CASH HOLDINGS AND THE CRISIS

A study of U.S. corporate cash holdings during and after
the financial crisis of 2008

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Abstract

This thesis investigates U.S. corporate cash holdings in the light of the financial crisis of 2008. Towards this end, we research the determinants of corporate cash holdings and then study their development before, during, and after the financial crisis. Our initial research encompasses a comprehensive literature review and a systematic content analysis of media publications such as The Economist, The Wall Street Journal, and CFO Magazine. In total, we analyze 113 media articles published between 2004 and 2013. The results of our initial research are then synthesized into a set of distinct hypotheses. We test these empirically, mainly with regression analysis, using a Compustat sample of 44,275 firm-year observations of U.S.-based public companies between 1998 and 2012. Overall, we conclude that the financial crisis has had a profound impact on corporate cash holdings. Regarding the determinants of cash holdings, we find that observed cash holdings must be understood as a combination of targeted cash holdings and shocks to these, and that targeted cash holdings are primarily determined by precautionary motives. Regarding the development of the determinants of cash holdings, we conclude that three major effects influenced cash holdings over the course of the financial crisis. Our results show that the immediate effect of the crisis was a negative shock to cash holdings caused by the recession and credit crunch. Thus, actual cash holdings fell below targeted cash holdings in 2008. At the same time, however, firms were actually increasing their targeted cash holdings due to elevated risk and risk aversion also caused by the crisis. In the aftermath of the crisis, the situation changed and firms' actual cash holdings surpassed their targets. This was due to recovered operating cash flows, a lack of investment opportunities, and, for firms with an investment grade debt rating, cheap and easy access to external finance. Hence, we show that the development of corporate cash holdings observed between 2008 and 2012 is caused by the interplay of different, and at times opposing, mechanisms.

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1. Introduction

Since the outset of the financial crisis of 2008, the topic of corporate cash holdings[1] has received considerable attention from many different interest groups, including economists, politicians, investors, banks, journalists, and CFOs themselves. This interest has been sparked by the extremes that corporate cash holdings have traversed over the course of the financial crisis. For instance in 2008, The Wall Street Journal reported that:

> "*The 2008 financial crisis wiped out the cash reserves even of seemingly healthy companies*" (The Wall Street Journal, 2012a, p. 1)

Just a few years later, however, the focus had shifted towards claims that corporate cash holdings were at an all-time high. Consider the following quote from CFO Magazine in 2013:

> "*Corporate America has a superabundance of liquidity and non-financial companies held a record $1.8 trillion in cash and liquid assets at the end of 2012, according to the Fed*" (CFO Magazine, 2013, p. 2)

Interestingly, the arguments put forward to explain these fluctuations have varied almost as much as cash holdings themselves. They have ranged from a recession and dearth of external finance to a lack of growth opportunities and historically low interest rates (e.g. Financial Times, 2010; Campello, et al., 2010; Kahle & Stulz, 2013). Moreover, it appears that corporations' very attitude to cash had been changing:

> "*The shocks of the last five years may now have scarred, and scared, company executives such that they have become addicted to their cash security blankets*" (Financial Times, 2012, p. 2)

> "'*I am not sure if the last ten years of leverage is a benchmark for the future, so that's why I would tend to hold more cash to keep my flexibility in my own hands rather than be dependent on banks, who might not be around next time*'" (The Wall Street Journal, 2012b, p. 1)[2]

Corporate motives for holding cash are, however, not a new concern. They have been studied since Keynes (1936), who presented the prominent precautionary motive for cash holdings, which describes them as an all-purpose insurance against adverse shocks. Since then, numerous different theories and motives have been advanced in order to identify the determinants of corporate cash holdings.

Not until more recently, though, have some of the most influential studies on the topic been conducted. Two papers in particular have spearheaded this research. The first was published by Opler, Pinkowitz, Stulz, and Williamson (henceforth OPWS) in 1999 and studied a sample of U.S. firms during the period 1971-1994 (Opler, et al., 1999). By developing an empirical model of cash holdings, the authors found evidence in support of a static trade-off theory, implying that firms actively set a cash holdings target by balancing the

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[1] The terms 'cash' and 'cash and cash equivalents' will be treated synonymously throughout this thesis and refer to cash and short term investments, unless otherwise indicated.

[2] The Wall Street Journal was quoting Joe Kaeser, then-CFO of Siemens AG.

costs and benefits of cash holdings. The second paper was published by Bates, Kahle, and Stulz (henceforth BKS) in 2009 and focused on the years 1980-2006 (Bates, et al., 2009). The paper set out to explain the surge in cash holdings during the period. The authors found that the phenomenon could be attributed to changing firm characteristics, such as increased risk and growth opportunities, that led to higher precautionary cash holdings. BKS furthermore updated OPSW's empirical model. Consequently, their empirical model has afterwards been used as a base model by the majority of papers that investigate isolated aspects of corporate cash holdings.

A working paper by Pinkowitz, Stulz, and Williamson (henceforth PSW) furthermore deserves mentioning in relation to our research because, next to ours, it investigates cash holdings based on the most recent data (Pinkowitz, et al., 2013). Hence, by using data until 2010, the authors contribute in two ways. First, they find that cash holdings follow a u-shaped pattern over the course of the financial crisis, confirming the fluctuations reported in the media. Second, they investigate abnormal cash holdings, which they define as cash holdings that cannot be explained by BKS' empirical model. They find that not only is there an 87% increase in abnormal cash holdings after 2008, but that systematic patterns can be identified in these by using simple difference-in-differences analyses.

Based on the above, we are therefore convinced that new research into corporate cash holdings is needed for at least two reasons. First, it appears likely that there have been systematic changes in the determinants of cash holdings due to the financial crisis, just like BKS have previously documented a shift in cash holdings following the IT-boom. Second, this void has yet to be filled, since the amount of research on cash holdings during and especially after the recent financial crisis is very limited.

1.1 Research question

The purpose of this thesis, then, is to answer the following research questions:

> Main question: *How have effects related to the financial crisis of 2008 influenced the holdings of cash and cash equivalents of U.S. non-financial, non-utility corporations?*

>> Sub-question 1: *What are the determinants of corporate cash holdings?*

>> Sub-question 2: *How have the determinants of corporate cash holdings been affected by the financial crisis?*

While they may appear unassuming, our research questions encompass an ambitious research agenda. In answering the first sub-question, we set out to conduct a complete review of the determinants of cash holdings. Specifically, we will not be satisfied with a standard application of BKS' model, but want to investigate the emergence of new determinants of cash holdings that have become relevant due to the financial crisis. In order to answer the second sub-question, we will then investigate changes to old and new determinants of cash holdings caused by the crisis. This may include both changes in variables themselves as well as changes in their importance over the course of the crisis. In practice, we thus seek to contribute with an improved empirical model that enables us to find the real reasons for the recent fluctuations in

corporate cash holdings. This, we hope, will yield a better understanding of cash holdings and of how and why firms acted as they did during and after the crisis.

