters, three are clusters that increased these expenditures (cluster 1, 4 and 7). However during and after the crisis no pattern like this can be seen, instead the expense reducing clusters are more successful, as mentioned above. This indicates that CAPEX have an important role to play for value creation in a company but during times of high uncertainty this value creating effect decreases. Instead a more conservative, expense reducing behavior is in demand by the investors.

Although Piergiovanni and Santorelli (2010) talk about a connection between CAPEX and R&D working together to create values for the firm, we could not see any clear signs of this in our analysis of the eight clusters.

6.0 Conclusion

In Chapter 6 we summarize our findings and come to various conclusions. We end this chapter by giving suggestions for interesting further research in our field of work.

The first question to be answered in our thesis was whether the firm´s cash holdings changed during and after the economic downturn that followed the credit crunch in 2008. We found statistical secure evidence that firms indeed increased their cash holdings throughout the different periods. We also identified several issues and motives regarding cash holdings.

The second question to be answered was how the research and development, capital expenditures and dividend payments was affected by these changes. We identified an overall decrease in all of the mentioned variables throughout the different periods. In step 2 we found evidence that strengthened our findings in step 1. Namely that firms indeed increased their excess cash holdings on behalf of capital expenditures, R&D expenses and dividend payments in the post-crisis period. Excess cash was negatively correlated to CAPEX throughout the different periods, while the correlation with R&D-ratio had a reduced positive impact when moving from the pre-crisis period to the crisis period. This once again led us to the conclusion that US firms adopted a more conservative cash holding policy during and after the crisis. We also identified some key characteristics of the dividend, R&D, and CAPEX-heavy firms.

Since we identified an impact on the different examined expenditures, the third question to be addressed was whether the market perceived one way of change in expenditure policy over another. From the regressions made we found that the market's view on the different expenditures differ substantially from one period to another. In the pre-crisis period we could only identify a significant impact on market value from dividends, indicating that the market took the other expenditures into account in a very limited extent in the valuation process. In the crisis period we identified a negative correlation between all expenditures and the market value, giving a clear indication of the market preferences in this period. In the post-crisis period we saw a positive relationship between the capital expenditures and research and development investments and the market value, indicating a more positive view regarding these expenditures. The dividends were significantly negatively correlated with the market value in every period meaning that there is never a bad time to decrease dividends, if a high market value is the primary target. In the crisis times the CAPEX-ratio had the most negative correlation with the market value, indicating that this was the primary item that the market wished to see reductions in. In the post-crisis period R&D was the most favorable item to

reduce from a market point of view (if it's not possible to decrease dividends which is negatively correlated as mentioned above). It is positive to reduce all payments in the crisis period and in the post crisis the last item that should be reduced would be the capital expenditures.

We also clustered the companies within the sample to be able to analyze the characteristics of the companies that chose a certain way to handle their expenditures and the market outcome of this action. In the pre-crisis period we could not see any clear patterns, but during and after the crisis the most successful clusters were those that decreased expenses. We were also able to see signs of reluctance among large firms to reduce dividends payments in our step 3 tables.

6.1 Further research

This paper's main focus is the market's reactions regarding cuts in investments and expenditures. The only consequence to be examined is therefore the market reactions and the effects on market value. It would be of highest interest to investigate the long term effects of cutting these expenditures and investments. Especially cuts in vital functions like research and development and capital expenditures (even during crisis times) could have negative consequences for the company in the future, which maybe isn't acknowledged by the market in crisis times as it only tries to put out the worst fires by accumulating cash. The market reactions are only based on discounted cash flows and predictions of the companies' future performance; therefore it would be highly interesting to look at the true long term consequences for the company value.

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8.0 Appendix

In this Appendix section we provide all the detailed regressions and all other tests described in the methodology section of this thesis. First of all we have the Regression test summary in section 8.1 that gives a brief overview of all the test results performed on the different regressions. For more detailed descriptions, please see section 8.2-8.9 in this Appendix.

8.1 Regression tests summary

Table A1 Shows the results from the different tests performed on every regression used in the analysis. A prob of < 0.05 means that we reject the null-hypotisis. For a more detailed description of the different tests we refer you to chapter 3.0 in the thesis.

Regressions	Heteroskedasticity (Prob)	Likelihood-ratio CS (Prob)	Likelihood-ratio period (Prob)	Hausman CS (Prob)	Hausman period (Prob)	Normality	Multicollinearity
Step 1: Whole period	0.0000	0.0000	0.0000	0.0000	0.0000	No	No
Step 2: R&D pre-crisis	0.0000	0.0000	0.8774	0.0000	0.8595	No	No
Step 2: R&D crisis	0.0000	0.0000	0.0017	0.0000	NA	No	No
Step 2: R&D post-crisis	0.0000	0.0000	0.2306	0.0000	NA	No	No
Step 2: CAPEX pre-crisis	0.0000	0.0000	0.0008	0.0000	0.0002	No	No
Step 2: CAPEX crisis	0.0325	0.0000	0.0004	0.0000	NA	No	No
Step 2: CAPEX post-crisis	0.0000	0.0000	0.0486	0.0001	NA	No	No
Step 2: DIV pre-crisis	0.0000	0.0000	0.2139	0.0000	0.1093	No	No
Step 2: DIV crisis	0.0000	0.0000	0.0046	0.0000	NA	No	No
Step 2: DIV post-crisis	0.0000	0.0000	0.1286	0.0000	NA	No	No
Step 3: Pre-crisis	0.6528	0.7116	0.0000	0.0000	0.0000	No	No
Step 3: Crisis	0.0000	1.0000	0.0000	0.0000	NA	No	No
Step 3: Post-crisis	0.1253	1.0000	0.0000	0.1037	NA	No	No

8.2 Heteroskedasticity

8.2.1 Step 1 Heteroskedasticity test

Table A2 Heteroscedasticity test to see whether we have homoscedasticity in the step 1 regression or if we need to use robust standard errors.

Dependent Variable: RESID01^2
Method: Panel Least Squares
Periods included: 11
Cross-sections included: 1696
Total panel (unbalanced) observations: 18136

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.627128	0.209042	26.91871	0.0000
CAPEX	-0.387919	0.053693	-7.224783	0.0000
CASH_FLOW	-0.078591	0.049391	-1.591215	0.1116
CASHFLOW_RISKINESS	-1.157606	0.122687	-9.435450	0.0000
DIVIDEND_DUMMY	-0.184995	0.065921	-2.806333	0.0050
FINANCIAL_DISTRESS	-0.003830	0.000665	-5.758348	0.0000
FIRM_SIZE	-0.241291	0.016185	-14.90830	0.0000
LEVERAGE	0.074560	0.025953	2.872926	0.0041
MARKET_TO_BOOK	0.019203	0.000754	25.46986	0.0000
WC	-0.530414	0.018483	-28.69710	0.0000

R-squared	0.156294	Mean dependent var	2.134933
Adjusted R-squared	0.155876	S.D. dependent var	4.286832
S.E. of regression	3.938580	Akaike info criterion	5.580069
Sum squared resid	281178.0	Schwarz criterion	5.584373
Log likelihood	-50590.06	Hannan-Quinn criter.	5.581484
F-statistic	373.0888	Durbin-Watson stat	0.896109
Prob(F-statistic)	0.000000		

8.2.2 Step 2 Heteroskedasticity test

Table A3 Heteroscedasticity test to see whether we have homoscedasticity in the regression for step 2 with R&D as dependant variable, pre crisis, or if we need to use robust standard errors.

Dependent Variable: RDRESIDPRE^2
Method: Panel Least Squares
Periods included: 7
Cross-sections included: 1698
Total panel (unbalanced) observations: 11641

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.449174	0.139306	10.40278	0.0000
EXCESS_CASH	0.441407	0.046123	9.570264	0.0000
EBIT_RATIO	-0.372334	0.016129	-23.08483	0.0000
M_B_RATIO	0.062193	0.001646	37.78254	0.0000
SALES_GROWTH	-0.000357	0.000340	-1.049332	0.2940

R-squared	0.258755	Mean dependent var	1.099705
Adjusted R-squared	0.258500	S.D. dependent var	9.674396
S.E. of regression	8.330660	Akaike info criterion	7.078192
Sum squared resid	807537.2	Schwarz criterion	7.081354
Log likelihood	-41193.62	Hannan-Quinn criter.	7.079254
F-statistic	1015.478	Durbin-Watson stat	0.747757
Prob(F-statistic)	0.000000		

Table A4 Heteroscedasticity test to see whether we have homoscedasticity in the regression for step 2 with R&D as dependant variable, crisis, or if we need to use robust standard errors.

Dependent Variable: RDRESIDCRISIS^2
Method: Panel Least Squares
Periods included: 2
Cross-sections included: 1687
Total panel (unbalanced) observations: 3340

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.061614	0.215528	0.285874	0.7750
EXCESS_CASH	0.063093	0.075078	0.840368	0.4008
EBIT_RATIO	-0.721067	0.032142	-22.43367	0.0000
M_B_RATIO	0.139199	0.006410	21.71443	0.0000
SALES_GROWTH	-0.000724	0.000559	-1.293678	0.1959

R-squared	0.320712	Mean dependent var	0.838998
Adjusted R-squared	0.319897	S.D. dependent var	7.696361
S.E. of regression	6.347062	Akaike info criterion	6.535357
Sum squared resid	134351.1	Schwarz criterion	6.544509
Log likelihood	-10909.05	Hannan-Quinn criter.	6.538631
F-statistic	393.6378	Durbin-Watson stat	0.465296
Prob(F-statistic)	0.000000		

Table A5 Heteroscedasticity test to see whether we have homoscedasticity in the regression for step 2 with R&D as dependant variable, post-crisis, or if we need to use robust standard errors.

Dependent Variable: RDRESIDPOST^2
Method: Panel Least Squares
Periods included: 2
Cross-sections included: 1685
Total panel (unbalanced) observations: 3343

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.074121	0.170352	0.435104	0.6635
EXCESS_CASH	0.076044	0.062142	1.223707	0.2211
EBIT_RATIO	-0.971884	0.036273	-26.79395	0.0000
M_B_RATIO	0.126557	0.003911	32.35927	0.0000
SALES_GROWTH	0.132357	0.077075	1.717252	0.0860

R-squared	0.476864	Mean dependent var	0.730922
Adjusted R-squared	0.476237	S.D. dependent var	7.073987
S.E. of regression	5.119548	Akaike info criterion	6.105504
Sum squared resid	87488.21	Schwarz criterion	6.114649
Log likelihood	-10200.35	Hannan-Quinn criter.	6.108775
F-statistic	760.6875	Durbin-Watson stat	0.820590
Prob(F-statistic)	0.000000		

Table A6 Heteroscedasticity test to see whether we have homoscedasticity in the regression for step 2 with CAPEX as dependant variable, pre-crisis, or if we need to use robust standard errors.

Dependent Variable: CAPEXRESIDPRE^2
Method: Panel Least Squares
Periods included: 7
Cross-sections included: 1698
Total panel (unbalanced) observations: 11641

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.312714	0.039237	7.969888	0.0000
EXCESS_CASH	-0.048277	0.012991	-3.716211	0.0002
EBIT_RATIO	0.017995	0.004543	3.961091	0.0001
M_B_RATIO	0.005855	0.000464	12.62933	0.0000
SALES_GROWTH	1.74E-05	9.57E-05	0.182314	0.8553

R-squared	0.016045	Mean dependent var	0.494777
Adjusted R-squared	0.015706	S.D. dependent var	2.365057
S.E. of regression	2.346410	Akaike info criterion	4.544080
Sum squared resid	64063.65	Schwarz criterion	4.547242
Log likelihood	-26443.82	Hannan-Quinn criter.	4.545142
F-statistic	47.43496	Durbin-Watson stat	0.743337
Prob(F-statistic)	0.000000		

Table A7 Heteroscedasticity test to see whether we have homoscedasticity in the regression for step 2 with CAPEX as dependant variable, crisis, or if we need to use robust standard errors.

Dependent Variable: CAPEXRESIDCRISIS^2
Method: Panel Least Squares
Periods included: 2
Cross-sections included: 1687
Total panel (unbalanced) observations: 3340

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.354431	0.080420	4.407246	0.0000
EXCESS_CASH	-0.042253	0.028014	-1.508275	0.1316
EBIT_RATIO	-0.016435	0.011993	-1.370341	0.1707
M_B_RATIO	0.004635	0.002392	1.937705	0.0527
SALES_GROWTH	-7.01E-05	0.000209	-0.336102	0.7368

R-squared	0.003148	Mean dependent var	0.482969
Adjusted R-squared	0.001953	S.D. dependent var	2.370597
S.E. of regression	2.368282	Akaike info criterion	4.563703
Sum squared resid	18705.21	Schwarz criterion	4.572855
Log likelihood	-7616.383	Hannan-Quinn criter.	4.566977
F-statistic	2.633069	Durbin-Watson stat	0.965265
Prob(F-statistic)	0.032539		

Table A8 Heteroscedasticity test to see whether we have homoscedasticity in the regression for step 2 with CAPEX as dependant variable, post-crisis, or if we need to use robust standard errors.

Dependent Variable: CAPEXRESIDPOST^2
Method: Panel Least Squares
Periods included: 2
Cross-sections included: 1685
Total panel (unbalanced) observations: 3343

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.073198	0.073630	0.994130	0.3202
EXCESS_CASH	-0.111105	0.026860	-4.136535	0.0000
EBIT_RATIO	0.093283	0.015678	5.949992	0.0000
M_B_RATIO	0.011848	0.001690	7.008564	0.0000
SALES_GROWTH	0.034654	0.033314	1.040228	0.2983

R-squared	0.023282	Mean dependent var	0.435838
Adjusted R-squared	0.022111	S.D. dependent var	2.237678
S.E. of regression	2.212800	Akaike info criterion	4.427889
Sum squared resid	16344.46	Schwarz criterion	4.437034
Log likelihood	-7396.217	Hannan-Quinn criter.	4.431161
F-statistic	19.89186	Durbin-Watson stat	0.628504
Prob(F-statistic)	0.000000		

Table A9 Heteroscedasticity test to see whether we have homoscedasticity in the regression for step 2 with dividend as dependant variable, pre-crisis, or if we need to use robust standard errors.

Dependent Variable: DIVRESIDPRE^2
Method: Panel Least Squares
Periods included: 7
Cross-sections included: 1698
Total panel (unbalanced) observations: 11641

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-88743.95	8790.068	-10.09593	0.0000
EXCESS_CASH	-37749.60	2910.293	-12.97107	0.0000
EBIT_RATIO	2174.762	1017.717	2.136902	0.0326
M_B_RATIO	-7.210692	103.8655	-0.069423	0.9447
SALES_GROWTH	5.317838	21.44109	0.248021	0.8041

R-squared	0.014255	Mean dependent var	4977.563
Adjusted R-squared	0.013916	S.D. dependent var	529351.1
S.E. of regression	525654.9	Akaike info criterion	29.18311
Sum squared resid	3.22E+15	Schwarz criterion	29.18627
Log likelihood	-169855.3	Hannan-Quinn criter.	29.18417
F-statistic	42.06826	Durbin-Watson stat	1.167297
Prob(F-statistic)	0.000000		

Table A10 Heteroscedasticity test to see whether we have homoscedasticity in the regression for step 2 with dividend as dependant variable, crisis, or if we need to use robust standard errors.

Dependent Variable: DIVRESIDCRISIS^2
Method: Panel Least Squares
Periods included: 2
Cross-sections included: 1687
Total panel (unbalanced) observations: 3340

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.073869	0.007697	9.596589	0.0000
EXCESS_CASH	0.027016	0.002681	10.07547	0.0000
EBIT_RATIO	-0.001155	0.001148	-1.006416	0.3143
M_B_RATIO	0.000147	0.000229	0.641605	0.5212
SALES_GROWTH	-8.22E-06	2.00E-05	-0.411770	0.6805

R-squared	0.031378	Mean dependent var	0.011654
Adjusted R-squared	0.030216	S.D. dependent var	0.230183
S.E. of regression	0.226679	Akaike info criterion	-0.129068
Sum squared resid	171.3635	Schwarz criterion	-0.119915
Log likelihood	220.5431	Hannan-Quinn criter.	-0.125794
F-statistic	27.00860	Durbin-Watson stat	1.434230
Prob(F-statistic)	0.000000		

Table A11 Heteroscedasticity test to see whether we have homoscedasticity in the regression for step 2 with dividend as dependant variable, post-crisis, or if we need to use robust standard errors.