An improved understanding of corporate cash holdings is relevant for several audiences. First, our research progresses the academic inquiry into corporate financial policies. Second, CFOs and bankers may benefit from our research, since professionals in the business of managing or providing liquidity benefit from a refined understanding of corporate cash holdings. This may be especially so during times when liquidity is constrained and thus all the more valuable. Third, a better understanding of the extremes of cash holdings may benefit society at large. This is because extreme levels of cash holdings affect corporate investment. Naturally, firms are less likely to invest if their cash holdings are depleted. Likewise, very high levels of cash holdings indicate that firms are holding back on investments. This creates a strong link between cash holdings and the paradox of thrift popularized by Keynes (1936). The paradox emphasizes that collective saving, although seemingly rational for the individual corporation, is bad for the economy at large, and eventually the corporation itself, because it creates a downward spiral of demand. Seen in the light of the recession that followed the financial crisis, it is therefore unsurprising that corporate cash hoarding became a scapegoat:

> "*Anyone wondering where all the economy's jobs are might want to look into firms' piggy banks*" (USA Today, 2010, p. 1).

Last, investors may be interested in a better understanding of the determinants of cash holdings, since this is a first step towards assessing whether they are excessive or in fact valuable. The relevance of this has been exemplified by hedge fund manager David Einhorn's highly publicised lawsuit against Apple's considerable cash holdings (Forbes, 2013a).

1.2 Research approach

Our approach to answering our research questions rests on four main steps. Thus, we conduct both a literature review and a media analysis to collect existing insights on cash holdings. These are then used to develop a set of hypotheses that are tested with quantitative methods. Below, we will briefly introduce the purpose and methodology of each step.

We begin our thesis with a literature review in order to investigate how earlier studies can help answer our research questions. The chapter also serves as the theoretical foundation of this thesis. We will mainly review academic journals on the topics of cash holdings, the financial crisis of 2008, and the scarce amount of papers combining the two. The review of contemporaneous papers on cash holdings will allow us to collect the most recent advances in the literature on the determinants of corporate cash holdings. The literature on the financial crisis should furthermore provide evidence on the development of the determinants of cash holdings.

In order to enhance our search for the determinants and developments of cash holdings, we complement our literature review with a media analysis. Although many academic papers cite isolated media articles in their

introductions, the opinions and insights reported in the media have yet to be investigated systematically. We therefore conduct a media analysis of publications such as The Economist, The Wall Street Journal, and CFO Magazine because this may contribute to our study both theoretically and empirically. The possible theoretical contributions are at least twofold. First, the media can respond to new developments much faster than academic papers, which have to pass time-consuming peer reviews before being published. As the crisis and its aftermath are a relatively recent phenomenon, this speediness may add perspectives that have yet to be published in academic journals. Second, journalists' research methods, as opposed to those in financial journals, tend to be more qualitative in nature. This may enable journalists to arrive at conclusions different from those of traditional quantitative research. Specifically, we expect that interviews, which are the workhorse of journalism, are well suited for uncovering the sense-making, attitudes, and rationales that managers employ to decide on cash holdings more directly. This qualitative emphasis is also the source of the empirical contributions of our media analysis. Naturally, the conclusions of journalists have to be treated with considerably more caution than those of peer-reviewed journals. Still, they may provide valid inferences about cash holdings that are derived from qualified expert opinions. Methodologically, we will therefore rely on a qualitative content analysis to capture the full extent of arguments put forth in the media. This is opposed to approaches that, say, use analytical software to count how many times 'cash holdings' have been mentioned in the popular press.

We expect that the literature review and media analysis will provide ample input for our research question, which we therefore synthesize in a separate hypothesis section. The section will relate directly to our sub-questions and address both the determinants of cash holdings as well as their development over the course of the crisis.

As a last step, we will then test our hypotheses quantitatively, mainly by the use of panel data regressions. Additionally, we will trace the development of the determinants of cash holdings during, under and after the crisis. Our quantitative analysis is based on accounting data of U.S.-based public companies between 1998 and 2012. Hence, we include two more years of data than PSW and, importantly, employ a different statistical method. Emphasis will furthermore be put on securing the validity of our statistical analysis, particularly with respect to the peculiarities of panel data regression.

1.3 Delimitations

In order to keep our research focused, we apply several limitations to our study. First, as our research question indicates, we only investigate the cash holdings of publicly traded corporations incorporated in the U.S. We also confine ourselves to the 2008 financial crisis and do not investigate other crises, for instance the dot-com crisis in the early 2000s. Second, we study corporate cash holdings mainly from a descriptive rather than normative angle. This means that we will not investigate a hypothetical optimal level of cash holdings by, for instance, launching a statistical analysis of the relation between cash holdings and firm value (see Martnez-Sola et al. (2013) for such a study). Third, while the adjustment dynamics of cash holdings are central to our theoretical framework, we do not develop our own partial-adjustment model to estimate adjustment speeds. This has already been done by Dittmar & Duchin (2010) and Venkiteshwaran

(2011), and is an area fraught with statistical problems. Further, more specific limitations will be discussed where appropriate.

1.4 Structure

The remainder of this paper follows the structure laid out in section 1.2. The next chapter presents the literature review, which is then complemented by our media analysis in Chapter 3. In Chapter 4, we synthesize the main findings of the preceding two chapters into a set of hypotheses. These serve as the foundation of our empirical analysis in Chapter 5. We discuss the implications of our conclusions for different audiences, some apparent limitations of our study, and suggestions for future research in Chapter 6. Chapter 7 summarizes our findings and concludes the paper.

2. Literature Review

In the following, we will review the corporate finance literature for existing research that is relevant to our investigation of corporate cash holdings in relation to the financial crisis. To do so, we will proceed in three steps. Section 2.1 reviews the relatively extensive literature on the determinants of corporate cash holdings. Section 2.2 will look into the impact the financial crisis has had on U.S. non-financial corporations in general. Finally, Section 2.3 will review the small amount of research that has already investigated cash holdings during and immediately after the financial crisis.

2.1 Cash holdings

The corporate finance literature provides a multitude of reasons for why firms may choose to hold a certain amount of cash. However, before diving into these, we will briefly review the theoretical underpinnings of cash holdings, and discuss why cash holdings are an important element of corporate financial policy.

2.1.1 The relevance of cash holdings

Theories on corporate cash holdings are a sub-section of the vast literature on corporate finance and thus related to several of this field's other topics. In particular, corporate cash holdings are closely related to well-known discussions on capital structure. Similar to capital structure, the relevance of corporate cash holdings hinges on various capital market imperfections. This follows from Modigliani and Miller's famous Proposition I, which states that any capital structure decisions are irrelevant in perfect capital markets (Brealey, et al., 2013). Hence, it is in relaxing the strict assumptions of perfect capital markets that different theories have attributed varying degrees of relevance to corporate cash holdings. At the one end of the spectrum, financial frictions exist but cash holdings are seen as an irrelevant sideshow to capital structure. At the other, cash holdings are an important financial policy decision in their own right (e.g. OPSW; BKS).