Dependent Variable: DIVRESIDPOST^2
Method: Panel Least Squares
Periods included: 2
Cross-sections included: 1685
Total panel (unbalanced) observations: 3343

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000277	0.003798	0.073037	0.9418
EXCESS_CASH	0.000235	0.001386	0.169772	0.8652
EBIT_RATIO	0.001805	0.000809	2.232177	0.0257
M_B_RATIO	0.001119	8.72E-05	12.83166	0.0000
SALES_GROWTH	-0.003708	0.001719	-2.157857	0.0310

R-squared	0.050890	Mean dependent var	0.008277
Adjusted R-squared	0.049753	S.D. dependent var	0.117099
S.E. of regression	0.114149	Akaike info criterion	-1.501130
Sum squared resid	43.49411	Schwarz criterion	-1.491985
Log likelihood	2514.139	Hannan-Quinn criter.	-1.497858
F-statistic	44.74496	Durbin-Watson stat	0.769399
Prob(F-statistic)	0.000000		

8.2.3 Step 3 Heteroscedacity Test

Table A12 Heteroscedasticity test to see whether we have homoscedasticity in the regression for step 3, pre-crisis, or if we need to use robust standard errors.

Dependent Variable: RESIDPRE^2
Method: Panel Least Squares
Periods included: 7
Cross-sections included: 1693
Total panel (unbalanced) observations: 11799

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.404140	0.218557	1.849123	0.0645
RD	1.04E-05	0.000119	0.087405	0.9304
CAPEX	-2.37E-05	0.000450	-0.052717	0.9580
DIV	-8.01E-06	3.88E-05	-0.206600	0.8363
MB	0.007072	0.009574	0.738701	0.4601
SIZE	-0.083203	0.176560	-0.471247	0.6375
BETA	0.181319	0.097587	1.858025	0.0632

R-squared	0.000354	Mean dependent var	0.591250
Adjusted R-squared	-0.000155	S.D. dependent var	20.28559
S.E. of regression	20.28716	Akaike info criterion	8.858446
Sum squared resid	4853219.	Schwarz criterion	8.862822
Log likelihood	-52253.40	Hannan-Quinn criter.	8.859915
F-statistic	0.696090	Durbin-Watson stat	1.261139
Prob(F-statistic)	0.652804		

Table A13 Heteroscedasticity test to see whether we have homoscedasticity in the regression for step 3, crisis, or if we need to use robust standard errors.

Dependent Variable: RESID01CRISIS^2
Method: Panel Least Squares
Periods included: 2
Cross-sections included: 1690
Total panel (unbalanced) observations: 3323

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.383675	0.042195	9.092905	0.0000
RD	4.28E-06	2.98E-05	0.143741	0.8857
CAPEX	4.03E-05	0.000600	0.067176	0.9464
DIV	-3.53E-06	1.55E-05	-0.227600	0.8200
MB	0.134108	0.022745	5.896127	0.0000
SIZE	0.239793	1.590821	0.150736	0.8802
BETA	0.191545	0.019227	9.962447	0.0000

R-squared	0.038512	Mean dependent var	0.598922
Adjusted R-squared	0.036772	S.D. dependent var	2.174730
S.E. of regression	2.134371	Akaike info criterion	4.356326
Sum squared resid	15106.17	Schwarz criterion	4.369194
Log likelihood	-7231.035	Hannan-Quinn criter.	4.360930
F-statistic	22.13666	Durbin-Watson stat	1.990776
Prob(F-statistic)	0.000000		

Table A14 Heteroscedasticity test to see whether we have homoscedasticity in the regression for step 3, post-crisis, or if we need to use robust standard errors.

Dependent Variable: RESID01POST^2
Method: Panel Least Squares
Periods included: 2
Cross-sections included: 1689
Total panel (unbalanced) observations: 3295

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.115227	0.017398	6.623167	0.0000
RD	-9.93E-07	3.58E-06	-0.277491	0.7814
CAPEX	-1.36E-06	8.41E-06	-0.162081	0.8713
DIV	-2.19E-06	3.83E-06	-0.572542	0.5670
MB	0.000128	0.000329	0.387903	0.6981
SIZE	1.155492	0.774389	1.492133	0.1358
BETA	0.019208	0.007521	2.553826	0.0107

R-squared	0.003030	Mean dependent var	0.140576
Adjusted R-squared	0.001211	S.D. dependent var	0.855118
S.E. of regression	0.854600	Akaike info criterion	2.525755
Sum squared resid	2401.360	Schwarz criterion	2.538714
Log likelihood	-4154.181	Hannan-Quinn criter.	2.530394
F-statistic	1.665758	Durbin-Watson stat	2.033241
Prob(F-statistic)	0.125266		

8.3 Likelihood-ratio Test

8.3.1 Step 1 Likelihood-ratio test

Table A15 Likelihood-ratio test to probe the need for cross-sectional effects in the regression for step 1.

Redundant Fixed Effects Tests
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	25.218645	(1695,16432)	0.0000
Cross-section Chi-square	23237.883568	1695	0.0000

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.760617	0.076002	-23.16555	0.0000
CAPEX	0.542567	0.019700	27.54194	0.0000
CASH_FLOW	-0.196687	0.018809	-10.45730	0.0000
DIVIDEND_DUMMY	-0.547469	0.025093	-21.81747	0.0000
FINANCIAL_DISTRESS	0.000767	0.000254	3.026030	0.0025
FIRM_SIZE	0.070865	0.006155	11.51305	0.0000
LEVERAGE	-0.334325	0.009827	-34.02243	0.0000
MARKET_TO_BOOK	0.006097	0.000287	21.23300	0.0000
WC	-0.212808	0.007014	-30.34255	0.0000

R-squared	0.243466	Mean dependent var	-1.158969
Adjusted R-squared	0.243132	S.D. dependent var	1.726241
S.E. of regression	1.501798	Akaike info criterion	3.651699
Sum squared resid	40883.58	Schwarz criterion	3.655573
Log likelihood	-33104.61	Hannan-Quinn criter.	3.652973
F-statistic	729.1975	Durbin-Watson stat	0.400513
Prob(F-statistic)	0.000000		

Table A16 Likelihood-ratio test to probe the need for periodical effects in the regression for step 1.

Redundant Fixed Effects Tests
Test period fixed effects

Effects Test	Statistic	d.f.	Prob.
Period F	20.158354	(10,18116)	0.0000
Period Chi-square	200.691565	10	0.0000

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.504881	0.077572	-32.29106	0.0000
CAPEX	0.369860	0.019925	18.56299	0.0000
CASH_FLOW	-0.226316	0.018328	-12.34804	0.0000
CASHFLOW_RISKINESS	1.449211	0.045527	31.83182	0.0000
DIVIDEND_DUMMY	-0.502095	0.024462	-20.52543	0.0000
FINANCIAL_DISTRESS	0.000653	0.000247	2.644239	0.0082
FIRM_SIZE	0.084708	0.006006	14.10385	0.0000
LEVERAGE	-0.370529	0.009631	-38.47415	0.0000
MARKET_TO_BOOK	0.005654	0.000280	20.20742	0.0000
WC	-0.191327	0.006859	-27.89512	0.0000

R-squared	0.283518	Mean dependent var	-1.158969
Adjusted R-squared	0.283162	S.D. dependent var	1.726241
S.E. of regression	1.461544	Akaike info criterion	3.597415
Sum squared resid	38719.14	Schwarz criterion	3.601719
Log likelihood	-32611.36	Hannan-Quinn criter.	3.598830
F-statistic	796.9565	Durbin-Watson stat	0.402131
Prob(F-statistic)	0.000000		

8.3.2 Step 2 Likelihood-ratio test

Table A17 Likelihood-ratio test to probe the need for cross-sectional effects in the regression for step 2 with R&D as dependant variable, pre-crisis.

Redundant Fixed Effects Tests
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	15.355829	(1697,9939)	0.0000
Cross-section Chi-square	14981.88043	1697	0.0000

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.580939	0.017540	33.12133	0.0000
EXCESS_CASH	0.146295	0.005807	25.19198	0.0000
EBIT_RATIO	-0.067391	0.002031	-33.18496	0.0000
M_B_RATIO	0.002779	0.000207	13.40778	0.0000
SALES_GROWTH	9.13E-05	4.28E-05	2.135093	0.0328

R-squared	0.190914	Mean dependent var	0.259119
Adjusted R-squared	0.190636	S.D. dependent var	1.165895
S.E. of regression	1.048894	Akaike info criterion	2.933778
Sum squared resid	12801.67	Schwarz criterion	2.936941
Log likelihood	-17071.06	Hannan-Quinn criter.	2.934841
F-statistic	686.4137	Durbin-Watson stat	0.460359
Prob(F-statistic)	0.000000		

Table A18 Likelihood-ratio test to probe the need for periodic effects in the regression for step 2 with R&D as dependant variable, pre-crisis.

Redundant Fixed Effects Tests
Test period fixed effects

Effects Test	Statistic	d.f.	Prob.
Period F	0.403119	(6,11630)	0.8774
Period Chi-square	2.420748	6	0.8772

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.580939	0.017540	33.12133	0.0000
EXCESS_CASH	0.146295	0.005807	25.19198	0.0000
EBIT_RATIO	-0.067391	0.002031	-33.18496	0.0000
M_B_RATIO	0.002779	0.000207	13.40778	0.0000
SALES_GROWTH	9.13E-05	4.28E-05	2.135093	0.0328

R-squared	0.190914	Mean dependent var	0.259119
Adjusted R-squared	0.190636	S.D. dependent var	1.165895
S.E. of regression	1.048894	Akaike info criterion	2.933778
Sum squared resid	12801.67	Schwarz criterion	2.936941
Log likelihood	-17071.06	Hannan-Quinn criter.	2.934841
F-statistic	686.4137	Durbin-Watson stat	0.460359
Prob(F-statistic)	0.000000		

Table A19 Likelihood-ratio test to probe the need for cross-sectional effects in the regression for step 2 with R&D as dependant variable, crisis.

Redundant Fixed Effects Tests
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	11.391630	(1686,1649)	0.0000
Cross-section Chi-square	8475.044631	1686	0.0000

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.173140	0.031127	5.562367	0.0000
EXCESS_CASH	0.043691	0.010843	4.029451	0.0001
EBIT_RATIO	-0.063292	0.004642	-13.63459	0.0000
M_B_RATIO	0.027057	0.000926	29.22577	0.0000
SALES_GROWTH	8.24E-05	8.08E-05	1.020702	0.3075

R-squared	0.328803	Mean dependent var	0.243380
Adjusted R-squared	0.327998	S.D. dependent var	1.118203
S.E. of regression	0.916654	Akaike info criterion	2.665324
Sum squared resid	2802.252	Schwarz criterion	2.674476
Log likelihood	-4446.090	Hannan-Quinn criter.	2.668598
F-statistic	408.4347	Durbin-Watson stat	0.382834
Prob(F-statistic)	0.000000		

Table A20 Likelihood-ratio test to probe the need for periodic effects in the regression for step 2 with R&D as dependant variable, crisis.

Redundant Fixed Effects Tests
Test period fixed effects

Effects Test	Statistic	d.f.	Prob.
Period F	9.878110	(1,3334)	0.0017
Period Chi-square	9.881256	1	0.0017

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.173140	0.031127	5.562367	0.0000
EXCESS_CASH	0.043691	0.010843	4.029451	0.0001
EBIT_RATIO	-0.063292	0.004642	-13.63459	0.0000
M_B_RATIO	0.027057	0.000926	29.22577	0.0000
SALES_GROWTH	8.24E-05	8.08E-05	1.020702	0.3075

R-squared	0.328803	Mean dependent var	0.243380
Adjusted R-squared	0.327998	S.D. dependent var	1.118203
S.E. of regression	0.916654	Akaike info criterion	2.665324
Sum squared resid	2802.252	Schwarz criterion	2.674476
Log likelihood	-4446.090	Hannan-Quinn criter.	2.668598
F-statistic	408.4347	Durbin-Watson stat	0.382834
Prob(F-statistic)	0.000000		

Table A21 Likelihood-ratio test to probe the need for cross-sectional effects in the regression for step 2 with R&D as dependant variable, post-crisis.

Redundant Fixed Effects Tests
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	8.274378	(1684,1654)	0.0000
Cross-section Chi-square	7499.379185	1684	0.0000

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.267491	0.028469	9.395801	0.0000
EXCESS_CASH	0.052444	0.010385	5.049824	0.0000
EBIT_RATIO	-0.127584	0.006062	-21.04699	0.0000
M_B_RATIO	0.011255	0.000654	17.21923	0.0000
SALES_GROWTH	0.051422	0.012881	3.992124	0.0001

R-squared	0.281706	Mean dependent var	0.223458
Adjusted R-squared	0.280845	S.D. dependent var	1.008903
S.E. of regression	0.855580	Akaike info criterion	2.527420
Sum squared resid	2443.472	Schwarz criterion	2.536565
Log likelihood	-4219.582	Hannan-Quinn criter.	2.530691
F-statistic	327.2799	Durbin-Watson stat	0.567415
Prob(F-statistic)	0.000000		

Table A21 Likelihood-ratio test to probe the need for periodic effects in the regression for step 2 with R&D as dependant variable, post-crisis.

Redundant Fixed Effects Tests
Test period fixed effects

Effects Test	Statistic	d.f.	Prob.
Period F	1.437512	(1,3337)	0.2306
Period Chi-square	1.439786	1	0.2302

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.267491	0.028469	9.395801	0.0000
EXCESS_CASH	0.052444	0.010385	5.049824	0.0000
EBIT_RATIO	-0.127584	0.006062	-21.04699	0.0000
M_B_RATIO	0.011255	0.000654	17.21923	0.0000
SALES_GROWTH	0.051422	0.012881	3.992124	0.0001

R-squared	0.281706	Mean dependent var	0.223458
Adjusted R-squared	0.280845	S.D. dependent var	1.008903
S.E. of regression	0.855580	Akaike info criterion	2.527420
Sum squared resid	2443.472	Schwarz criterion	2.536565
Log likelihood	-4219.582	Hannan-Quinn criter.	2.530691
F-statistic	327.2799	Durbin-Watson stat	0.567415
Prob(F-statistic)	0.000000		

Table A22 Likelihood-ratio test to probe the need for cross-sectional effects in the regression for step 2 with CAPEX as dependant variable, pre-crisis.

Redundant Fixed Effects Tests
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	18.530248	(1697,9939)	0.0000
Cross-section Chi-square	16605.280914	1697	0.0000

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.408876	0.011765	34.75378	0.0000
EXCESS_CASH	0.016307	0.003895	4.186303	0.0000
EBIT_RATIO	0.003915	0.001362	2.873877	0.0041
M_B_RATIO	0.001614	0.000139	11.60876	0.0000
SALES_GROWTH	3.49E-05	2.87E-05	1.216912	0.2237

R-squared	0.013995	Mean dependent var	0.385529
Adjusted R-squared	0.013656	S.D. dependent var	0.708409
S.E. of regression	0.703555	Akaike info criterion	2.135088
Sum squared resid	5759.699	Schwarz criterion	2.138250
Log likelihood	-12422.28	Hannan-Quinn criter.	2.136150
F-statistic	41.28981	Durbin-Watson stat	0.400604
Prob(F-statistic)	0.000000		

Table A23 Likelihood-ratio test to probe the need for periodic effects in the regression for step 2 with CAPEX as dependant variable, pre-crisis.

Redundant Fixed Effects Tests
Test period fixed effects

Effects Test	Statistic	d.f.	Prob.
Period F	3.812351	(6,11630)	0.0008
Period Chi-square	22.873252	6	0.0008

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.408876	0.011765	34.75378	0.0000
EXCESS_CASH	0.016307	0.003895	4.186303	0.0000
EBIT_RATIO	0.003915	0.001362	2.873877	0.0041
M_B_RATIO	0.001614	0.000139	11.60876	0.0000
SALES_GROWTH	3.49E-05	2.87E-05	1.216912	0.2237

R-squared	0.013995	Mean dependent var	0.385529
Adjusted R-squared	0.013656	S.D. dependent var	0.708409
S.E. of regression	0.703555	Akaike info criterion	2.135088
Sum squared resid	5759.699	Schwarz criterion	2.138250
Log likelihood	-12422.28	Hannan-Quinn criter.	2.136150
F-statistic	41.28981	Durbin-Watson stat	0.400604
Prob(F-statistic)	0.000000		

Table A24 Likelihood-ratio test to probe the need for cross-sectional effects in the regression for step 2 with CAPEX as dependant variable, crisis.

Redundant Fixed Effects Tests
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	7.279784	(1686,1649)	0.0000
Cross-section Chi-square	7125.397892	1686	0.0000

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.403095	0.023617	17.06834	0.0000
EXCESS_CASH	0.017967	0.008227	2.183942	0.0290
EBIT_RATIO	0.002101	0.003522	0.596519	0.5509
M_B_RATIO	0.001853	0.000702	2.638455	0.0084
SALES_GROWTH	-5.62E-05	6.13E-05	-0.916828	0.3593

R-squared	0.004383	Mean dependent var	0.371824
Adjusted R-squared	0.003189	S.D. dependent var	0.696592
S.E. of regression	0.695480	Akaike info criterion	2.113067
Sum squared resid	1613.115	Schwarz criterion	2.122220
Log likelihood	-3523.822	Hannan-Quinn criter.	2.116341
F-statistic	3.670156	Durbin-Watson stat	0.501022
Prob(F-statistic)	0.005478		

Table A25 Likelihood-ratio test to probe the need for periodic effects in the regression for step 2 with CAPEX as dependant variable, crisis.