The supposed irrelevance of cash holdings is displayed in traditional trade-off theories of capital structure and corporate valuation. According to these perspectives, companies optimize their capital structure by balancing the present value of an interest tax shield with the present value of the cost of financial distress. However, it is assumed that companies can easily interchange debt and cash, and that cash holdings are irrelevant because they are simply negative debt (OPSW; Acharya, et al., 2007).

The classic pecking order theory of capital structure has also been applied to cash holdings. When taking a narrow interpretation of it, cash holdings targets are irrelevant to financial policy as well, although in a way almost contrary to that of the debt-equity trade-off (OPSW). According to the pecking order theory of cash, firms actually have a preference for cash holdings because information asymmetries make external finance costly. Thus, if internally generated cash flows exceed the need for funds, firms will accumulate cash. These cash holdings will then be drawn upon when the need for funds exceeds internally generated cash flows. Only if no more cash is available will firms start issuing securities. As information asymmetries increase with the riskiness of securities, companies prefer to issue the safest security first, which is debt (Myers & Majluf, 1984). The benefit of this theory is that it explains and emphasizes the value of cash

holdings and idle debt capacity, since they may prevent situations where companies pass up positive NPV projects due to excessively costly external finance (Myers & Majluf, 1984). The problem is that there are no costs to holding cash in this model, so that firms would passively let cash accumulate without bounds. Hence, there is no optimal cash ratio, and cash holdings are presumed to fluctuate with the surplus or deficit of internally generated cash flows (Myers, 1984; OPSW).

Most modern theories of corporate cash holdings apply a static trade-off perspective to cash holdings and reach a very different conclusion from the above. They emphasize that cash is different from negative debt due to financial frictions (e.g. Acharya, et al., 2007) and that there are both costs and benefits to liquidity (see Denis (2011) for a review). The latter implies that financial managers should seek to equalize the marginal costs and benefits of cash holdings. In other words, companies must actively manage their cash holdings and have a cash holdings target (OPSW). A range of determinants of such cash holding targets have been identified in the literature and will be discussed in detail later.

A problem with the static trade-off theory is that it implicitly assumes that companies adjust to deviations from their cash target instantaneously. More realistically, it has been emphasized that companies actively manage cash holdings, but may deviate from their cash target due to financial frictions that make adjustments costly (Myers, 1984; OPSW). Recent papers have therefore used partial adjustment models, which explicitly investigate said delays, to measure the speed with which companies revert to cash targets (Ozkan & Ozkan, 2004; Dittmar & Duchin, 2010; Venkiteshwaran, 2011). The dynamics of cash holdings may be particularly relevant to our research because economic shocks may cause systematic deviations from cash holdings targets.

In the following sub-sections we will turn to a more detailed review of the determinants of cash holdings. We will start by discussing optimal cash holdings from a trade-off perspective, assuming that managers maximize shareholder value. That is, they seek to balance the opportunity cost of cash holdings with the transaction cost motive, the precautionary motive, and repatriation tax motive. Next, we discuss agency problems, which may lead managers to set a suboptimal cash target from a shareholder perspective. Following this, we discuss the implications of a dynamic perspective where actual cash holdings may differ from target cash holdings due to delays in adjustments.

2.1.2 The opportunity cost of cash

Beginning with the downside of large cash holdings, it is evident that these are not free because firms incur a lower rate of return compared to other safe investments. Simply speaking, this means that we should observe a negative relation between cash holdings and the T-Bill rate (OPSW; BKS).

Strictly speaking, however, the issue is a bit more complicated. This is because there are differences in the cost of cash, meaning only cash, and the cost of cash equivalents. While we generally do not distinguish between cash and cash equivalents in this thesis, we must briefly do so in order to clarify their cost. The opportunity cost of holding cash, meaning only cash, is derived from the forgone interest that could be earned by investing at the nominal risk free rate (OPSW). Cash equivalents, on the other hand, do earn the nominal risk free rate, but are subject to a liquidity premium. The liquidity premium reflects the benefit of

holding a security that can be readily converted to cash with virtually no expected loss of value. Note that this liquidity premium is different from a risk premium, which is important since it would otherwise compensate for different risk characteristics of the underlying assets and therefore not constitute an opportunity cost (OPSW). The corollary is that only the opportunity costs of cash, meaning only cash, rise with the nominal risk-free rate. The opportunity costs of cash equivalents, on the other hand, rise with their respective liquidity premium but not with the nominal risk-free rate.

The empirical implication of these differences is that the aggregate opportunity costs of liquidity a firm faces are hard to asses. One reason is that a change in the nominal risk-free rate or the liquidity premium may induce a switch between different types of liquid assets rather than a decline in the overall holdings of liquid assets. It is furthermore problematic that different cash equivalents are usually not reported separately. Last, there are no easily observable measures of the liquidity premium. Accordingly, BKS find that the T-Bill rate is mostly insignificant in their empirical models.

2.1.3 The transaction cost motive
Some of the earliest papers modeling an optimal level of cash holdings build on insights from operations theory and conceptualize cash holdings as inventory. Baumol (1952) uses said approach by applying the intuition of the economic order quantity (EOQ) formula to show that there is an optimal level of average cash holdings if firms incur fixed transaction costs when converting assets or securities to cash. The EOQ formula minimizes total inventory costs and yields the optimal order quantity of inventory (cash holdings) given a fixed cost to reordering (transaction cost), variable cost to holding inventory (opportunity cost of cash), and constant demand (negative net-cash flow). Based on the EOQ and demand for cash an average level of cash holdings can then be derived (Baumol, 1952). Note that this transaction cost intuition also holds for the inverse case, where companies have excess cash flows. An important property of the EOQ method is that the interval of replenishment is decreasing with the overall demand for cash, which in turn decreases the average inventory level relative to demand. This means that large companies should have lower cash holdings relative to assets (Baumol, 1952). Furthermore, average transaction costs may be lower for larger firms due to economies of scale in managing cash, which would also reduce their average cash holdings (Brealey, et al., 2013). Several studies find evidence that large companies hold relatively less cash than smaller companies (e.g. Mulligan, 1997; OPSW; BKS). Cash holdings should also fall when the opportunity costs of holding liquidity rise (Baumol, 1952). Last, Miller & Orr (1966) extend the application of inventory theory by allowing for non-constant net cash flows. The result is that optimal cash holdings should also be increasing with cash flow volatility.

2.1.4 The precautionary motive
According to the precautionary motive, cash holdings can be used to fund activities and investments when internal cash flows are insufficient and other sources of funding are unavailable or excessively costly. That is, cash can protect against adverse shocks (OPSW; BKS). While specific mechanisms may differ, this is valuable due to the general insight that a firm may forgo positive NPV projects if in some states of the world it cannot access funds at fair cost (Myers & Majluf, 1984; Froot et al., 1993). Furthermore, cash holdings may reduce various expected cost related to financial distress (OPSW).