Redundant Fixed Effects Tests
Test period fixed effects

Effects Test	Statistic	d.f.	Prob.
Period F	12.393248	(1,3334)	0.0004
Period Chi-square	12.392533	1	0.0004

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.403095	0.023617	17.06834	0.0000
EXCESS_CASH	0.017967	0.008227	2.183942	0.0290
EBIT_RATIO	0.002101	0.003522	0.596519	0.5509
M_B_RATIO	0.001853	0.000702	2.638455	0.0084
SALES_GROWTH	-5.62E-05	6.13E-05	-0.916828	0.3593

R-squared	0.004383	Mean dependent var	0.371824
Adjusted R-squared	0.003189	S.D. dependent var	0.696592
S.E. of regression	0.695480	Akaike info criterion	2.113067
Sum squared resid	1613.115	Schwarz criterion	2.122220
Log likelihood	-3523.822	Hannan-Quinn criter.	2.116341
F-statistic	3.670156	Durbin-Watson stat	0.501022
Prob(F-statistic)	0.005478		

Table A26 Likelihood-ratio test to probe the need for cross-sectional effects in the regression for step 2 with CAPEX as dependant variable, post-crisis.

Redundant Fixed Effects Tests
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	13.345995	(1684,1654)	0.0000
Cross-section Chi-square	8959.920564	1684	0.0000

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.289832	0.021984	13.18390	0.0000
EXCESS_CASH	-0.009108	0.008019	-1.135757	0.2561
EBIT_RATIO	0.025411	0.004681	5.428601	0.0000
M_B_RATIO	0.003268	0.000505	6.474642	0.0000
SALES_GROWTH	0.031951	0.009946	3.212293	0.0013

R-squared	0.023251	Mean dependent var	0.345916
Adjusted R-squared	0.022080	S.D. dependent var	0.668091
S.E. of regression	0.660674	Akaike info criterion	2.010383
Sum squared resid	1457.005	Schwarz criterion	2.019528
Log likelihood	-3355.355	Hannan-Quinn criter.	2.013654
F-statistic	19.86478	Durbin-Watson stat	0.288679
Prob(F-statistic)	0.000000		

Table A27 Likelihood-ratio test to probe the need for periodic effects in the regression for step 2 with CAPEX as dependant variable, post-crisis.

Redundant Fixed Effects Tests
Test period fixed effects

Effects Test	Statistic	d.f.	Prob.
Period F	3.892477	(1,3337)	0.0486
Period Chi-square	3.897203	1	0.0484

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.289832	0.021984	13.18390	0.0000
EXCESS_CASH	-0.009108	0.008019	-1.135757	0.2561
EBIT_RATIO	0.025411	0.004681	5.428601	0.0000
M_B_RATIO	0.003268	0.000505	6.474642	0.0000
SALES_GROWTH	0.031951	0.009946	3.212293	0.0013

R-squared	0.023251	Mean dependent var	0.345916
Adjusted R-squared	0.022080	S.D. dependent var	0.668091
S.E. of regression	0.660674	Akaike info criterion	2.010383
Sum squared resid	1457.005	Schwarz criterion	2.019528
Log likelihood	-3355.355	Hannan-Quinn criter.	2.013654
F-statistic	19.86478	Durbin-Watson stat	0.288679
Prob(F-statistic)	0.000000		

Table A28 Likelihood-ratio test to probe the need for cross-sectional effects in the regression for step 2 with dividend as dependant variable, pre-crisis.

Redundant Fixed Effects Tests
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	1.339373	(1697,9939)	0.0000
Cross-section Chi-square	2397.415328	1697	0.0000

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-11.77451	1.180030	-9.978141	0.0000
EXCESS_CASH	-5.016587	0.390695	-12.84017	0.0000
EBIT_RATIO	0.293351	0.136624	2.147133	0.0318
M_B_RATIO	-0.000654	0.013944	-0.046900	0.9626
SALES_GROWTH	0.000772	0.002878	0.268156	0.7886

R-squared	0.013973	Mean dependent var	0.683172
Adjusted R-squared	0.013634	S.D. dependent var	71.05303
S.E. of regression	70.56700	Akaike info criterion	11.35143
Sum squared resid	57943814	Schwarz criterion	11.35459
Log likelihood	-66066.01	Hannan-Quinn criter.	11.35249
F-statistic	41.22256	Durbin-Watson stat	1.167304
Prob(F-statistic)	0.000000		

Table A29 Likelihood-ratio test to probe the need for periodic effects in the regression for step 2 with dividend as dependant variable, pre-crisis.

Redundant Fixed Effects Tests
Test period fixed effects

Effects Test	Statistic	d.f.	Prob.
Period F	1.391044	(6,11630)	0.2139
Period Chi-square	8.351162	6	0.2135

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-11.77451	1.180030	-9.978141	0.0000
EXCESS_CASH	-5.016587	0.390695	-12.84017	0.0000
EBIT_RATIO	0.293351	0.136624	2.147133	0.0318
M_B_RATIO	-0.000654	0.013944	-0.046900	0.9626
SALES_GROWTH	0.000772	0.002878	0.268156	0.7886

R-squared	0.013973	Mean dependent var	0.683172
Adjusted R-squared	0.013634	S.D. dependent var	71.05303
S.E. of regression	70.56700	Akaike info criterion	11.35143
Sum squared resid	57943814	Schwarz criterion	11.35459
Log likelihood	-66066.01	Hannan-Quinn criter.	11.35249
F-statistic	41.22256	Durbin-Watson stat	1.167304
Prob(F-statistic)	0.000000		

Table A30 Likelihood-ratio test to probe the need for cross-section effects in the regression for step 2 with dividend as dependant variable, crisis.

Redundant Fixed Effects Tests
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	4.937117	(1686,1649)	0.0000
Cross-section Chi-square	6011.032632	1686	0.0000

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.053766	0.003669	14.65593	0.0000
EXCESS_CASH	0.013609	0.001278	10.64982	0.0000
EBIT_RATIO	-0.000863	0.000547	-1.576991	0.1149
M_B_RATIO	0.000358	0.000109	3.279247	0.0011
SALES_GROWTH	-7.62E-06	9.52E-06	-0.800286	0.4236

R-squared	0.042193	Mean dependent var	0.024167
Adjusted R-squared	0.041044	S.D. dependent var	0.110322
S.E. of regression	0.108034	Akaike info criterion	-1.611246
Sum squared resid	38.92390	Schwarz criterion	-1.602094
Log likelihood	2695.782	Hannan-Quinn criter.	-1.607972
F-statistic	36.72812	Durbin-Watson stat	0.807572
Prob(F-statistic)	0.000000		

Table A31 Likelihood-ratio test to probe the need for periodic effects in the regression for step 2 with dividend as dependant variable, crisis.

Redundant Fixed Effects Tests
Test period fixed effects

Effects Test	Statistic	d.f.	Prob.
Period F	8.052343	(1,3334)	0.0046
Period Chi-square	8.057108	1	0.0045

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.053766	0.003669	14.65593	0.0000
EXCESS_CASH	0.013609	0.001278	10.64982	0.0000
EBIT_RATIO	-0.000863	0.000547	-1.576991	0.1149
M_B_RATIO	0.000358	0.000109	3.279247	0.0011
SALES_GROWTH	-7.62E-06	9.52E-06	-0.800286	0.4236

R-squared	0.042193	Mean dependent var	0.024167
Adjusted R-squared	0.041044	S.D. dependent var	0.110322
S.E. of regression	0.108034	Akaike info criterion	-1.611246
Sum squared resid	38.92390	Schwarz criterion	-1.602094
Log likelihood	2695.782	Hannan-Quinn criter.	-1.607972
F-statistic	36.72812	Durbin-Watson stat	0.807572
Prob(F-statistic)	0.000000		

Table A32 Likelihood-ratio test to probe the need for cross-sectional effects in the regression for step 2 with dividend as dependant variable, post-crisis.

Redundant Fixed Effects Tests
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	7.778319	(1684,1654)	0.0000
Cross-section Chi-square	7315.248790	1684	0.0000

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.010255	0.003030	3.384978	0.0007
EXCESS_CASH	-0.002735	0.001105	-2.474424	0.0134
EBIT_RATIO	0.000115	0.000645	0.178332	0.8585
M_B_RATIO	0.001224	6.96E-05	17.59514	0.0000
SALES_GROWTH	-0.007520	0.001371	-5.486020	0.0000

R-squared	0.101355	Mean dependent var	0.024677
Adjusted R-squared	0.100278	S.D. dependent var	0.095989
S.E. of regression	0.091049	Akaike info criterion	-1.953347
Sum squared resid	27.67166	Schwarz criterion	-1.944201
Log likelihood	3270.019	Hannan-Quinn criter.	-1.950075
F-statistic	94.12063	Durbin-Watson stat	0.625063
Prob(F-statistic)	0.000000		

Table A33 Likelihood-ratio test to probe the need for periodic effects in the regression for step 2 with dividend as dependant variable, post-crisis.

Redundant Fixed Effects Tests
Test period fixed effects

Effects Test	Statistic	d.f.	Prob.
Period F	2.310889	(1,3337)	0.1286
Period Chi-square	2.314243	1	0.1282

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.010255	0.003030	3.384978	0.0007
EXCESS_CASH	-0.002735	0.001105	-2.474424	0.0134
EBIT_RATIO	0.000115	0.000645	0.178332	0.8585
M_B_RATIO	0.001224	6.96E-05	17.59514	0.0000
SALES_GROWTH	-0.007520	0.001371	-5.486020	0.0000

R-squared	0.101355	Mean dependent var	0.024677
Adjusted R-squared	0.100278	S.D. dependent var	0.095989
S.E. of regression	0.091049	Akaike info criterion	-1.953347
Sum squared resid	27.67166	Schwarz criterion	-1.944201
Log likelihood	3270.019	Hannan-Quinn criter.	-1.950075
F-statistic	94.12063	Durbin-Watson stat	0.625063
Prob(F-statistic)	0.000000		

8.3.3 Step 3 Likelihood-ratio test

Table A34 Likelihood-ratio test to probe the need for cross-sectional effects in the regression for step 3, pre-crisis.

Redundant Fixed Effects Tests
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	0.979109	(1692,10101)	0.7116
Cross-section Chi-square	1791.913180	1692	0.0449

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.139085	0.007240	19.20995	0.0000
RD	1.23E-06	4.52E-06	0.273036	0.7848
CAPEX	-2.56E-06	1.71E-05	-0.150398	0.8805
DIV	-1.41E-06	1.47E-06	-0.961127	0.3365
MB	0.001082	0.000363	2.981939	0.0029
SIZE	0.981614	0.006672	147.1322	0.0000

R-squared	0.647888	Mean dependent var	0.330064
Adjusted R-squared	0.647738	S.D. dependent var	1.296064
S.E. of regression	0.769235	Akaike info criterion	2.313669
Sum squared resid	6978.188	Schwarz criterion	2.317419
Log likelihood	-13643.49	Hannan-Quinn criter.	2.314928
F-statistic	4339.832	Durbin-Watson stat	1.593994
Prob(F-statistic)	0.000000		

Table A35 Likelihood-ratio test to probe the need for periodic effects in the regression for step 3, pre-crisis.

Redundant Fixed Effects Tests
Test period fixed effects

Effects Test	Statistic	d.f.	Prob.
Period F	55.019753	(6,11786)	0.0000
Period Chi-square	325.938979	6	0.0000

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.146546	0.008286	17.68538	0.0000
RD	1.30E-06	4.52E-06	0.286778	0.7743
CAPEX	-2.61E-06	1.71E-05	-0.153097	0.8783
DIV	-1.43E-06	1.47E-06	-0.973957	0.3301
MB	0.001078	0.000363	2.969933	0.0030
SIZE	0.982640	0.006694	146.7944	0.0000
BETA	-0.006848	0.003700	-1.850751	0.0642

R-squared	0.647990	Mean dependent var	0.330064
Adjusted R-squared	0.647811	S.D. dependent var	1.296064
S.E. of regression	0.769156	Akaike info criterion	2.313548
Sum squared resid	6976.162	Schwarz criterion	2.317924
Log likelihood	-13641.77	Hannan-Quinn criter.	2.315017
F-statistic	3617.841	Durbin-Watson stat	1.594394
Prob(F-statistic)	0.000000		

Table A36 Likelihood-ratio test to probe the need for cross-sectional effects in the regression for step 3, crisis.

Redundant Fixed Effects Tests
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	0.491498	(1689,1628)	1.0000
Cross-section Chi-square	1369.250229	1689	1.0000

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.070702	0.013593	5.201439	0.0000
RD	1.30E-05	1.09E-05	1.197031	0.2314
CAPEX	-3.86E-05	0.000219	-0.176162	0.8602
DIV	-7.74E-06	5.67E-06	-1.365177	0.1723
MB	0.213289	0.008305	25.68147	0.0000
SIZE	2.908603	0.579916	5.015558	0.0000

R-squared	0.169012	Mean dependent var	0.097988
Adjusted R-squared	0.167760	S.D. dependent var	0.854427
S.E. of regression	0.779470	Akaike info criterion	2.341398
Sum squared resid	2015.319	Schwarz criterion	2.352428
Log likelihood	-3884.233	Hannan-Quinn criter.	2.345345
F-statistic	134.9272	Durbin-Watson stat	2.788611
Prob(F-statistic)	0.000000		

Table A37 Likelihood-ratio test to probe the need for periodic effects in the regression for step 3, crisis.

Redundant Fixed Effects Tests
Test period fixed effects

Effects Test	Statistic	d.f.	Prob.
Period F	1492.577068	(1,3315)	0.0000
Period Chi-square	1235.277417	1	0.0000

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.024043	0.015316	1.569849	0.1165
RD	1.37E-05	1.08E-05	1.271372	0.2037
CAPEX	7.33E-06	0.000218	0.033635	0.9732
DIV	-7.31E-06	5.64E-06	-1.297370	0.1946
MB	0.214233	0.008256	25.94936	0.0000
SIZE	3.132992	0.577423	5.425815	0.0000
BETA	0.045133	0.006979	6.467247	0.0000

R-squared	0.179363	Mean dependent var	0.097988
Adjusted R-squared	0.177878	S.D. dependent var	0.854427
S.E. of regression	0.774717	Akaike info criterion	2.329465
Sum squared resid	1990.216	Schwarz criterion	2.342333
Log likelihood	-3863.407	Hannan-Quinn criter.	2.334070
F-statistic	120.7941	Durbin-Watson stat	2.821979
Prob(F-statistic)	0.000000		

Table A38 Likelihood-ratio test to probe the need for cross-sectional effects in the regression for step 3, post-crisis.

Redundant Fixed Effects Tests
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	0.698870	(1688,1601)	1.0000
Cross-section Chi-square	1819.076329	1688	0.0135

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.064711	0.007183	9.009020	0.0000
RD	1.65E-07	1.64E-06	0.100273	0.9201
CAPEX	6.57E-06	3.86E-06	1.703583	0.0886
DIV	-2.34E-06	1.76E-06	-1.330733	0.1834
MB	0.000316	0.000151	2.095040	0.0362
SIZE	4.581829	0.354737	12.91614	0.0000

R-squared	0.051686	Mean dependent var	0.089982
Adjusted R-squared	0.050244	S.D. dependent var	0.402364
S.E. of regression	0.392126	Akaike info criterion	0.967351
Sum squared resid	505.7252	Schwarz criterion	0.978459
Log likelihood	-1587.711	Hannan-Quinn criter.	0.971327
F-statistic	35.85180	Durbin-Watson stat	2.368324
Prob(F-statistic)	0.000000		

Table A39 Likelihood-ratio test to probe the need for periodic effects in the regression for step 3, post-crisis.