Basic economic intuition suggests that the value of precautionary cash holdings to a given company should directly influence the target cash holdings of that company. Therefore, the demand for precautionary cash holdings can be understood as a function of four factors. First, cash holdings should decrease with the company's ability to raise external finance without incurring excess costs. Second, cash holdings should decrease with the company's ability to easily raise additional funds internally, for instance through asset sales. Third, cash holdings should increase with the risk that the company may actually be short of funds. And fourth, cash holdings should increase with the potential cost of actually being short of funds. Below, we will review the precautionary motive through the lens each of these four factors.

2.1.4.1 Ability to access external finance

The ability to access external finance without incurring excess cost is essentially a measure of how constrained a company is in its financing. These constraints have received considerable attention in the literature because the precautionary motive would not matter for a firm that is completely unconstrained and can therefore borrow freely in all states of the world (Almeida, et al., 2004; Han & Qiu, 2007). In theoretical models of cash holdings, financial constraints are typically modeled as binding in the sense that access to external capital is strictly limited to some level. In reality, less extreme capital market imperfections are sufficient to warrant precautionary cash holdings. That is, there are different magnitudes of excess costs in raising capital to fund all the firm's investments and activities, where the inability to raise any external capital is the far end of the scale (Froot, et al., 1993). In gauging the extent of financial constraints, we can therefore estimate the value of precautionary cash holdings to a firm.

Credit lines may reduce financial constraints because, in theory, they provide cheap and fast access to external liquidity, thereby constituting a substitute for cash holdings (Sufi, 2009). In accordance with this, companies with access to credit lines are found to have lower cash holdings (BKS). Furthermore, the use of credit lines is widespread (Sufi, 2009). In practice, however, credit lines may be imperfect substitutes for cash holdings because their availability is contingent on a variety of covenants, such as minimum levels of OCF and OCF-to-debt (Demiroglu & James, 2011). Credit lines may therefore cease to be available exactly when a firm needs them the most (Sufi, 2009; Demiroglu & James, 2011). Accordingly, both the access to credit lines and credit lines' share of a given firm's total liquidity[3] are positively related to operating cash flow[4] (OCF) and negatively related to OCF volatility and industry sales volatility (Sufi, 2009). Hence,

> "*The contingent lines of credit that exist in the marketplace are distinct from the committed lines of credit that are described in the theoretical literature.*" (Sufi, 2009, p. 1060)

These findings are consistent with the results of an international survey of 204 CFOs by Lins et al. (2010). The results of this survey show that cash holdings are used as general purpose insurance for bad times whereas credit lines are held to fund growth opportunities that may appear during good times.

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[3] Share of liquidity = Nominal value of credit lines / (Nominal value of credit lines + Cash and cash equivalents).

[4] Note that we and the studies cited in this paper understand OCF as a measure of cash flows produced by normal operating activities. This is usually defined as operating income before depreciation less interest expense, income taxes, and/or dividends. The measure is therefore different from the accounting definition of OCF found in annual reports' statements of cash flows.

Acharya et al. (2013) furthermore show theoretically that a company's choice between credit lines and cash holdings is influenced by the company's systematic risk as well as aggregate risk in the economy. This is based on the insight that banks are essentially pooling companies' idiosyncratic demand for cash by offering credit lines. This is valuable because not all companies will use all of their credit line at the same time, which allows banks to hold less liquidity than the nominal amount of credit lines offered. Therefore, banks can offer credit lines to companies at a commitment fee that is lower than the opportunity cost the companies would incur in holding the credit line's nominal amount in cash (Acharya, et al., 2013). Since firms with higher systematic risk are more likely to demand cash from banks when general demand for credit lines is high, banks will require a higher commitment fee from these companies in return for the larger liquidity cushion needed. Hence, firms with high systematic risk will use more cash because credit lines are more expensive to them. Likewise, if aggregate risk in the economy is high, banks will need more liquidity which again increases the cost of credit lines (Acharya, et al., 2013). The authors find empirical evidence consistent with their theory by using various measures of beta as a proxy for firms' systematic risk and the S&P500 VIX as a measure for aggregate risk in the economy.

Information asymmetries between managers and investors are another factor that can influence a company's access to capital markets, because they may lead investors to require an excessive risk premium (Myers & Majluf, 1984; OPSW). Several proxies have been proposed in the literature to capture this mechanism. Guney et al. (2007) argue that high leverage in itself can be a proxy for a firm's ability to issue debt at fair cost. Firm size, a credit rating, and a commercial paper rating have furthermore been used as proxies for the degree of analyst coverage, which in turn reduces information asymmetries (Almeida, et al., 2004). Additionally, Minton & Schrand (1999) find that higher OCF volatility increases costs of external finance, which they argue is due to increased information asymmetries caused for instance by more volatile earnings forecasts.

Last, asset tangibility can influence the ability to finance investments externally, since it influences the extent to which these can be collateralized. This means that plant and equipment should be cheaper to finance externally than research projects with notoriously uncertain outcomes. The implication is that cash holdings should increase with the level of R&D expenditure and decrease with the level of capex and ratio of tangible assets (Kim, et al., 1998; Han & Qiu, 2007; BKS).

2.1.4.2 Ability to finance internally
In addition to raising funds externally, companies can also choose to reduce existing expenditures or sell assets in order to finance investments and activities. Low costs of raising funds internally should therefore reduce cash holdings (OPSW). Since inventories can be liquidated cheaply and receivables securitized, firms with high net working capital net of cash should therefore hold less cash (OPSW; BKS). Dividends and share repurchases can also be cut if need be, implying a negative relation between cash holdings and dividends or the payout ratio (OPSW; BKS). Dividends are also indicative of firms that are less risky, established, and have easier access to capital which would further weaken the precautionary motive (OPSW; BKS; Acharya, et al., 2007). Empirical evidence has generally been consistent with all of these hypothesized relations (OPSW; BKS).

2.1.4.3 Likelihood of being short of funds

Naturally, the value of holding cash out of precaution rises with the risk of being short of funds. Hence, cash holdings targets should also increase with this risk.

High OCF volatility is one of the factors that make a company more likely to experience a shortfall in internal funds (Minton & Schrand, 1999). Empirical research shows that higher OCF volatility is associated with lower levels of discretionary investment in capital, R&D, and advertising. This indicates that firms do not fully cover shortfalls with external capital or wait until cash becomes available again, but permanently forgo investments (Minton & Schrand, 1999). This should make cash holdings more valuable for firms with volatile OCFs. Han & Qiu (2007) formalize the impact of volatility on cash holdings in a theoretical model in which firms hold more cash in response to higher OCF volatility. The intuition is that a firm with binding financial constraints may save cash in one period because it seeks to equalize the marginal return on investment across periods. Faced with higher risk of future OCF shortfalls, a firm will therefore choose to save more (Han & Qiu, 2007). The authors' empirical results are consistent with their theory and show that OCF volatility has a significant positive association with cash holdings for financially constrained firms but not for unconstrained firms. OPSW and BKS also find that industry OCF volatility is positively related to cash holdings, even though they do not differentiate between constrained and unconstrained firms. Similarly, the results of Minton & Schrand (1999) apply to constrained as well as unconstrained firms, although the former are more heavily affected. BKS actually conclude that the general increase in cash holdings among all U.S. firms over the past two decades is primarily driven by increases in OCF volatility. Finally, risk management theory in general states that the expected costs of financial distress increase with OCF volatility, which further increases the value of cash holdings (Froot, et al., 1993).

An important addition to the above is that underinvestment can occur even with perfectly stable OCFs if investment needs are volatile. Hence, it has been suggested that the correlation between OCFs and investment opportunities is the most relevant measure of the need to hold cash in order to avoid underinvestment. This is because a low or even negative correlation between the availability and the need for funds increases the risk of a 'financing gap' (Froot, et al., 1993; Acharya, et al., 2007; Duchin, 2010). This insight is used in a theoretical model by Acharya et al. (2007), where a firm has future investment opportunities that exceed its limited access to external finance. This means that it can profitably invest as many funds as it is able to obtain. The firm is therefore faced with the options to either increase cash holdings or increase debt capacity in order to maximize future available funds. The best option depends on the correlation between investments and OCFs. If OCFs are usually low when investment opportunities arrive, cash holdings are better because access to debt is restricted in bad times. The reason is that, in the model, future debt capacity is influenced by materializations of OCFs, whereas borrowing today and saving the cash is not. Therefore, cash holdings are a way to transfer cash from high future OCF states to low future OCF states by borrowing today based on expected future OCFs. This has two main implications. First, firms will hold more cash if they are financially constrained and the correlation between OCFs and investment needs is low or negative. Second, cash holdings are different from negative debt (Acharya, et al., 2007). In testing their theory empirically the authors arrive at confirming results. Note that the predictions

of their model are also consistent with the evidence on credit lines' sensitivity to OCF covenants (Sufi, 2009) and CFOs' perspectives on when they use cash versus credit lines (Lins, et al., 2010).

Extending the 'financing gap' approach, Duchin (2010) argues that corporate diversification weakens the precautionary motive for cash holdings if firms can smooth cash flows across divisions. For instance, if investment opportunities tend to appear at different times across business segments, a firm needs a relatively smaller cash buffer for each segment because it can transfer funds internally. Hence, firms should have lower cash holdings if: Cross-divisional OCF correlations are low or negative; cross-divisional correlations of investment needs are low or negative; or intra-industry correlations between cash-flows and investment needs are positive (the 'financing gap' discussed above). Empirically, the study finds support for all three correlations' impact on cash holdings. Interestingly, the coefficient for cross-divisional correlations between OCFs becomes insignificant when all three correlation variables are jointly applied, which indicates that the effect is absorbed by the other measures (Duchin, 2010).

A further substitute for precautionary cash holdings is hedging with derivatives, since it can reduce the risk of a shortage of funds. Cash holdings should therefore be lower for firms that use derivatives or can hedge certain exposures cheaply (Froot, et al., 1993; OPSW). This would be the case for companies where cash flow risk is tied to easily verifiable and hedgeable variables like commodity prices, interest rates, or foreign exchange rates (Disatnik, et al., 2012).

Leverage can also influence the risk of a business. The higher a firm is levered, the higher its risk of facing cost of financial distress and the more difficult it may be to fund investments by raising additional debt. In order to avoid this, highly levered firms should hold more cash (Guney, et al., 2007; Acharya, et al., 2012). Guney et al. (2007) find evidence of a non-linear relation between cash holdings and leverage by including a squared leverage term in a regression on cash holdings. The authors interpret this as evidence that companies increase their cash holdings in response to high debt; while moderate levels of debt indicate the ability seek external finance. Acharya et al. (2012) support the former notion by showing that there is a positive correlation of cash holdings with credit spreads and a company's risk of default. While this may be puzzling since cash holdings should reduce risk, the findings are explained by companies endogenously setting cash holdings in response to higher risk of distress or default caused by leverage (Acharya, et al., 2012).

Another risk-aspect of leverage is that debt is usually rolled-over instead of repaid, which introduces refinancing risk (Harford, et al., 2012). In response, companies may increase their target cash holdings if they have debt with short maturities. This cash is, however, not held to repay the debt. It is held to increase creditworthiness for refinancing or to reduce underinvestment problems if it enables partial refinancing (Harford, et al., 2012). Empirical evidence is consistent with these theories in that firms with shorter debt maturity hold more cash. Furthermore, the authors find that the effect is found to be more pronounced when credit markets are tight, and conclude that this increases refinancing risk as well.

2.1.4.4 Cost of being short of funds

The final factor influencing precautionary cash holdings are the costs likely to be incurred if the company finds itself in a position where it is actually short of funds. For instance, the higher the amount of investment opportunities are, the higher the cost of being short of funds should be. The reason is that firms with more investment opportunities have more projects to lose and may also have better projects to lose (OPSW). Confirming this, both BKS and OPSW find a positive relation between cash holdings and market-to-book ratio and R&D expenses, which are proxies for investment opportunities. The intangibility of R&D projects and growth options further contribute to this relation because they increase bankruptcy costs (Brealey, et al., 2013).

Additionally, competitive pressures may aggravate the costs of being short of funds. The reason is that a company that forgoes investments may lose these growth opportunities as well as market share to rivals. Hence, firms in more competitive industries should hold more cash (Haushalter, et al., 2007). Additionally, firms with large cash holdings may use these strategically to finance competitive actions in the product market. This may even make cash holdings a deterrent because they signal the capability to strike back (Fresard, 2010). Haushalter et al. (2007) and Fresard (2010) assert that strategic competition is more likely in concentrated industries and use the Herfindahl–Hirschman Index (HHI) to test for the impact of competition on cash holdings. Haushalter et al. (2007) finds that the HHI is positively related to cash holdings after controlling for other determinants of cash suggested by OPSW. Fresard (2010) finds that larger cash holdings lead to systematic future market share gains and that this effect is stronger in more concentrated industries.

2.1.5 The tax motive

Foley et al. (2007) test the argument that repatriation taxes have a significant impact on U.S. corporations' cash holdings. The repatriation tax roughly taxes the difference between what a company paid in income taxes abroad and what it should have paid in income taxes in the U.S. when earnings are repatriated. This means that companies can defer taxes by accumulating cash in their foreign subsidiaries. Additionally, because companies have considerable liberties in setting transfer prices, they can even move earnings to low-tax jurisdictions in order to defer taxes (Foley, et al., 2007). To the extent that cash holdings in foreign accounts are imperfect substitutes for domestic cash holdings, this should increase cash holdings for firms with large foreign income (Foley, et al., 2007). Empirically, the authors show that companies that would face a larger repatriation tax have higher consolidated cash holdings, and that higher foreign cash holdings do not proportionally reduce domestic cash holdings.