Redundant Fixed Effects Tests
Test period fixed effects

Effects Test	Statistic	d.f.	Prob.
Period F	649.225293	(1,3287)	0.0000
Period Chi-square	593.913607	1	0.0000

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.064223	0.007984	8.043987	0.0000
RD	1.72E-07	1.64E-06	0.104851	0.9165
CAPEX	6.56E-06	3.86E-06	1.701485	0.0889
DIV	-2.34E-06	1.76E-06	-1.330468	0.1835
MB	0.000316	0.000151	2.094184	0.0363
SIZE	4.578969	0.355375	12.88490	0.0000
BETA	0.000484	0.003452	0.140327	0.8884

R-squared	0.051691	Mean dependent var	0.089982
Adjusted R-squared	0.049961	S.D. dependent var	0.402364
S.E. of regression	0.392184	Akaike info criterion	0.967952
Sum squared resid	505.7222	Schwarz criterion	0.980911
Log likelihood	-1587.701	Hannan-Quinn criter.	0.972591
F-statistic	29.87088	Durbin-Watson stat	2.368311
Prob(F-statistic)	0.000000		

8.4 Hausman test

8.4.1 Step 1 Hausman test

Table A40 Hausman test to examine whether random effects are needed in the cross-sectional dimension for the regression in step 1.

Correlated Random Effects - Hausman Test
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	731.905049	8	0.0000

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
CAPEX	0.231989	0.243723	0.000024	0.0157
CASH_FLOW	-0.041455	-0.059991	0.000008	0.0000
DIVIDEND_DUMMY	-0.063166	-0.181315	0.000128	0.0000
FINANCIAL_DISTRESS	0.000013	0.000150	0.000000	0.0000
FIRM_SIZE	0.397024	0.212581	0.000094	0.0000
LEVERAGE	-0.345767	-0.378794	0.000031	0.0000
MARKET_TO_BOOK	0.002674	0.002987	0.000000	0.0000
WC	-0.093807	-0.102246	0.000001	0.0000

Cross-section random effects test equation:
Dependent Variable: LIQUID_ASSET_HOLDINGS
Method: Panel Least Squares
Periods included: 11
Cross-sections included: 1696
Total panel (unbalanced) observations: 18136
WARNING: estimated coefficient covariance matrix is of reduced rank

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5.995707	0.181350	-33.06145	0.0000
CAPEX	0.231989	0.017426	13.31254	0.0000
CASH_FLOW	-0.041455	0.013456	-3.080841	0.0021
CASHFLOW_RISKINESS	NA	NA	NA	NA
DIVIDEND_DUMMY	-0.063166	0.029516	-2.140041	0.0324
FINANCIAL_DISTRESS	1.27E-05	0.000165	0.076862	0.9387
FIRM_SIZE	0.397024	0.014108	28.14206	0.0000
LEVERAGE	-0.345767	0.012146	-28.46834	0.0000
MARKET_TO_BOOK	0.002674	0.000198	13.52908	0.0000
WC	-0.093807	0.005055	-18.55623	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.789931	Mean dependent var	-1.158969
Adjusted R-squared	0.768160	S.D. dependent var	1.726241
S.E. of regression	0.831181	Akaike info criterion	2.557308
Sum squared resid	11352.25	Schwarz criterion	3.290702
Log likelihood	-21485.67	Hannan-Quinn criter.	2.798393
F-statistic	36.28301	Durbin-Watson stat	1.187126
Prob(F-statistic)	0.000000		

Table A41 Hausman test to examine whether random effects are needed in the periodic dimension for the regression in step 1.

Correlated Random Effects - Hausman Test
Test period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Period random	131.098978	9	0.0000

Period random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
CAPEX	0.381414	0.373851	0.000001	0.0000
CASH_FLOW	-0.231863	-0.228223	0.000002	0.0072
CASHFLOW_RISKINESS	1.431077	1.442983	0.000001	0.0000
DIVIDEND_DUMMY	-0.500813	-0.501624	0.000001	0.3057
FINANCIAL_DISTRESS	0.000622	0.000642	0.000000	0.0000
FIRM_SIZE	0.079215	0.082824	0.000000	0.0000
LEVERAGE	-0.368775	-0.369943	0.000000	0.0265
MARKET_TO_BOOK	0.005624	0.005644	0.000000	0.2429
WC	-0.190632	-0.191089	0.000000	0.0000

Period random effects test equation:
Dependent Variable: LIQUID_ASSET_HOLDINGS
Method: Panel Least Squares
Periods included: 11
Cross-sections included: 1696
Total panel (unbalanced) observations: 18136

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.431763	0.077575	-31.34741	0.0000
CAPEX	0.381414	0.019856	19.20916	0.0000
CASH_FLOW	-0.231863	0.018309	-12.66409	0.0000
CASHFLOW_RISKINESS	1.431077	0.045313	31.58216	0.0000
DIVIDEND_DUMMY	-0.500813	0.024354	-20.56428	0.0000
FINANCIAL_DISTRESS	0.000622	0.000246	2.532981	0.0113
FIRM_SIZE	0.079215	0.006004	13.19293	0.0000
LEVERAGE	-0.368775	0.009602	-38.40548	0.0000
MARKET_TO_BOOK	0.005624	0.000279	20.15618	0.0000
WC	-0.190632	0.006824	-27.93599	0.0000

Effects Specification

Period fixed (dummy variables)

R-squared	0.291403	Mean dependent var	-1.158969
Adjusted R-squared	0.290660	S.D. dependent var	1.726241
S.E. of regression	1.453881	Akaike info criterion	3.587452
Sum squared resid	38293.04	Schwarz criterion	3.596060
Log likelihood	-32511.01	Hannan-Quinn criter.	3.590281
F-statistic	392.1054	Durbin-Watson stat	0.400189
Prob(F-statistic)	0.000000		

8.4.2 Step 2 Hausman test

Table A42 Hausman test to examine whether random effects are needed in the cross-sectional dimension for the regression in step 2 with R&D as the dependant variable, pre-crisis.

Correlated Random Effects - Hausman Test
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	429.402814	4	0.0000

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
EXCESS_CASH	0.039551	0.067218	0.000005	0.0000
EBIT_RATIO	-0.033832	-0.042065	0.000000	0.0000
M_B_RATIO	0.000711	0.001149	0.000000	0.0000
SALES_GROWTH	-0.000106	-0.000088	0.000000	0.0000

Cross-section random effects test equation:
Dependent Variable: R_D_RATIO
Method: Panel Least Squares
Periods included: 7
Cross-sections included: 1698
Total panel (unbalanced) observations: 11641

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.344469	0.015304	22.50787	0.0000
EXCESS_CASH	0.039551	0.005820	6.796270	0.0000
EBIT_RATIO	-0.033832	0.001586	-21.33511	0.0000
M_B_RATIO	0.000711	0.000154	4.622501	0.0000
SALES_GROWTH	-0.000106	2.65E-05	-3.995010	0.0001

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.776611	Mean dependent var	0.259119
Adjusted R-squared	0.738380	S.D. dependent var	1.165895
S.E. of regression	0.596342	Akaike info criterion	1.938342
Sum squared resid	3534.540	Schwarz criterion	3.014762
Log likelihood	-9580.117	Hannan-Quinn criter.	2.299968
F-statistic	20.31333	Durbin-Watson stat	1.492809
Prob(F-statistic)	0.000000		

Table A43 Hausman test to examine whether random effects are needed in the periodic dimension for the regression in step 2 with R&D as the dependant variable, pre-crisis.

Correlated Random Effects - Hausman Test
Test period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Period random	1.311021	4	0.8595

** WARNING: estimated period random effects variance is zero.

Period random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
EXCESS_CASH	0.146624	0.146295	0.000000	0.3104
EBIT_RATIO	-0.067370	-0.067391	0.000000	0.7650
M_B_RATIO	0.002784	0.002779	0.000000	0.3694
SALES_GROWTH	0.000091	0.000091	0.000000	0.9787

Period random effects test equation:
Dependent Variable: R_D_RATIO
Method: Panel Least Squares
Periods included: 7
Cross-sections included: 1698
Total panel (unbalanced) observations: 11641

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.581703	0.017559	33.12817	0.0000
EXCESS_CASH	0.146624	0.005817	25.20548	0.0000
EBIT_RATIO	-0.067370	0.002032	-33.14960	0.0000
M_B_RATIO	0.002784	0.000207	13.42624	0.0000
SALES_GROWTH	9.14E-05	4.28E-05	2.134842	0.0328

Effects Specification

Period fixed (dummy variables)

R-squared	0.191082	Mean dependent var	0.259119
Adjusted R-squared	0.190386	S.D. dependent var	1.165895
S.E. of regression	1.049055	Akaike info criterion	2.934601
Sum squared resid	12799.01	Schwarz criterion	2.941558
Log likelihood	-17069.85	Hannan-Quinn criter.	2.936938
F-statistic	274.7228	Durbin-Watson stat	0.460619
Prob(F-statistic)	0.000000		

Table A44 Hausman test to examine whether random effects are needed in the cross-sectional dimension for the regression in step 2 with R&D as the dependant variable, crisis.

Correlated Random Effects - Hausman Test
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	241.841492	4	0.0000

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
EXCESS_CASH	-0.012438	0.020337	0.000078	0.0002
EBIT_RATIO	-0.034901	-0.051463	0.000003	0.0000
M_B_RATIO	0.014300	0.021053	0.000000	0.0000
SALES_GROWTH	-0.000100	-0.000072	0.000000	0.0582

Cross-section random effects test equation:
Dependent Variable: R_D_RATIO
Method: Panel Least Squares
Periods included: 2
Cross-sections included: 1687
Total panel (unbalanced) observations: 3340

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.123774	0.032374	3.823201	0.0001
EXCESS_CASH	-0.012438	0.013284	-0.936310	0.3493
EBIT_RATIO	-0.034901	0.003550	-9.831739	0.0000
M_B_RATIO	0.014300	0.000887	16.11344	0.0000
SALES_GROWTH	-9.98E-05	4.68E-05	-2.134543	0.0329

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.946929	Mean dependent var	0.243380
Adjusted R-squared	0.892539	S.D. dependent var	1.118203
S.E. of regression	0.366560	Akaike info criterion	1.137466
Sum squared resid	221.5703	Schwarz criterion	4.232769
Log likelihood	-208.5680	Hannan-Quinn criter.	2.244774
F-statistic	17.40995	Durbin-Watson stat	4.038694
Prob(F-statistic)	0.000000		

Table A45 Hausman test to examine whether random effects are needed in the cross-sectional dimension for the regression in step 2 with R&D as the dependant variable, post-crisis.

Correlated Random Effects - Hausman Test
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	348.055355	4	0.0000

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
EXCESS_CASH	-0.016249	0.033185	0.000108	0.0000
EBIT_RATIO	-0.110171	-0.104508	0.000039	0.3645
M_B_RATIO	-0.000638	0.006525	0.000000	0.0000
SALES_GROWTH	-0.036913	-0.011601	0.000009	0.0000

Cross-section random effects test equation:
Dependent Variable: R_D_RATIO
Method: Panel Least Squares
Periods included: 2
Cross-sections included: 1685
Total panel (unbalanced) observations: 3343

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.220297	0.033643	6.548166	0.0000
EXCESS_CASH	-0.016249	0.014533	-1.118076	0.2637
EBIT_RATIO	-0.110171	0.008268	-13.32513	0.0000
M_B_RATIO	-0.000638	0.000762	-0.837293	0.4025
SALES_GROWTH	-0.036913	0.008575	-4.304827	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.923784	Mean dependent var	0.223458
Adjusted R-squared	0.846001	S.D. dependent var	1.008903
S.E. of regression	0.395920	Akaike info criterion	1.291590
Sum squared resid	259.2693	Schwarz criterion	4.380911
Log likelihood	-469.8928	Hannan-Quinn criter.	2.396708
F-statistic	11.87647	Durbin-Watson stat	4.030139
Prob(F-statistic)	0.000000		

Table A46 Hausman test to examine whether random effects are needed in the cross-sectional dimension for the regression in step 2 with CAPEX as the dependant variable, pre-crisis.

Correlated Random Effects - Hausman Test
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	65.486926	4	0.0000

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
EXCESS_CASH	-0.016497	-0.010599	0.000002	0.0000
EBIT_RATIO	-0.005005	-0.004405	0.000000	0.0279
M_B_RATIO	0.000310	0.000454	0.000000	0.0000
SALES_GROWTH	0.000038	0.000037	0.000000	0.4426

Cross-section random effects test equation:
Dependent Variable: CAPEX_RATIO
Method: Panel Least Squares
Periods included: 7
Cross-sections included: 1698
Total panel (unbalanced) observations: 11641

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.339879	0.009574	35.49972	0.0000
EXCESS_CASH	-0.016497	0.003641	-4.531377	0.0000
EBIT_RATIO	-0.005005	0.000992	-5.045010	0.0000
M_B_RATIO	0.000310	9.62E-05	3.219451	0.0013
SALES_GROWTH	3.82E-05	1.66E-05	2.306971	0.0211

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.763201	Mean dependent var	0.385529
Adjusted R-squared	0.722674	S.D. dependent var	0.708409
S.E. of regression	0.373061	Akaike info criterion	1.000196
Sum squared resid	1383.252	Schwarz criterion	2.076617
Log likelihood	-4119.639	Hannan-Quinn criter.	1.361822
F-statistic	18.83200	Durbin-Watson stat	1.612263
Prob(F-statistic)	0.000000		

Table A47 Hausman test to examine whether random effects are needed in the periodic dimension for the regression in step 2 with CAPEX as the dependant variable, pre-crisis.

Correlated Random Effects - Hausman Test
Test period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Period random	22.354747	4	0.0002

** WARNING: estimated period random effects variance is zero.

Period random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
EXCESS_CASH	0.017228	0.016307	0.000000	0.0000
EBIT_RATIO	0.004004	0.003915	0.000000	0.0595
M_B_RATIO	0.001625	0.001614	0.000000	0.0051
SALES_GROWTH	0.000034	0.000035	0.000000	0.0371

Period random effects test equation:
Dependent Variable: CAPEX_RATIO
Method: Panel Least Squares
Periods included: 7
Cross-sections included: 1698
Total panel (unbalanced) observations: 11641

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.411070	0.011768	34.93226	0.0000
EXCESS_CASH	0.017228	0.003898	4.419128	0.0000
EBIT_RATIO	0.004004	0.001362	2.939492	0.0033
M_B_RATIO	0.001625	0.000139	11.69423	0.0000
SALES_GROWTH	3.36E-05	2.87E-05	1.172309	0.2411

Effects Specification

Period fixed (dummy variables)

R-squared	0.015931	Mean dependent var	0.385529
Adjusted R-squared	0.015085	S.D. dependent var	0.708409
S.E. of regression	0.703045	Akaike info criterion	2.134154
Sum squared resid	5748.393	Schwarz criterion	2.141111
Log likelihood	-12410.84	Hannan-Quinn criter.	2.136491
F-statistic	18.82729	Durbin-Watson stat	0.398686
Prob(F-statistic)	0.000000		

Table A48 Hausman test to examine whether random effects are needed in the cross-sectional dimension for the regression in step 2 with CAPEX as the dependant variable, crisis.

Correlated Random Effects - Hausman Test
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	52.492203	4	0.0000

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
EXCESS_CASH	-0.056760	-0.008209	0.000083	0.0000
EBIT_RATIO	-0.000898	-0.001370	0.000003	0.7903
M_B_RATIO	-0.003114	-0.000534	0.000000	0.0000
SALES_GROWTH	0.000029	-0.000014	0.000000	0.0098

Cross-section random effects test equation:
Dependent Variable: CAPEX_RATIO
Method: Panel Least Squares
Periods included: 2
Cross-sections included: 1687
Total panel (unbalanced) observations: 3340

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.257777	0.030063	8.574643	0.0000
EXCESS_CASH	-0.056760	0.012335	-4.601545	0.0000
EBIT_RATIO	-0.000898	0.003296	-0.272501	0.7853
M_B_RATIO	-0.003114	0.000824	-3.778918	0.0002
SALES_GROWTH	2.88E-05	4.34E-05	0.662501	0.5077

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.882080	Mean dependent var	0.371824
Adjusted R-squared	0.761227	S.D. dependent var	0.696592
S.E. of regression	0.340385	Akaike info criterion	0.989295
Sum squared resid	191.0566	Schwarz criterion	4.084598
Log likelihood	38.87662	Hannan-Quinn criter.	2.096604
F-statistic	7.298818	Durbin-Watson stat	4.038694
Prob(F-statistic)	0.000000		

Table A49 Hausman test to examine whether random effects are needed in the cross-sectional dimension for the regression in step 2 with CAPEX as the dependant variable, post-crisis.