2.1.6 Agency costs of managerial discretion

The use of cash in a corporation is central to the agency conflict between managers and shareholders because managers have a high discretion over how to use cash. This may lead self-interested managers to increase their utility at the expense of shareholders, for instance by overinvesting in order to increase firm size or to obtain other benefits (Jensen & Meckling, 1976; Jensen, 1986). Hence, the notion that managers *use* cash wastefully is widely cited in the literature as a cost of cash (e.g. OPSW BKS). The problem is that

the impact of agency problems on the *level* of cash holdings has been relatively unclear from a theoretical as well as empirical perspective (Harford, et al., 2008).

Harford et al. (2008) summarize the theoretical perspectives on agency problems' impact on cash holdings as the flexibility hypothesis, the spending hypothesis, and the shareholder power hypothesis. According to the flexibility hypothesis, self-interested managers value the financial flexibility from cash holdings because it allows them to undertake investments that capital markets would not support (Jensen, 1986; OPSW). Cash holdings should therefore be higher for firms where shareholders' control over managers is weaker (Harford, et al., 2008). The spending hypothesis states that self-interested managers prefer immediate overinvestment over savings and will spend excess cash when it is available (Jensen & Meckling, 1976). Cash holdings should therefore be lower for firms where shareholder's control over managers is weaker (Harford, et al., 2008). Finally, the shareholder power hypothesis states that shareholders face a trade-off between letting managers have valuable slack to avoid underinvestment and the agency costs this slack may entail (Jensen & Meckling, 1976; Myers & Majluf, 1984). If shareholders have more effective control with managers, they will let them have more slack. Cash holdings should therefore be lower for firms where shareholders' control over managers is weaker (Harford, et al., 2008). Empirically, Harford et al. (2008) find support for the spending hypothesis in that U.S. firms with weaker governance will spend cash faster. Additionally, Dittmar & Mahrt-Smith (2007) show that cash in poorly governed U.S. firms is worth less than in well governed firms, indicating that investors price-in agency problems in valuating cash holdings.

Last, international evidence shows that firms hold more cash when country-level measures of shareholders rights are weak (Dittmar, et al., 2003). While these results seem contrary to the relation between corporate governance and cash holdings observed in U.S. firms by Harford et al. (2008), the difference may be explained by strong country-level legal protection. In the U.S., even entrenched managers with poor firm-level governance are not unassailable and may therefore spend highly visible excess piles of cash to guard against shareholder action. Hence, firm-level corporate governance may simply be less important in the U.S. (Harford, et al., 2008).

2.1.7 Dynamics of cash holdings

An emerging theme in the literature is the impact on observed cash holdings of companies' imperfect adjustment to deviations from their targeted cash holdings level. The speed of adjustment can be affected by a variety of factors tied to financing and investment frictions, because these influence the costs and benefits of actively re-balancing cash holdings (OPSW; Ozkan & Ozkan, 2004; Dittmar & Duchin, 2010; Venkiteshwaran, 2011). This can lead to systematic differences in how fast companies adjust to their target cash holdings. The inter-temporal dynamics of cash holdings are important because they can lead to systematic differences between observed and targeted cash holdings, particularly during times of crisis (OPSW; Ozkan & Ozkan, 2004; Dittmar & Duchin, 2010; Venkiteshwaran, 2011). Unfortunately, there is currently mixed empirical evidence regarding the determinants of adjustment speed.

The overall speed of adjustment towards target cash holdings following a shock to cash holdings has been estimated to be around 2 years by Venkiteshwaran (2011) and Ozkan & Ozkan (2004), but to 3 to 6 years by Dittmar & Duchin (2010). All papers generally use the same two-step method. First, targeted cash

holdings are estimated based on the empirical models proposed by OPSW and BKS. Second, these estimates are then used in a variety of partial adjustment models. Venkiteshwaran (2011) therefore suggests that the discrepancy in results is mainly due to sample composition. The author studies only manufacturing firms starting in 1987, whereas Dittmar & Duchin (2010) use a larger and more diverse sample starting in 1965. Hence, firm characteristics seem to be important for the speed of adjustment, and there may also have been shifts in adjustment speed over time.

Differences in the speed of adjustment may also depend on whether a company has a surplus or deficit in cash holdings. Dittmar & Duchin (2010) find that firms below their target have a lower speed of adjustment, which they attribute to asymmetric costs in building cash holdings versus distributing cash to creditors or shareholders. In contrast, Venkiteshwaran (2011) finds that firms above their target have lower speed of adjustment. The results are puzzling and may again be due to sample composition.

Finally, the speed of adjustment seems to depend on the type of cash flow, which caused the deviation from target holdings. Cash flows from net debt and equity issuances are found to cause short-lived deviations from target cash holdings. This may be because they are self-imposed deviations from cash holdings undertaken to finance upcoming investments (Dittmar & Duchin, 2010). Likewise, large capital investment are found to push companies back towards their target cash holdings, confirming that firms build excess cash holdings just ahead of investments (Dittmar & Duchin, 2010). However, BKS find that IPOs are special cases and that cash holdings are higher for up to five year after an IPO. This may be explained by the different nature of firms' first access to capital markets. In these cases, money is likely raised to finance several years of growth. The most persistent deviations from target cash holdings are caused by fluctuations in OCF (Dittmar & Duchin, 2010; Venkiteshwaran, 2011).

2.1.8 Section summary

In sum, this section presents ample evidence that companies' characteristics and environments can predict systematic variation in cash holdings. Most theories and research are based on a trade-off perspective, according to which companies set their cash holdings by balancing the costs and benefits of holding cash. The costs of holding cash originate from forgone interest and potentially wasteful use of cash. The benefits of holding cash can be categorized according to several motives. The transaction motive draws on operations research and states that firms hold cash in order to minimize inventory costs. The precautionary motive shows that cash holdings are valuable because they can reduce the risk of underinvestment and financial distress. Hence, cash holdings increase with a company's risk as well as potential cost of being short of funds, but decrease with its ease of access to external and internal financing. Additionally, the tax motive maintains that U.S. companies may hold more cash due to repatriation taxes. It also seems that, in the U.S., agency problems can cause companies to hold lower levels of cash. Recently, the trade-off perspective has been extended to include inter-temporal dynamics. According to this research, financial frictions cause companies to adjust their cash holdings over time, rather than instantaneously. Observed cash holdings can therefore systematically deviate from targeted cash holdings.