Correlated Random Effects - Hausman Test
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	24.538346	4	0.0001

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
EXCESS_CASH	-0.014226	-0.011011	0.000031	0.5655
EBIT_RATIO	0.005437	0.013128	0.000012	0.0253
M_B_RATIO	-0.000717	0.000655	0.000000	0.0000
SALES_GROWTH	0.027753	0.028210	0.000002	0.7621

Cross-section random effects test equation:
Dependent Variable: CAPEX_RATIO
Method: Panel Least Squares
Periods included: 2
Cross-sections included: 1685
Total panel (unbalanced) observations: 3343

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.314410	0.020881	15.05743	0.0000
EXCESS_CASH	-0.014226	0.009020	-1.577150	0.1150
EBIT_RATIO	0.005437	0.005132	1.059426	0.2896
M_B_RATIO	-0.000717	0.000473	-1.514838	0.1300
SALES_GROWTH	0.027753	0.005322	5.214718	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.933045	Mean dependent var	0.345916
Adjusted R-squared	0.864713	S.D. dependent var	0.668091
S.E. of regression	0.245733	Akaike info criterion	0.337658
Sum squared resid	99.87653	Schwarz criterion	3.426978
Log likelihood	1124.605	Hannan-Quinn criter.	1.442776
F-statistic	13.65464	Durbin-Watson stat	4.030139
Prob(F-statistic)	0.000000		

Table A50 Hausman test to examine whether random effects are needed in the cross-sectional dimension for the regression in step 2 with dividend as the dependant variable, pre-crisis.

Correlated Random Effects - Hausman Test
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	202.501354	4	0.0000

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
EXCESS_CASH	-13.147366	-5.515925	0.287807	0.0000
EBIT_RATIO	0.988510	0.326156	0.014569	0.0000
M_B_RATIO	-0.053443	-0.002766	0.000118	0.0000
SALES_GROWTH	0.002124	0.000910	0.000001	0.2760

Cross-section random effects test equation:
Dependent Variable: DIV_RATIO
Method: Panel Least Squares
Periods included: 7
Cross-sections included: 1698
Total panel (unbalanced) observations: 11641

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-31.35548	1.767795	-17.73706	0.0000
EXCESS_CASH	-13.14737	0.672211	-19.55839	0.0000
EBIT_RATIO	0.988510	0.183170	5.396695	0.0000
M_B_RATIO	-0.053443	0.017771	-3.007384	0.0026
SALES_GROWTH	0.002124	0.003059	0.694388	0.4875

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.197495	Mean dependent var	0.683172
Adjusted R-squared	0.060151	S.D. dependent var	71.05303
S.E. of regression	68.88293	Akaike info criterion	11.43704
Sum squared resid	47159147	Schwarz criterion	12.51346
Log likelihood	-64867.30	Hannan-Quinn criter.	11.79867
F-statistic	1.437959	Durbin-Watson stat	1.416708
Prob(F-statistic)	0.000000		

Table A51 Hausman test to examine whether random effects are needed in the periodic dimension for the regression in step 2 with dividend as the dependant variable, pre-crisis.

Correlated Random Effects - Hausman Test
Test period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Period random	7.554637	4	0.1093

** WARNING: estimated period random effects variance is zero.

Period random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
EXCESS_CASH	-5.059280	-5.016587	0.000476	0.0504
EBIT_RATIO	0.293134	0.293351	0.000022	0.9636
M_B_RATIO	-0.001004	-0.000654	0.000000	0.3916
SALES_GROWTH	0.000676	0.000772	0.000000	0.1248

Period random effects test equation:
Dependent Variable: DIV_RATIO
Method: Panel Least Squares
Periods included: 7
Cross-sections included: 1698
Total panel (unbalanced) observations: 11641

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-11.87669	1.181037	-10.05615	0.0000
EXCESS_CASH	-5.059280	0.391264	-12.93060	0.0000
EBIT_RATIO	0.293134	0.136693	2.144480	0.0320
M_B_RATIO	-0.001004	0.013948	-0.071965	0.9426
SALES_GROWTH	0.000676	0.002879	0.234837	0.8143

Effects Specification

Period fixed (dummy variables)

R-squared	0.014680	Mean dependent var	0.683172
Adjusted R-squared	0.013833	S.D. dependent var	71.05303
S.E. of regression	70.55989	Akaike info criterion	11.35175
Sum squared resid	57902260	Schwarz criterion	11.35870
Log likelihood	-66061.83	Hannan-Quinn criter.	11.35408
F-statistic	17.32697	Durbin-Watson stat	1.167888
Prob(F-statistic)	0.000000		

Table A52 Hausman test to examine whether random effects are needed in the cross-sectional dimension for the regression in step 2 with dividend as the dependant variable, crisis.

Correlated Random Effects - Hausman Test
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	249.769304	4	0.0000

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
EXCESS_CASH	0.004193	0.010180	0.000003	0.0011
EBIT_RATIO	-0.001987	-0.001847	0.000000	0.7106
M_B_RATIO	-0.000648	0.000068	0.000000	0.0000
SALES_GROWTH	-0.000132	-0.000089	0.000000	0.0000

Cross-section random effects test equation:
Dependent Variable: DIV_RATIO
Method: Panel Least Squares
Periods included: 2
Cross-sections included: 1687
Total panel (unbalanced) observations: 3340

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.038421	0.005518	6.963280	0.0000
EXCESS_CASH	0.004193	0.002264	1.851896	0.0642
EBIT_RATIO	-0.001987	0.000605	-3.283955	0.0010
M_B_RATIO	-0.000648	0.000151	-4.282346	0.0000
SALES_GROWTH	-0.000132	7.97E-06	-16.53112	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.841630	Mean dependent var	0.024167
Adjusted R-squared	0.679322	S.D. dependent var	0.110322
S.E. of regression	0.062473	Akaike info criterion	-2.401376
Sum squared resid	6.435942	Schwarz criterion	0.693927
Log likelihood	5701.298	Hannan-Quinn criter.	-1.294067
F-statistic	5.185389	Durbin-Watson stat	4.038694
Prob(F-statistic)	0.000000		

Table A53 Hausman test to examine whether random effects are needed in the cross-sectional dimension for the regression in step 2 with dividend as the dependant variable, post-crisis.

Correlated Random Effects - Hausman Test
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	425.482585	4	0.0000

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
EXCESS_CASH	-0.015721	-0.007371	0.000001	0.0000
EBIT_RATIO	0.011326	0.003615	0.000000	0.0000
M_B_RATIO	0.000464	0.000730	0.000000	0.0000
SALES_GROWTH	-0.016367	-0.013850	0.000000	0.0000

Cross-section random effects test equation:
Dependent Variable: DIV_RATIO
Method: Panel Least Squares
Periods included: 2
Cross-sections included: 1685
Total panel (unbalanced) observations: 3343

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.013212	0.003680	-3.590052	0.0003
EXCESS_CASH	-0.015721	0.001590	-9.888762	0.0000
EBIT_RATIO	0.011326	0.000904	12.52341	0.0000
M_B_RATIO	0.000464	8.34E-05	5.566782	0.0000
SALES_GROWTH	-0.016367	0.000938	-17.44858	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.899248	Mean dependent var	0.024677
Adjusted R-squared	0.796426	S.D. dependent var	0.095989
S.E. of regression	0.043309	Akaike info criterion	-3.134097
Sum squared resid	3.102412	Schwarz criterion	-0.044776
Log likelihood	6927.644	Hannan-Quinn criter.	-2.028979
F-statistic	8.745615	Durbin-Watson stat	4.030139
Prob(F-statistic)	0.000000		

8.4.3 Step 3 Hausman test

Table A54 Hausman test to examine whether random effects are needed in the cross-sectional dimension for the regression in step 3, pre-crisis.

Correlated Random Effects - Hausman Test
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	58.203240	5	0.0000

** WARNING: estimated cross-section random effects variance is zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
RD	-0.000004	0.000001	0.000000	0.0051
CAPEX	0.000002	-0.000003	0.000000	0.4907
DIV	-0.000001	-0.000001	0.000000	0.4470
MB	0.000299	0.001078	0.000000	0.0000
SIZE	0.969757	0.982640	0.000006	0.0000

Cross-section random effects test equation:
Dependent Variable: MV
Method: Panel Least Squares
Periods included: 7
Cross-sections included: 1693
Total panel (unbalanced) observations: 11799
WARNING: estimated coefficient covariance matrix is of reduced rank

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.142005	0.007274	19.52164	0.0000
RD	-4.01E-06	4.90E-06	-0.818701	0.4130
CAPEX	2.19E-06	1.84E-05	0.118720	0.9055
DIV	-9.80E-07	1.59E-06	-0.617882	0.5367
MB	0.000299	0.000393	0.760403	0.4470
SIZE	0.969757	0.007159	135.4506	0.0000
BETA	NA	NA	NA	NA

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.697500	Mean dependent var	0.330064
Adjusted R-squared	0.646679	S.D. dependent var	1.296064
S.E. of regression	0.770391	Akaike info criterion	2.448603
Sum squared resid	5994.962	Schwarz criterion	3.510053
Log likelihood	-12747.53	Hannan-Quinn criter.	2.804962
F-statistic	13.72468	Durbin-Watson stat	1.857869
Prob(F-statistic)	0.000000		

Table A54 Hausman test to examine whether random effects are needed in the period dimension for the regression in step 3, pre-crisis.

Correlated Random Effects - Hausman Test
Test period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Period random	330.118507	6	0.0000

** WARNING: estimated period random effects variance is zero.

Period random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
RD	0.000002	0.000001	0.000000	0.0005
CAPEX	-0.000001	-0.000003	0.000000	0.0001
DIV	-0.000001	-0.000001	0.000000	0.0000
MB	0.001096	0.001078	0.000000	0.1595
SIZE	1.005805	0.982640	0.000004	0.0000
BETA	-0.007943	-0.006848	0.000000	0.0000

Period random effects test equation:
Dependent Variable: MV
Method: Panel Least Squares
Periods included: 7
Cross-sections included: 1693
Total panel (unbalanced) observations: 11799

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.142971	0.008181	17.47603	0.0000
RD	1.68E-06	4.46E-06	0.377940	0.7055
CAPEX	-1.19E-06	1.68E-05	-0.070937	0.9434
DIV	-8.32E-07	1.45E-06	-0.573818	0.5661
MB	0.001096	0.000358	3.058773	0.0022
SIZE	1.005805	0.006922	145.3081	0.0000
BETA	-0.007943	0.003651	-2.175396	0.0296

Effects Specification

Period fixed (dummy variables)

R-squared	0.657581	Mean dependent var	0.330064
Adjusted R-squared	0.657232	S.D. dependent var	1.296064
S.E. of regression	0.758799	Akaike info criterion	2.286940
Sum squared resid	6786.088	Schwarz criterion	2.295067
Log likelihood	-13478.81	Hannan-Quinn criter.	2.289669
F-statistic	1886.151	Durbin-Watson stat	1.590696
Prob(F-statistic)	0.000000		

Table A55 Hausman test to examine whether random effects are needed in the cross-sectional dimension for the regression in step 3, crisis.

Correlated Random Effects - Hausman Test
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	124.563359	5	0.0000

** WARNING: estimated cross-section random effects variance is zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
RD	0.000021	0.000014	0.000000	0.5802
CAPEX	-0.000212	0.000007	0.000000	0.3882
DIV	-0.000010	-0.000007	0.000000	0.6935
MB	0.311407	0.214233	0.000077	0.0000
SIZE	4.116540	3.132992	0.436083	0.1364

Cross-section random effects test equation:
Dependent Variable: MV
Method: Panel Least Squares
Periods included: 2
Cross-sections included: 1690
Total panel (unbalanced) observations: 3323
WARNING: estimated coefficient covariance matrix is of reduced rank

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.058046	0.015859	3.660064	0.0003
RD	2.07E-05	1.79E-05	1.160402	0.2461
CAPEX	-0.000212	0.000360	-0.589311	0.5557
DIV	-9.92E-06	9.33E-06	-1.062892	0.2880
MB	0.311407	0.013059	23.84552	0.0000
SIZE	4.116540	0.944210	4.359772	0.0000
BETA	NA	NA	NA	NA

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.449646	Mean dependent var	0.097988
Adjusted R-squared	-0.123021	S.D. dependent var	0.854427
S.E. of regression	0.905459	Akaike info criterion	2.945897
Sum squared resid	1334.725	Schwarz criterion	6.061791
Log likelihood	-3199.608	Hannan-Quinn criter.	4.060861
F-statistic	0.785179	Durbin-Watson stat	4.067319
Prob(F-statistic)	1.000000		

Table A55 Hausman test to examine whether random effects are needed in the cross-sectional dimension for the regression in step 3, post-crisis.

Correlated Random Effects - Hausman Test
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	9.136578	5	0.1037

** WARNING: estimated cross-section random effects variance is zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
RD	-0.000001	0.000000	0.000000	0.5644
CAPEX	0.000008	0.000007	0.000000	0.7159
DIV	-0.000004	-0.000002	0.000000	0.4044
MB	0.000273	0.000316	0.000000	0.7927
SIZE	3.385956	4.578969	0.171390	0.0040

Cross-section random effects test equation:
Dependent Variable: MV
Method: Panel Least Squares
Periods included: 2
Cross-sections included: 1689
Total panel (unbalanced) observations: 3295
WARNING: estimated coefficient covariance matrix is of reduced rank

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.072335	0.008224	8.795595	0.0000
RD	-8.54E-07	2.52E-06	-0.338601	0.7350
CAPEX	8.09E-06	5.93E-06	1.363913	0.1728
DIV	-3.92E-06	2.69E-06	-1.455477	0.1457
MB	0.000273	0.000232	1.176245	0.2397
SIZE	3.385956	0.566324	5.978831	0.0000
BETA	NA	NA	NA	NA

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.454003	Mean dependent var	0.089982
Adjusted R-squared	-0.123370	S.D. dependent var	0.402364
S.E. of regression	0.426462	Akaike info criterion	1.439862
Sum squared resid	291.1742	Schwarz criterion	4.576030
Log likelihood	-678.1725	Hannan-Quinn criter.	2.562564
F-statistic	0.786325	Durbin-Watson stat	4.100809
Prob(F-statistic)	0.999999		

8.5 Multicollinearity test

8.5.1 Step 1 Multicollinearity test

Table A56 Correlation matrix for the explaining variables in the regression for step 1 to check for potential multicollinearity.

	Step 1								
Variables	CAPEX	CF	CFR	DIV-D	FD	SIZE	LEVERAGE	MB	WC
CAPEX	1								
CF	0.2371	1							
CFR	0.3985	0.0851	1						
DIV-D	0.0244	0.1640	-0.074	1					
FD	0.0185	-0.0701	0.0387	-0.0319	1				
SIZE	-0.0587	0.2001	-0.12	0.4404	-0.0535	1			
LEVERAGE	0.4249	0.1958	0.2622	0.1196	-0.0138	0.0436	1		
MB	0.1317	-0.2781	0.1393	-0.1119	0.1147	-0.1631	-0.0463	1	
WC	-0.2569	0.1968	-0.2271	0.0631	-0.1278	0.0873	-0.1689	-0.4539	1

8.5.2 Step 2 Multicollinearity test

Table A57 Correlation matrix for the explaining variables in the regression for step 2 to check for potential multicollinearity.

	Step 2			
Variables	XC	EBIT	MB	Growth
XC	1			
EBIT	0.1618	1		
MB	-0.0669	-0.5185	1	
Growth	0.0157	-0.0260	0.0179	1

8.5.3 Step 3 Multicollinearity test

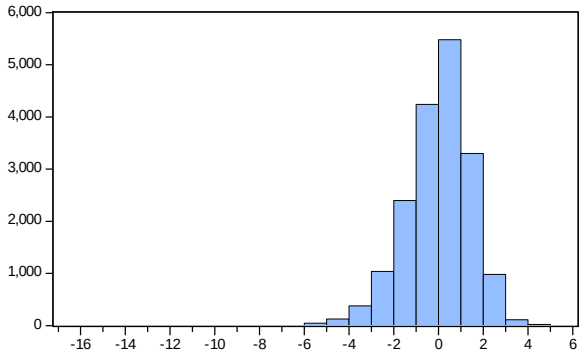
Table A58 Correlation matrix for the explaining variables in the regression for step 3 to check for potential multicollinearity.

	Step 3					
Variables	BETA	CAPEX	DIV	MB	R&D	SIZE
BETA	1					
CAPEX	0.0118	1				
DIV	-0.0022	0.0485	1			
MB	0.0057	0.0009	0.0014	1		
R&D	-0.0330	-0.0009	-0.0050	0.0007	1	
SIZE	0.0574	-0.0069	-0.0440	0.0337	0.0011	1

8.6 Normality test

8.6.1 Step 1 Normality test

Table A59 Normality test for the regression in step 1.