2.2 The financial crisis

We now turn to the literature on the financial crisis of 2008. We will start by briefly outlining the chain of events leading to the financial crisis. Afterwards, we document how U.S. corporations were generally affected by the crisis and that existing literature has identified three mechanisms through which this has happened.

2.2.1 Chain of events

The recent financial crisis had its early roots in August 2007, where the credit boom came to an end due to consumer defaults on subprime mortgages issued to them by U.S. banks (Duchin, et al., 2010). Subprime mortgages were a part of the prevailing lax credit philosophy that enabled low-income families to borrow money based on very little collateral (Brealey, et al., 2013). This widespread availability of mortgage credit caused a spiral of increasing house prices, which doubled in the five years until 2006. However, the real estate bubble burst in early 2007. This caused many borrowers to default on their mortgages because they had bet on consistently rising prices in order to be able to repay them. The mortgages had originally been issued by smaller banks to homeowners, but were later sold to investment banks. The investment banks had then repackaged the mortgages as CDOs and resold them to other investors, such as insurance companies, federal mortgage agencies, and other banks. The consumer defaults on mortgages therefore rippled through the entire U.S. financial system. Although credit stabilized and amounts of loans actually increased again during January 2008, this was just a brief respite (Ivashina & Scharfstein, 2010). Consumer defaults continued in 2008 and financial institutions began to struggle, which caused the financial markets to panic (Brunnermeier, 2009). This subsequently led to a bailout by the U.S. Government of the federal mortgages agencies Fannie Mae and Freddie Mac. Lehman Brothers was, however, not saved and went bankrupt in September 2008 in what is known as the peak of the crisis (Brealey, et al., 2013). The consequence was a complete credit freeze and the dollar volume of lending in Q4 2008 was less than one-fourth of its level 18 months earlier (Ivashina & Scharfstein, 2010). Although originating in the U.S., the financial crisis soon spread across the global financial system, making it a worldwide financial crisis. This resulted in a global recession unparalleled since the Great Depression that left few industries and developed countries unaffected (Claessens, et al., 2012).

2.2.2 General impact of the financial crisis on U.S. corporations

Naturally, the global recession and financial crisis had a significant negative effect on both the U.S. economy and U.S. corporations. Although the credit crisis initially had a more direct impact on banks and the financial system, the consequences soon became wide-ranging. This evolved into a deep recession that unfolded during 2008 (U.S. Department of the Treasury, 2012). As shown in Figure 1, the crisis was particularly severe from Q3 2008 to Q2 2009, where the U.S. experienced four consecutive quarters of negative GDP growth.
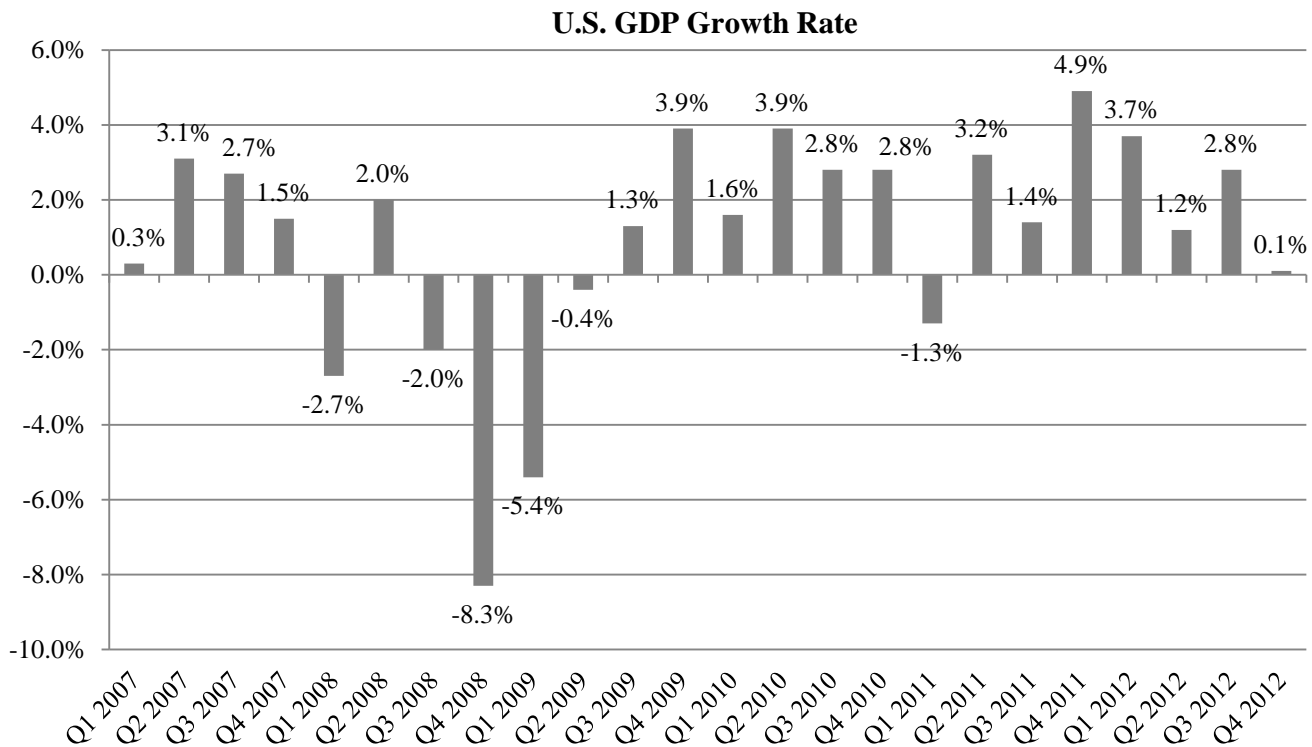
Figure 1 – U.S. GDP Growth Rate. The figure shows the annualized quarterly growth rate of U.S. GDP from Q1 2007 to Q4 2012. *Source: U.S. Department of Commerce: Bureau of Economic Analysis (2013)*

The impact of this grim economic climate was evident in a multitude of indicators. One was the number of bankruptcies reported. Brealey et al. (2013) note that since the 2006 peak in manufacturing profits, the number of business bankruptcies tripled until 2009. Furthermore, stock prices of S&P500 firms fell by 55% between 2007 and 2009, which made the index fall to its lowest value in more than ten years (Brealey, et al., 2013). In addition to this, firms also lowered their investments. As an example, Duchin et al. (2010) report that corporate investments declined by more than 6% as a consequence of the crisis.

The literature has categorized the effects of the crisis on corporations into three main effects; a limited access to external finance, a drop in demand, and increased uncertainty. We discuss all three effects separately before addressing their relative importance.