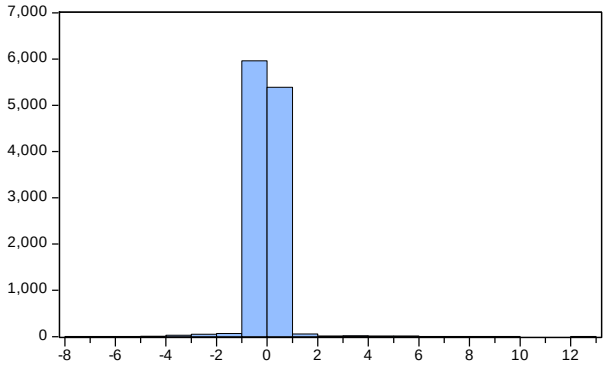


Series: Standardized Residuals
Sample 2001 2011 IF CAPEX<6.4523985240 AND CASH_FLOW>-273.2 AND FINANCIAL_DISTRESS<4006 AND LEVERAGE<8.1783925830 AND MARKET_TO_BOOK<7490488 AND WC>-6800 AND LIQUID_ASSET_HOLDINGS<5.1855611490 AND LIQUID_ASSET_HOLDINGS>-7.5834869810 AND FIRM_SIZE>5.680172 AND CASHFLOW_RISKINESS<1.7768
Observations 18136

Mean	-2.32e-16
Median	0.157578
Maximum	5.074840
Minimum	-16.19487
Std. Dev.	1.453119
Skewness	-0.695957
Kurtosis	5.091543
Jarque-Bera	4769.748
Probability	0.000000

8.6.2 Step 2 Normality test

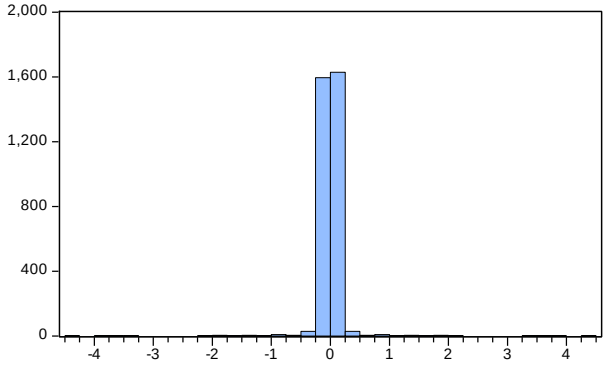
Table A60 Normality test for the regression in step 2 with R&D as the dependant variable, pre-crisis.



Series: Standardized Residuals
Sample 2001 2007 IF CAPEX_RATIO<6.5296116660 AND DIV_RATIO <181392 AND EBIT_RATIO>-1371 AND M_B_RATIO<7490488 AND R_D_RATIO<16.3752422200 AND SALES_GROWTH<44874 AND LIQUID_ASSET_HOLDINGS<5.1855611490 AND LIQUID_ASSET_HOLDINGS>-7.5834869810 AND EXCESS_CASH> -95807.4267944450
Observations 11641

Mean	3.39e-18
Median	-0.002249
Maximum	12.29342
Minimum	-7.894336
Std. Dev.	0.550982
Skewness	3.958487
Kurtosis	120.7949
Jarque-Bera	6760663.
Probability	0.000000

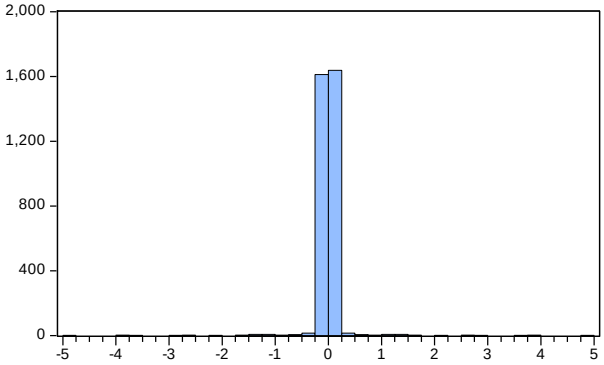
Table A61 Normality test for the regression in step 2 with R&D as the dependant variable, crisis.



Series: Standardized Residuals
Sample 2008 2009 IF CAPEX_RATIO<6.5296116660 AND DIV_RATIO <181392 AND EBIT_RATIO>-1371 AND M_B_RATIO<7490488 AND R_D_RATIO<16.3752422200 AND SALES_GROWTH<44874 AND LIQUID_ASSET_HOLDINGS<5.1855611490 AND LIQUID_ASSET_HOLDINGS>-7.5834869810 AND EXCESS_CASH> -95807.4267944450
Observations 3340

Mean	1.41e-18
Median	0.000000
Maximum	4.386658
Minimum	-4.386658
Std. Dev.	0.256935
Skewness	-4.62e-16
Kurtosis	138.9350
Jarque-Bera	2571566.
Probability	0.000000

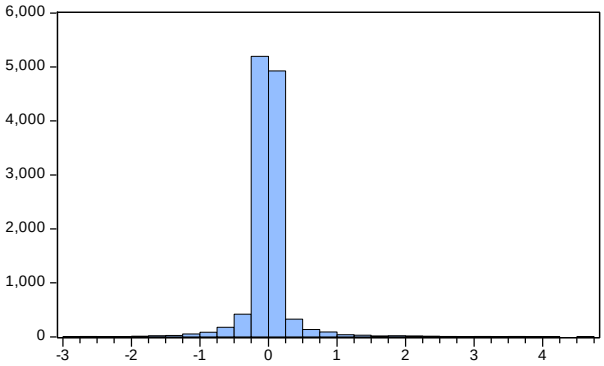
Table A62 Normality test for the regression in step 2 with R&D as the dependant variable, post-crisis.



Series: Standardized Residuals
Sample 2010 2011 IF CAPEX_RATIO<6.5296116660 AND DIV_RATIO <181392 AND EBIT_RATIO>-1371 AND M_B_RATIO<7490488 AND R_D_RATIO<16.3752422200 AND SALES_GROWTH<44874 AND LIQUID_ASSET_HOLDINGS<5.1855611490 AND LIQUID_ASSET_HOLDINGS>-7.5834869810 AND EXCESS_CASH> -95807.4267944450
Observations 3343

Mean	1.19e-18
Median	0.000000
Maximum	4.957907
Minimum	-4.957907
Std. Dev.	0.278519
Skewness	5.92e-16
Kurtosis	148.1744
Jarque-Bera	2935656.
Probability	0.000000

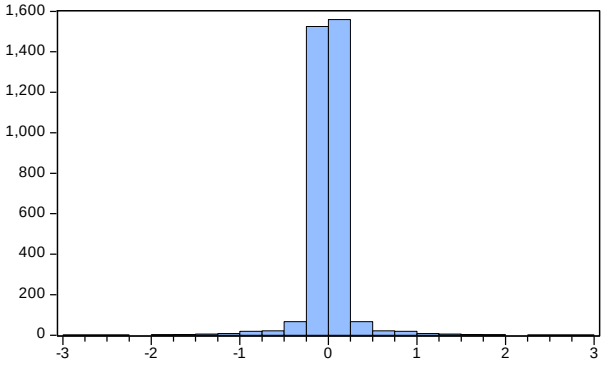
Table A63 Normality test for the regression in step 2 with CAPEX as the dependant variable, pre-crisis.



Series: Standardized Residuals
Sample 2001 2007 IF CAPEX_RATIO<6.5296116660 AND DIV_RATIO <181392 AND EBIT_RATIO>-1371 AND M_B_RATIO<7490488 AND R_D_RATIO<16.3752422200 AND SALES_GROWTH<44874 AND LIQUID_ASSET_HOLDINGS<5.1855611490 AND LIQUID_ASSET_HOLDINGS>-7.5834869810 AND EXCESS_CASH> -95807.4267944450
Observations 11641

Mean	1.51e-18
Median	-0.002498
Maximum	4.655705
Minimum	-2.880316
Std. Dev.	0.343217
Skewness	2.787463
Kurtosis	39.96429
Jarque-Bera	677816.0
Probability	0.000000

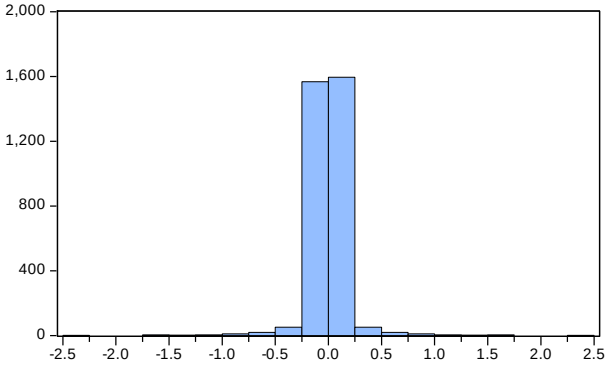
Table A64 Normality test for the regression in step 2 with CAPEX as the dependant variable, crisis.



Series: Standardized Residuals
Sample 2008 2009 IF CAPEX_RATIO<6.5296116660 AND DIV_RATIO <181392 AND EBIT_RATIO>-1371 AND M_B_RATIO<7490488 AND R_D_RATIO<16.3752422200 AND SALES_GROWTH<44874 AND LIQUID_ASSET_HOLDINGS<5.1855611490 AND LIQUID_ASSET_HOLDINGS>-7.5834869810 AND EXCESS_CASH> -95807.4267944450
Observations 3340

Mean	-3.29e-18
Median	0.000000
Maximum	2.768556
Minimum	-2.768556
Std. Dev.	0.236839
Skewness	-3.70e-16
Kurtosis	45.14963
Jarque-Bera	247242.2
Probability	0.000000

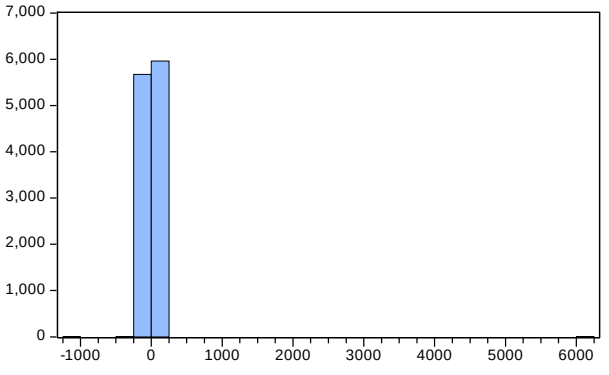
Table A65 Normality test for the regression in step 2 with CAPEX as the dependant variable, post-crisis.



Series: Standardized Residuals
Sample 2010 2011 IF CAPEX_RATIO<6.5296116660 AND DIV_RATIO <181392 AND EBIT_RATIO>-1371 AND M_B_RATIO<7490488 AND R_D_RATIO<16.3752422200 AND SALES_GROWTH<44874 AND LIQUID_ASSET_HOLDINGS<5.1855611490 AND LIQUID_ASSET_HOLDINGS>-7.5834869810 AND EXCESS_CASH> -95807.4267944450
Observations 3343

Mean	-6.73e-19
Median	0.000000
Maximum	2.331770
Minimum	-2.331770
Std. Dev.	0.171750
Skewness	-2.18e-16
Kurtosis	55.98068
Jarque-Bera	390985.1
Probability	0.000000

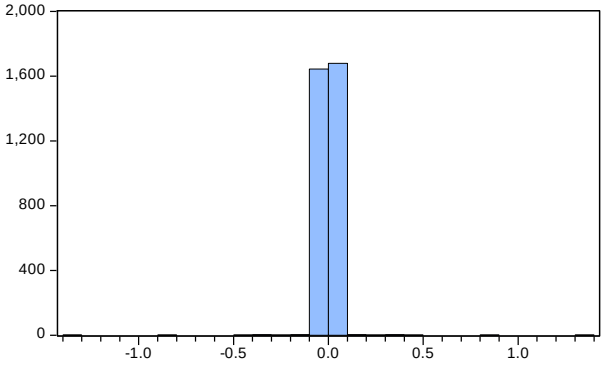
Table A66 Normality test for the regression in step 2 with dividend as the dependant variable, pre-crisis.



Series: Standardized Residuals
Sample 2001 2007 IF CAPEX_RATIO<6.5296116660 AND DIV_RATIO <181392 AND EBIT_RATIO>-1371 AND M_B_RATIO<7490488 AND R_D_RATIO<16.3752422200 AND SALES_GROWTH<44874 AND LIQUID_ASSET_HOLDINGS<5.1855611490 AND LIQUID_ASSET_HOLDINGS>-7.5834869810 AND EXCESS_CASH> -95807.4267944450
Observations 11641

Mean	2.39e-16
Median	0.202501
Maximum	6141.656
Minimum	-1239.916
Std. Dev.	63.60105
Skewness	74.22073
Kurtosis	7530.938
Jarque-Bera	2.75e+10
Probability	0.000000

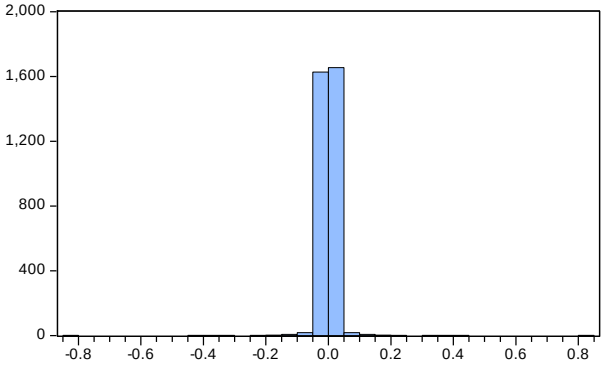
Table A67 Normality test for the regression in step 2 with dividend as the dependant variable, crisis.



Series: Standardized Residuals
Sample 2008 2009 IF CAPEX_RATIO<6.5296116660 AND DIV_RATIO <181392 AND EBIT_RATIO>-1371 AND M_B_RATIO<7490488 AND R_D_RATIO<16.3752422200 AND SALES_GROWTH<44874 AND LIQUID_ASSET_HOLDINGS<5.1855611490 AND LIQUID_ASSET_HOLDINGS>-7.5834869810 AND EXCESS_CASH> -95807.4267944450
Observations 3340

Mean	1.11e-19
Median	0.000000
Maximum	1.335267
Minimum	-1.335267
Std. Dev.	0.043863
Skewness	-3.61e-18
Kurtosis	603.4150
Jarque-Bera	50169328
Probability	0.000000

Table A68 Normality test for the regression in step 2 with dividend as the dependant variable, post-crisis.

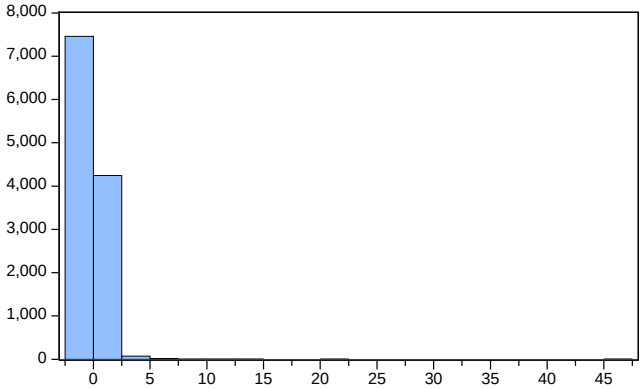


Series: Standardized Residuals
Sample 2010 2011 IF CAPEX_RATIO<6.5296116660 AND DIV_RATIO <181392 AND EBIT_RATIO>-1371 AND M_B_RATIO<7490488 AND R_D_RATIO<16.3752422200 AND SALES_GROWTH<44874 AND LIQUID_ASSET_HOLDINGS<5.1855611490 AND LIQUID_ASSET_HOLDINGS>-7.5834869810 AND EXCESS_CASH> -95807.4267944450
Observations 3343

Mean	-2.03e-19
Median	0.000000
Maximum	0.818095
Minimum	-0.818095
Std. Dev.	0.030461
Skewness	6.34e-16
Kurtosis	364.1866
Jarque-Bera	18171397
Probability	0.000000

8.6.3 Step 3 Normality test:

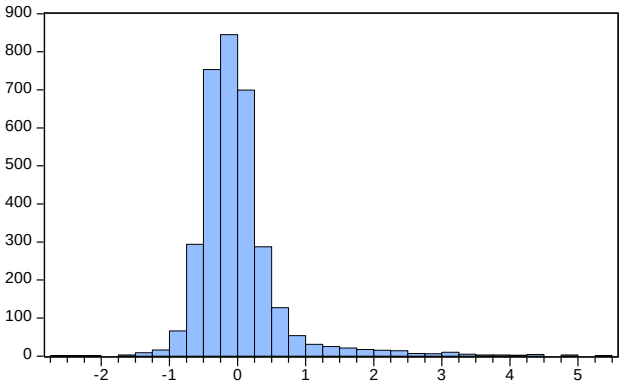
Table A69 Normality test for the regression in step 3, pre-crisis.



Series: Standardized Residuals
Sample 2001 2007 IF RD<57924.89855235463 AND CAPEX <47452.831778574044 AND DIV<139502.7542662116 AND BETA>-39.31220583679209 AND BETA <29.99673862223946 AND MB<1097974.279694854 AND SIZE<1427.6067708333333 AND MV<127.8918918918919
Observations 11799

Mean	-6.15e-17
Median	-0.004479
Maximum	45.88165
Minimum	-1.243499
Std. Dev.	0.758413
Skewness	24.64518
Kurtosis	1240.482
Jarque-Bera	7.54e+08
Probability	0.000000

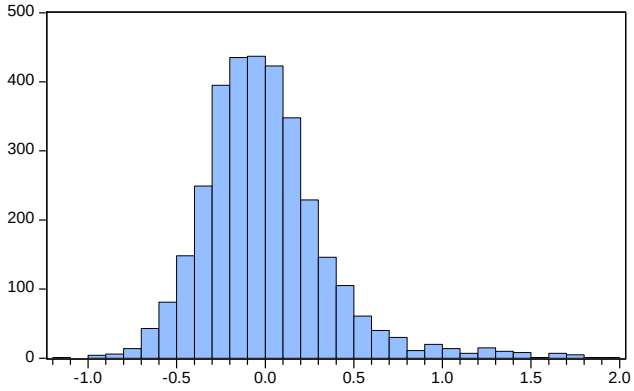
Table A70 Normality test for the regression in step 3, crisis.



Series: Standardized Residuals
Sample 2008 2009 IF RD<49458.3590929876 AND CAPEX <1453733.259693432 AND DIV<132890.2424198322 AND BETA>-39.3122058368 AND BETA<29.9967386222 AND MB> -27.0390033839 AND MB<29.2323844631 AND SIZE> -0.1254108823 AND SIZE<0.133850205 AND MV <5.9254327945
Observations 3323

Mean	8.79e-18
Median	-0.100759
Maximum	5.432548
Minimum	-2.660063
Std. Dev.	0.642731
Skewness	2.894120
Kurtosis	17.34043
Jarque-Bera	33112.55
Probability	0.000000

Table A71 Normality test for the regression in step 3, post-crisis.



Series: Standardized Residuals
Sample 2010 2011 IF RD<1040918.00067176 AND CAPEX <101735.9898464268 AND DIV<103453.8071165854 AND BETA>-39.3122058368 AND BETA<29.9967386222 AND MB >-2597.3601877753 AND SIZE>-0.0822651478 AND SIZE <0.0933064602 AND MV<2.1574329134
Observations 3295

Mean	8.93e-18
Median	-0.041035
Maximum	1.964402
Minimum	-1.137770
Std. Dev.	0.358059
Skewness	1.256685
Kurtosis	6.627223
Jarque-Bera	2673.587
Probability	0.000000

8.7 Tables

8.7.1 Step 1 Tables

Table A72 Descriptive statistics of the variables in the pre-crisis period.

	Pre-crisis									
	EXCESS_CASH	FIRM_SIZE	WC	MARKET_TO_BOOK	LEVERAGE	FINANCIAL_DISTRESS	DIVIDENDS	CASHFLOW_RISKINESS	CASH_FLOW	CAPEX
Mean	-2.534805	12.61921	-0.176818	11.82866	0.913149	1.497416	0.418425	0.45082	0.159311	0.370134
Median	-2.410998	12.67326	0.201437	3.51357	0.474531	4.46E-05	0	0.3737	0.170152	0.136523
Maximum	3.073199	18.83292	0.96668	2368.913	8.167928	2744	1	1.073726	8.409525	6.452399
Minimum	-18.66685	5.693732	-96.33333	-53.44501	1.42E-08	2.64E-09	0	0.054441	-20.44194	2.00E-07
Std, Dev,	1.560966	2.054172	1.992818	52.40143	1.271586	41.97045	0.493322	0.266024	0.695036	0.673854
Skewness	-0.531009	-0.077083	-17.1735	18.89857	2.50536	44.79267	0.330732	0.642526	-7.476456	4.129762
Kurtosis	4.844992	2.865378	578.0719	553.4847	10.16362	2348.383	1.109383	2.187166	159.4238	24.48305
Jarque-Bera	2174.734	20.10193	1.59E+08	1.46E+08	36674.31	2.64E+09	1925.242	1109.498	11849066	254209.6
Probability	0	0.000043	0	0	0	0	0	0	0	0
Sum	-29193.35	145335.5	-2036.415	136230.7	10516.74	17245.74	4819	5192.098	1834.79	4262.838
Sum Sq, Dev,	28060.04	48593.16	45733.76	31621894	18620.57	20285653	2802.61	814.9759	5563.085	5229.174
Observations	11517	11517	11517	11517	11517	11517	11517	11517	11517	11517

Table A73 Descriptive statistics of the variables in the crisis period.

	Crisis									
	EXCESS_CASH	FIRM_SIZE	WC	MARKET_TO_BOOK	LEVERAGE	FINANCIAL_DISTRESS	DIVIDENDS	CASHFLOW_RISKINESS	CASH_FLOW	CAPEX
Mean	-2.259277	12.92025	-0.137169	6.954343	0.920419	0.85304	0.711562	0.451535	0.078189	0.350526
Median	-2.136265	12.96466	0.207705	2.428491	0.475144	0.0000345	1	0.3737	0.143237	0.117722
Maximum	3.174419	18.61216	0.937733	825.9887	8.01399	1536.167	1	1.073726	3.997015	6.385214
Minimum	-8.011998	6.251904	-32.75767	-79.81185	2.31E-08	2.45E-09	0	0.054441	-17.22264	2.01E-07
Std. Dev.	1.425697	2.033497	1.670513	25.99336	1.303197	27.86747	0.453105	0.267231	0.732427	0.653183
Skewness	-0.508895	-0.035567	-9.414457	15.63794	2.532273	51.52727	-0.933973	0.645154	-8.511253	4.316537
Kurtosis	3.658007	2.779523	133.1072	371.8173	10.18659	2801.204	1.872306	2.191458	144.4047	26.90064
Jarque-Bera	202.2143	7.388563	2379210	18860938	10641.17	1080000000	655.4197	319.199	2792577	88901.05
Probability	0	0.024865	0	0	0	0	0	0	0	0
Sum	-7464.651	42688.49	-453.2074	22977.15	3041.065	2818.445	2351	1491.873	258.3358	1158.137
Sum Sq. Dev.	6713.713	13658.27	9217.4	2231688	5609.555	2565096	678.1183	235.8744	1771.893	1409.219
Observations	3304	3304	3304	3304	3304	3304	3304	3304	3304	3304

Table A74 Descriptive statistics of the variables in the post-crisis period.

	Post-crisis									
	EXCESS_CASH	FIRM_SIZE	WC	MARKET_TO_BOOK	LEVERAGE	FINANCIAL_DISTRESS	DIVIDENDS	CASHFLOW_RISKINESS	CASH_FLOW	CAPEX
Mean	-2.218522	13.02968	-0.128627	8.628751	0.890464	2.13792	0.512372	0.452364	0.184351	0.336878
Median	-2.097972	13.0736	0.220415	3.10648	0.417792	4.12E-05	1	0.3737	0.168662	0.112626
Maximum	1.487118	18.77353	0.969072	832.5288	8.163111	2904	1	1.073726	4.453739	6.394033
Minimum	-8.608355	6.507278	-40.92404	-19.22008	2.22E-08	2.24E-09	0	0.054441	-8.696742	6.46E-07
Std. Dev.	1.336091	2.062444	1.665739	32.81504	1.318229	62.74555	0.499922	0.267305	0.466893	0.65421
Skewness	-0.641125	-0.026256	-10.85766	13.76263	2.631865	38.40947	-0.049502	0.638389	-3.493166	4.554248
Kurtosis	4.042841	2.708264	188.077	252.1855	10.90536	1599.425	1.00245	2.179503	63.70816	28.96129
Jarque-Bera	377.1999	12.13298	4794952	8678680	12455.33	3.53E+08	552.3342	318.0583	515643.1	104522.6
Probability	0	0.002319	0	0	0	0	0	0	0	0
Sum	-7352.181	43180.36	-426.269	28595.68	2950.999	7085.068	1698	1499.134	610.9379	1116.413
Sum Sq. Dev.	5914.163	14092.43	9192.533	3567528	5757.096	13043296	827.9928	236.7204	722.1992	1417.934
Observations	3314	3314	3314	3314	3314	3314	3314	3314	3314	3314

8.8 Regressions (with OLS standard errors)

Table A75 Regression results for the homoscedastic sample in the step 3 regression, pre-crisis, with OLS standard errors.

Dependent Variable: MV
Method: Panel Least Squares
Periods included: 7
Cross-sections included: 1693
Total panel (unbalanced) observations: 11799

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.142971	0.008181	17.47603	0.0000
RD	1.68E-06	4.46E-06	0.377940	0.7055
CAPEX	-1.19E-06	1.68E-05	-0.070937	0.9434
DIV	-8.32E-07	1.45E-06	-0.573818	0.5661
MB	0.001096	0.000358	3.058773	0.0022
SIZE	1.005805	0.006922	145.3081	0.0000
BETA	-0.007943	0.003651	-2.175396	0.0296

Effects Specification

Period fixed (dummy variables)

R-squared	0.657581	Mean dependent var	0.330064
Adjusted R-squared	0.657232	S.D. dependent var	1.296064
S.E. of regression	0.758799	Akaike info criterion	2.286940
Sum squared resid	6786.088	Schwarz criterion	2.295067
Log likelihood	-13478.81	Hannan-Quinn criter.	2.289669
F-statistic	1886.151	Durbin-Watson stat	1.590696
Prob(F-statistic)	0.000000		

Table A76 Regression results for the homoscedastic sample in the step 3 regression, post-crisis, with OLS standard errors.

Dependent Variable: MV
Method: Panel Least Squares
Periods included: 2
Cross-sections included: 1689
Total panel (unbalanced) observations: 3295

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.063247	0.007297	8.667395	0.0000
RD	9.47E-07	1.50E-06	0.630748	0.5282
CAPEX	4.84E-06	3.53E-06	1.372807	0.1699
DIV	-1.57E-06	1.61E-06	-0.980631	0.3268
MB	0.000244	0.000138	1.765727	0.0775
SIZE	4.572419	0.324797	14.07776	0.0000
BETA	0.001011	0.003155	0.320534	0.7486

Effects Specification

Period fixed (dummy variables)

R-squared	0.208102	Mean dependent var	0.089982
Adjusted R-squared	0.206415	S.D. dependent var	0.402364
S.E. of regression	0.358440	Akaike info criterion	0.788312
Sum squared resid	422.3104	Schwarz criterion	0.803123
Log likelihood	-1290.744	Hannan-Quinn criter.	0.793614
F-statistic	123.3978	Durbin-Watson stat	2.069001
Prob(F-statistic)	0.000000		

8.9 Detailed regressions used for analysis

Table A77 Regression for step 1 with liquid asset holdings as the dependent variable, with periodical fixed effects and robust standard errors (white cross-section).

Dependent Variable: LIQUID_ASSET_HOLDINGS
Method: Panel Least Squares
Date: 04/24/13 Time: 15:26
Periods included: 11
Cross-sections included: 1696
Total panel (unbalanced) observations: 18136
White cross-section standard errors & covariance (d.f. corrected)
WARNING: estimated coefficient covariance matrix is of reduced rank

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.431763	0.086421	-28.13862	0.0000
CAPEX	0.381414	0.041788	9.127256	0.0000
CASH_FLOW	-0.231863	0.035438	-6.542800	0.0000
CASHFLOW_RISKINESS	1.431077	0.045449	31.48774	0.0000
DIVIDEND_DUMMY	-0.500813	0.039314	-12.73884	0.0000
FINANCIAL_DISTRESS	0.000622	0.000336	1.849780	0.0644
FIRM_SIZE	0.079215	0.006846	11.57141	0.0000
LEVERAGE	-0.368775	0.009211	-40.03524	0.0000
MARKET_TO_BOOK	0.005624	0.001168	4.816899	0.0000
WC	-0.190632	0.037276	-5.114119	0.0000

Effects Specification

Period fixed (dummy variables)

R-squared	0.291403	Mean dependent var	-1.158969
Adjusted R-squared	0.290660	S.D. dependent var	1.726241
S.E. of regression	1.453881	Akaike info criterion	3.587452
Sum squared resid	38293.04	Schwarz criterion	3.596060
Log likelihood	-32511.01	Hannan-Quinn criter.	3.590281
F-statistic	392.1054	Durbin-Watson stat	0.400189
Prob(F-statistic)	0.000000		

Table A78 Pre-crisis regression for step 2 with R&D-ratio as the dependent variable, with periodical and cross-sectional fixed effects and robust standard errors (white cross-section)

Dependent Variable: R_D_RATIO
Method: Panel Least Squares
Periods included: 7
Cross-sections included: 1698
Total panel (unbalanced) observations: 11641
White cross-section standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.342594	0.036103	9.489482	0.0000
EXCESS_CASH	0.038772	0.012855	3.016127	0.0026
EBIT_RATIO	-0.033830	0.006835	-4.949555	0.0000
M_B_RATIO	0.000705	0.000672	1.049492	0.2940
SALES_GROWTH	-0.000106	6.06E-05	-1.740513	0.0818

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.776666	Mean dependent var	0.259119
Adjusted R-squared	0.738285	S.D. dependent var	1.165895
S.E. of regression	0.596449	Akaike info criterion	1.939129
Sum squared resid	3533.680	Schwarz criterion	3.019345
Log likelihood	-9578.700	Hannan-Quinn criter.	2.302030
F-statistic	20.23605	Durbin-Watson stat	1.493114
Prob(F-statistic)	0.000000		

Table A79 Crisis Regression for step 2 with R&D-ratio as the dependent variable, with periodical and cross-sectional fixed effects and robust standard errors (white cross-section).

Method: Panel Least Squares
Periods included: 2
Cross-sections included: 1687
Total panel (unbalanced) observations: 3340
White cross-section standard errors & covariance (d.f. corrected)
WARNING: estimated coefficient covariance matrix is of reduced rank

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.152791	7.16E-14	2.13E+12	0.0000
EXCESS_CASH	0.001000	2.83E-14	3.53E+10	0.0000
EBIT_RATIO	-0.034811	1.09E-15	-3.19E+13	0.0000
M_B_RATIO	0.014703	8.71E-16	1.69E+13	0.0000
SALES_GROWTH	-0.000105	2.07E-17	-5.08E+12	0.0000

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.947204	Mean dependent var	0.243380
Adjusted R-squared	0.893030	S.D. dependent var	1.118203
S.E. of regression	0.365723	Akaike info criterion	1.132884
Sum squared resid	220.4255	Schwarz criterion	4.230018
Log likelihood	-199.9170	Hannan-Quinn criter.	2.240848
F-statistic	17.48447	Durbin-Watson stat	4.038694
Prob(F-statistic)	0.000000		

Table A80 Post-crisis regression for step 2 with R&D-ratio as the dependent variable, with periodical and cross-sectional fixed effects and robust standard errors (white cross-section).

Dependent Variable: R_D_RATIO
Method: Panel Least Squares
Periods included: 2
Cross-sections included: 1685
Total panel (unbalanced) observations: 3343
White cross-section standard errors & covariance (d.f. corrected)
WARNING: estimated coefficient covariance matrix is of reduced rank

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.221056	9.06E-14	2.44E+12	0.0000
EXCESS_CASH	-0.015834	4.41E-14	-3.59E+11	0.0000
EBIT_RATIO	-0.110121	3.35E-15	-3.29E+13	0.0000
M_B_RATIO	-0.000620	7.66E-16	-8.10E+11	0.0000
SALES_GROWTH	-0.036845	1.80E-15	-2.05E+13	0.0000

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.923790	Mean dependent var	0.223458
Adjusted R-squared	0.845921	S.D. dependent var	1.008903
S.E. of regression	0.396024	Akaike info criterion	1.292108
Sum squared resid	259.2484	Schwarz criterion	4.383258
Log likelihood	-469.7584	Hannan-Quinn criter.	2.397880
F-statistic	11.86329	Durbin-Watson stat	4.030139
Prob(F-statistic)	0.000000		

Table A81 Pre-crisis regression for step 2 with CAPEX -ratio as the dependent variable, with periodical and cross-sectional fixed effects and robust standard errors (White cross-section).

Dependent Variable: CAPEX_RATIO
Method: Panel Least Squares
Periods included: 7
Cross-sections included: 1698
Total panel (unbalanced) observations: 11641
White cross-section standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.347133	0.017797	19.50482	0.0000
EXCESS_CASH	-0.013472	0.007291	-1.847771	0.0647
EBIT_RATIO	-0.005067	0.001795	-2.822213	0.0048
M_B_RATIO	0.000336	0.000323	1.041998	0.2974
SALES_GROWTH	3.63E-05	2.94E-05	1.235525	0.2167

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.765269	Mean dependent var	0.385529
Adjusted R-squared	0.724930	S.D. dependent var	0.708409
S.E. of regression	0.371540	Akaike info criterion	0.992455
Sum squared resid	1371.171	Schwarz criterion	2.072670
Log likelihood	-4068.582	Hannan-Quinn criter.	1.355356
F-statistic	18.97099	Durbin-Watson stat	1.615356
Prob(F-statistic)	0.000000		

Table A82 Crisis regression for step 2 with CAPEX -ratio as the dependent variable, with periodical and cross-sectional fixed effects and robust standard errors (White cross-section).

Dependent Variable: CAPEX_RATIO
Method: Panel Least Squares
Periods included: 2
Cross-sections included: 1687
Total panel (unbalanced) observations: 3340
White cross-section standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.310382	4.26E-13	7.29E+11	0.0000
EXCESS_CASH	-0.032398	1.80E-13	-1.80E+11	0.0000
EBIT_RATIO	-0.000734	5.41E-15	-1.35E+11	0.0000
M_B_RATIO	-0.002384	7.23E-16	-3.30E+12	0.0000
SALES_GROWTH	1.90E-05	1.15E-16	1.65E+11	0.0000

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.884402	Mean dependent var	0.371824
Adjusted R-squared	0.765788	S.D. dependent var	0.696592
S.E. of regression	0.337119	Akaike info criterion	0.970003
Sum squared resid	187.2938	Schwarz criterion	4.067136
Log likelihood	72.09494	Hannan-Quinn criter.	2.077966
F-statistic	7.456118	Durbin-Watson stat	4.038694
Prob(F-statistic)	0.000000		

Table A83 Post-crisis regression for step 2 with CAPEX -ratio as the dependent variable, with periodical and cross-sectional fixed effects and robust standard errors (White cross-section).

Dependent Variable: CAPEX_RATIO
Method: Panel Least Squares
Periods included: 2
Cross-sections included: 1685
Total panel (unbalanced) observations: 3343
White cross-section standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.320385	2.78E-13	1.15E+12	0.0000
EXCESS_CASH	-0.010952	1.28E-13	-8.57E+10	0.0000
EBIT_RATIO	0.005829	2.41E-15	2.42E+12	0.0000
M_B_RATIO	-0.000577	5.95E-16	-9.70E+11	0.0000
SALES_GROWTH	0.028295	2.25E-16	1.26E+14	0.0000

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.933912	Mean dependent var	0.345916
Adjusted R-squared	0.866384	S.D. dependent var	0.668091
S.E. of regression	0.244210	Akaike info criterion	0.325218
Sum squared resid	98.58286	Schwarz criterion	3.416368
Log likelihood	1146.397	Hannan-Quinn criter.	1.430991
F-statistic	13.83011	Durbin-Watson stat	4.030139
Prob(F-statistic)	0.000000		

Table A84 Pre-crisis regression for step 2 with Dividend -ratio as the dependent variable, with periodical and cross-sectional fixed effects and robust standard errors (White cross-section).

Dependent Variable: DIV_RATIO
Method: Panel Least Squares
Periods included: 7
Cross-sections included: 1698
Total panel (unbalanced) observations: 11641
White cross-section standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-31.90684	27.74000	-1.150210	0.2501
EXCESS_CASH	-13.37807	11.39356	-1.174178	0.2404
EBIT_RATIO	0.989920	0.704115	1.405907	0.1598
M_B_RATIO	-0.055574	0.053312	-1.042443	0.2972
SALES_GROWTH	0.002070	0.003432	0.603059	0.5465

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.198759	Mean dependent var	0.683172
Adjusted R-squared	0.061064	S.D. dependent var	71.05303
S.E. of regression	68.84946	Akaike info criterion	11.43650
Sum squared resid	47084888	Schwarz criterion	12.51671
Log likelihood	-64858.13	Hannan-Quinn criter.	11.79940
F-statistic	1.443475	Durbin-Watson stat	1.418412
Prob(F-statistic)	0.000000		

Table A85 Crisis regression for step 2 with dividend -ratio as the dependent variable, with periodical and cross-sectional fixed effects and robust standard errors (White cross-section).

Dependent Variable: DIV_RATIO
Method: Panel Least Squares
Periods included: 2
Cross-sections included: 1687
Total panel (unbalanced) observations: 3340
White cross-section standard errors & covariance (d.f. corrected)
WARNING: estimated coefficient covariance matrix is of reduced rank

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.041379	6.83E-14	6.06E+11	0.0000
EXCESS_CASH	0.005563	2.89E-14	1.92E+11	0.0000
EBIT_RATIO	-0.001978	8.69E-16	-2.28E+12	0.0000
M_B_RATIO	-0.000607	1.20E-16	-5.06E+12	0.0000
SALES_GROWTH	-0.000132	1.85E-17	-7.15E+12	0.0000

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.841923	Mean dependent var	0.024167
Adjusted R-squared	0.679720	S.D. dependent var	0.110322
S.E. of regression	0.062435	Akaike info criterion	-2.402628
Sum squared resid	6.424043	Schwarz criterion	0.694505
Log likelihood	5704.388	Hannan-Quinn criter.	-1.294664
F-statistic	5.190578	Durbin-Watson stat	4.038694
Prob(F-statistic)	0.000000		

Table A86 Post-crisis regression for step 2 with dividend -ratio as the dependent variable, with periodical and cross-sectional fixed effects and robust standard errors (White cross-section).

Dependent Variable: DIV_RATIO
Periods included: 2
Cross-sections included: 1685
Total panel (unbalanced) observations: 3343
White cross-section standard errors & covariance (d.f. corrected)
WARNING: estimated coefficient covariance matrix is of reduced rank

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.013011	2.91E-14	-4.47E+11	0.0000
EXCESS_CASH	-0.015611	1.29E-14	-1.21E+12	0.0000
EBIT_RATIO	0.011340	1.03E-15	1.10E+13	0.0000
M_B_RATIO	0.000469	5.35E-17	8.77E+12	0.0000
SALES_GROWTH	-0.016349	3.37E-16	-4.85E+13	0.0000

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.899296	Mean dependent var	0.024677
Adjusted R-squared	0.796398	S.D. dependent var	0.095989
S.E. of regression	0.043312	Akaike info criterion	-3.133971
Sum squared resid	3.100949	Schwarz criterion	-0.042821
Log likelihood	6928.432	Hannan-Quinn criter.	-2.028198
F-statistic	8.739737	Durbin-Watson stat	4.030139
Prob(F-statistic)	0.000000		

Table A87 Pre-crisis regression for step 3 with market values as the dependant variable, with periodic fixed effects and robuststandard errors (White cross-section).

Dependent Variable: MV
Method: Panel Least Squares
Periods included: 7
Cross-sections included: 1693
Total panel (unbalanced) observations: 11799
White cross-section standard errors & covariance (d.f. corrected)
WARNING: estimated coefficient covariance matrix is of reduced rank

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.142971	0.019512	7.327203	0.0000
RD	1.68E-06	4.58E-06	0.367853	0.7130
CAPEX	-1.19E-06	1.74E-06	-0.686899	0.4922
DIV	-8.32E-07	4.08E-07	-2.038803	0.0415
MB	0.001096	0.000555	1.976247	0.0482
SIZE	1.005805	0.004717	213.2510	0.0000
BETA	-0.007943	0.017726	-0.448102	0.6541

Effects Specification

Period fixed (dummy variables)

R-squared	0.657581	Mean dependent var	0.330064
Adjusted R-squared	0.657232	S.D. dependent var	1.296064
S.E. of regression	0.758799	Akaike info criterion	2.286940
Sum squared resid	6786.088	Schwarz criterion	2.295067
Log likelihood	-13478.81	Hannan-Quinn criter.	2.289669
F-statistic	1886.151	Durbin-Watson stat	1.590696
Prob(F-statistic)	0.000000		

Table A88 Crisis regression for step 3 with change in market value as the dependent variable, with periodical fixed effects and robust standard errors (White cross-section).

Dependent Variable: MV
Method: Panel Least Squares
Periods included: 2
Cross-sections included: 1690
Total panel (unbalanced) observations: 3323
White cross-section standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.030954	0.070572	0.438609	0.6610
RD	-1.04E-06	4.50E-07	-2.320275	0.0204
CAPEX	-9.59E-05	5.99E-05	-1.601196	0.1094
DIV	-1.54E-06	6.36E-07	-2.412479	0.0159
MB	0.125327	0.015792	7.936261	0.0000
SIZE	3.439391	0.563885	6.099452	0.0000
BETA	0.050674	0.070674	0.717013	0.4734

Effects Specification			
Period fixed (dummy variables)			
R-squared	0.434141	Mean dependent var	0.097988
Adjusted R-squared	0.432946	S.D. dependent var	0.854427
S.E. of regression	0.643409	Akaike info criterion	1.958332
Sum squared resid	1372.327	Schwarz criterion	1.973038
Log likelihood	-3245.768	Hannan-Quinn criter.	1.963594
F-statistic	363.3356	Durbin-Watson stat	2.478507
Prob(F-statistic)	0.000000		

Table A89 Post-crisis regression for step 3 with change in market value as the dependent variable, with periodical fixed effects and robust standard errors (White cross-section).

Dependent Variable: MV
Method: Panel Least Squares
Periods included: 2
Cross-sections included: 1689
Total panel (unbalanced) observations: 3295
White cross-section standard errors & covariance (d.f. corrected)

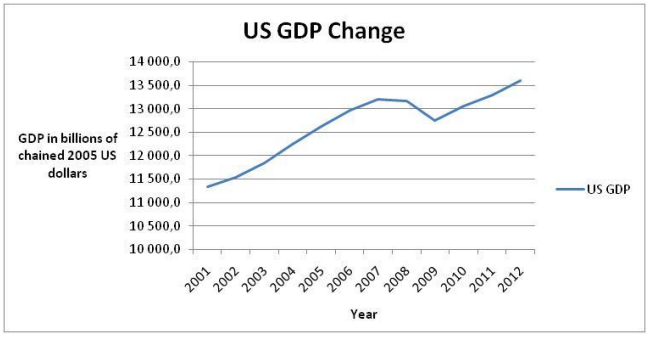
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.063247	0.010210	6.194716	0.0000
RD	9.47E-07	3.56E-07	2.662761	0.0078
CAPEX	4.84E-06	1.28E-07	37.79535	0.0000
DIV	-1.57E-06	3.81E-07	-4.133700	0.0000
MB	0.000244	5.44E-05	4.477129	0.0000
SIZE	4.572419	0.281383	16.24980	0.0000
BETA	0.001011	0.008090	0.124988	0.9005

Effects Specification			
Period fixed (dummy variables)			
R-squared	0.208102	Mean dependent var	0.089982
Adjusted R-squared	0.206415	S.D. dependent var	0.402364
S.E. of regression	0.358440	Akaike info criterion	0.788312
Sum squared resid	422.3104	Schwarz criterion	0.803123
Log likelihood	-1290.744	Hannan-Quinn criter.	0.793614
F-statistic	123.3978	Durbin-Watson stat	2.069001
Prob(F-statistic)	0.000000		

The optimal way to increase cash holdings

Now that the dust has finally begun to settle after the 2007 financial crisis it is, for many corporate managers, time to analyze the results. "What went so horribly wrong?", "Could we have done anything differently?", "Would it have changed the end-result?". These are only a few, among many, of the questions that will surely occupy many minds in the fields of financial management and research for years to come. However, two students have begun this analysis by looking into corporate cash holding decisions before, during and after the 2007 financial crisis, and more importantly, how these were perceived by the investors. More precisely; What is the optimal way to increase cash holdings, from a market perspective?

At the end of 2007 the world's financial markets were hit by the worst crisis since the great depression. When the US housing bubble eventually burst in 2007 it created an uncertainty on the global markets that limited borrowing and made the capital markets inaccessible. The mistrust between banks created a credit crunch that would limit the ability for firms to finance their operations, as well as limit consumers' ability to purchase products on credit. Suddenly no one had any money to spend.



Time of crisis; Dec 2007 - Jun 2009

To understand why Ramin Khadem and Patrik Petterssons thesis; *The optimal way to increase cash holdings: From a market perspective,* is so important, we first need to understand the importance of corporate cash holdings in different economic conditions. There are several reasons for a firm to hold cash and other liquid assets, among others there are transaction-, precautionary- and agency cost motives. Cash can also work as a powerful signaling tool to potential investors or creditors. The optimal level of cash holdings is a hard one to define. Too much and the firm will be punished by the opportunity cost of holding cash, too little and they will surely be punished by various costs, so called "Financial distress costs", that occur when the market believes the firm will have trouble financing their operations and obligations. Throw in the impact from different economic conditions (so called booms and busts) and you quickly realize that the corporate cash holding decision is a tough one.

Did firms increase cash?

In economic boom times the opportunity cost of holding cash is quite high, there will probably be plenty more profitable investments to use the cash for than keeping it safe "under the mattress". However in busts, or times of financial crisis, the potential for financial distress costs rise due to higher market volatility and difficulties for firms to reach external financing. Even though Mikhail Simutin concludes in his 2010 research that the stocks of cash rich firms actually underperform compared to stocks of cash poor firms, there seems to be a notion among corporate managers that "cash is good" in times of financial difficulties. "Like many before us we can see strong

signs among the 1701 US firms in our sample that they indeed increased their cash holdings during and after the 2007 financial crisis", says Patrik Pettersson.

However the main objective of their thesis is not to examine whether cash holdings are value creating or not. With the proof that the firms indeed increase their cash holdings during and after a financial crisis, they were able to move on to the next question; where does the money come from? "Researchers like Kyojik Song and Youngjoo Lee had already concluded that East-Asian firms increased their cash-holdings on behalf of investments in capital expenditures (CAPEX). We wanted to broaden this analysis by including research and development (R&D) investments as well as dividend payments in our research. As a last step we also wanted to find out how the investors reacted to reductions in these expenses. Basically, we asked ourselves; Can we find the, from the investors point of view, optimal way to increase cash holdings during different economic conditions?", says Ramin Khadem.

Their thesis consists of three steps. In the first step they come to the above mentioned results, that the sample firms increased their excess cash holdings during and after the crisis, while at the same time decreasing their R&D, CAPEX and dividend payouts. They also found out that the financial leverage was kept at a stable level throughout all periods, meaning that the increase in cash holdings was not a result of a sudden influx of external capital from creditors. In the second step they go on to find out the connection between excess cash holdings and the three analyzed items; R&D-ratio, CAPEX-ratio and Dividend-ratio in the three specified periods. “We made a total of nine panel regressions in step two that showed some interesting results. The impact on the R&D expenses went from positive in the pre-crisis period (meaning that the more excess cash the firm has the more they spend in research and development), to negative post-crisis (meaning the opposite, that the firm instead decrease their R&D expenses the more excess cash they hold). While the findings for the Dividend-ratio were not significant enough in the pre-crisis for us to draw any conclusions, comparing the variables in the crisis period to the post-crisis period showed the same results as in the R&D-regression; that the impact from excess cash became negative after the crisis. The excess cash had a negative impact on CAPEX-ratio in all three measured periods.” says Patrik.

Which expenses to cut?

These findings strengthened their initial believes; that the increased excess cash holdings found in step one were accomplished by reductions in CAPEX, R&D and dividends. Now they could turn to the final and most important question; what is the, from the markets perspective, optimal way to increase cash holdings during and after the crisis. “First we had to perform three panel regressions, one for each period, to find the impact from the three main variables (changes in R&D, CAPEX and Dividends) on the firms’ market values. The market value tells us what the investors think of the company's performance and so for example a positive correlation between R&D and market value would mean that the investors don't like to see a reduction in this variable in this specific period. The more negative the correlation is, the more positive the

investors are to a reduction in the item." says Ramin.

After performing the regressions it became clear that the dividend ratio had a negative impact on the firms' market values throughout all periods, meaning that the market always prefers a reduction in this variable. During the crisis all variables had a negative impact on the market value, telling us that the market prefers a conservative expenditure policy during times of high volatility, and that the positive implications of holding cash, far outweighs the negative ones for investing less. After the crisis the CAPEX-ratio changes from having the most negative impact on market value during the crisis, to having the most positive impact after the crisis. R&D also becomes positive in the post-crisis period. "If a non dividend paying firm, for some reason, needed to increase cash in the post-crisis period they would be better off reducing R&D before CAPEX", says Patrik.

Finally they also divided the companies into eight different clusters depending on their reductions/increases in expenses during the period. The clusters performance were then measured as changes in market value during the period to see which one was the best performing clusters during the three specified periods. "We came to rather similar conclusions as we did in the regressions for step three. For example, we were able to see that during the crisis the best performing clusters of firms were those that reduced either two or three categories of expenses. We also found out that large, mature firms were possibly more reluctant to reduce dividend payouts.", says Patrik.

The cash holding decision is an important but difficult one. Most firms are sometimes forced to increase their cash holdings during times of severe financial crisis. Thanks to Ramin Khadem and Patrik Pettersson, the managers of those firms now have some new studies to rely on when making those decisions.

Authors: Ramin Khadem and Patrik Pettersson

It is not always an easy task to decide what the "non-essentials" *really* are