2.2.2.1 Limited access to external finance
One of the main effects of the financial crisis on corporations was their limited access to finance. The main reason for the overall credit drought was a bank lending supply shock (Campello, et al., 2010). The origin of the bank lending contraction was that banks had suffered severe losses on their balance sheets during the crisis as a result of the defaults on structured securities and mortgages. As banks were usually highly levered already before the crisis, they were now extremely levered and needed to either raise equity or reduce outstanding loans to decrease their leverage (Kahle & Stulz, 2013). The major ways in which banks reduced their leverage from 2007 to 2009 were through not issuing new loans and not renewing loans

(Kahle & Stulz, 2013). Accordingly, Ivanshina and Scharfstein (2010) show how the credit crunch had its first immediate effect on firms towards the end of 2008. They find that new loans to large borrowers fell by 47% during Q4 2008 compared to the quarter prior, and by 79% relative to the peak of the credit boom in Q2 2007. Following this, the cost of bank and corporate borrowing rose substantially. Similarly, Campello et al. (2010) identified three main ways in which corporations felt this bank lending shock: (1) Quantity constraints, i.e. limited financing, (2) higher costs of external funds, and (3) difficulties in originating or renewing a line of credit or loan with their bank. Especially the inability to access credit lines caused firms to struggle. This happened as credit lines had been actively drawn upon by many firms as a source of funding at the beginning of the crisis. As the crisis progressed, this was no longer possible. In addition, since investors had lost confidence in corporate bonds, and turned to the safest investments such as U.S. treasuries, alternative sources of corporate finance dried up as well (Brealey, et al., 2013).

2.2.2.2 A drop in demand

Another effect of the crisis was a negative shock to consumer demand, as there was a reduction in personal consumption expenditures in six consecutive quarters from Q1 2008 to Q2 2009, reaching negative double-digit figures in two quarters (U.S. Department of the Treasury, 2012). This drop can be attributed to two factors. First, U.S. consumers had less disposable income and, second, they used the funds they had to pay down their debt.

The main reason that consumers had less money during the crisis was that many had lost their job. The private sector displayed negative job growth during 2008-2009, plummeting at -12% in Q1 2009. Even the federal government and states were forced to shed jobs in response to arising fiscal challenges (U.S. Department of the Treasury, 2012).

Also, as the crisis progressed, more and more consumers were faced with high leverage due to the collapsing real estate market (Kahle & Stulz, 2013). As a response, they shifted their consumption pattern from spending towards saving. After long periods of growth, the housing market had lost close to one-third of its value in Q2 2009 from the peak in 2006 (Brealey, et al., 2013). Since the main asset of many households was their real estate, the falling real estate prices were particularly critical (Kahle & Stulz, 2013). This situation was further aggravated by rising interest rates and the discontinuation of the issuance of subprime mortgages to credit-weak consumers. Consequently, consumers moved their focus towards paying down debt. This brought along a serious consumer credit contraction (U.S. Department of the Treasury, 2012). According to Brealey et al. (2013), the shift from borrowing to savings by consumers represents over 9% of U.S. GDP in 2009.

2.2.2.3 Increased uncertainty

A third generic effect of the crisis was increased uncertainty. This unrest has mainly been documented in financial markets. It has been argued that the volatile stock prices reflected the fact that future cash flows were uncertain and discount rates increasing. The S&P VIX, for instance, measures the market's expectation of stock price volatility. The value of the index increased more than 250%, from 12.8 in 2006 to

an unprecedented 32.7 in 2008[5]. According to Kahle & Stulz (2013), this reflected both panic in the financial sector and uncertainty about the development of the general economy.

2.2.2.4 The interplay of mechanisms over time

It has been discussed within the academic field, which of these factors has had the largest impact on corporations during the crisis. Although the limited access to finance has, to date, received most of the attention, all three factors have proven to be important (Kahle & Stulz, 2013).

Garcia-Appendini & Montoriol-Garriga (2013) note that in studies of the crisis, the credit supply shock has been the focus of a majority of the literature. This is probably because much of the literature has focused on the years 2007-2008, where the credit supply shock was in effect (Campello, et al., 2010; Ivashina & Scharfstein, 2010; Duchin, et al., 2010). Following this, much research mainly distinguishes between financially constrained and financially unconstrained firms when testing how the impact of the effects of the crisis varied across firms. Although several different proxies of financially constrained firms have been used, the general consensus of most research is that constrained firms with less financial flexibility were more severely affected by the crisis, since they had less room to maneuver and obtain capital (Korajczyk & Levy, 2003; Campello, et al., 2010; Duchin, et al., 2010; Meier, et al., 2013).

Yet, recent research shows that companies might have been affected equally by the crisis, which indicates that the limited access to capital cannot be the whole story. Thus, a very contemporary paper by Kahle & Stulz (2013) has extended the research on the causes of the crisis and includes the years 2009-2010. The study focuses on bank-dependent firms, which share several similarities with financially constrained firms. A bank-dependent firm is a firm that has borrowed twice from the same U.S. bank in the five years leading up to the credit crisis in 2007. Kahle & Stulz (2013) apply this distinction to detect whether a credit shock was the main consequence of the financial crisis, or if the demand drop and increased uncertainty factors also play noteworthy parts. In brief, it is reported that no differences are seen between bank-dependent firms and matching firms with respect to capex and net debt issuance. Hence, when covering the entire period from 2006-2010, Kahle & Stulz (2013) conclude that the impact on firms cannot be explained purely by firm characteristics. Rather, it must also be attributed to a common demand shock and an increase in uncertainty about future demand (Kahle & Stulz, 2013).

2.2.3 Section summary

In sum, it has been shown that the financial crisis of 2008 left its clear mark on corporations. Both stock prices and an increase in bankruptcies indicate that many firms were struggling to perform during the crisis. Research has documented that three factors contributed to this. Hence, a limited access to capital, a drop in consumer demand, and increased uncertainty all affected financial markets and U.S. corporations.

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[5] See section 5.1 for data sources.

2.3 Cash holdings and the financial crisis

Research on corporate cash holdings in relation to the recent financial crisis is still ongoing. In particular, very little research has been done on the post-crisis years. Nevertheless, the research that has been conducted thus far has documented that the crisis has had clear effects on corporate cash holdings. In addition to this, it has been shown that these effects differ both according to the specific time period examined and, to some extent, firm characteristics. In this section, we first look specifically at how of the financial crisis has affected firms' cash holdings. Subsequently, we study the research on how firms' investment decisions have been affected by the crisis conditional on a firm's level of cash holdings.

2.3.1 The effect of the financial crisis on cash holdings

Generally, the literature has described a u-shaped pattern in corporate cash holdings throughout the crisis. Cash holdings fall during the first part of the crisis and subsequently rise again in the post-crisis period. As the literature has typically studied specific time periods of the crisis, we split this section accordingly. The first subsection relates to the years 2007-2008 whereas the post-crisis subsection predominantly focuses on 2009-2010. The most recent years have yet to be covered.

2.3.1.1 Cash holdings during the crisis

Research published immediately after the crisis focused on the years 2007-2008 and documented that firms drew on their cash holdings, causing corporate cash levels to fall. This happened as firms used their cash holdings to fund daily operations and pay-off debt, since OCFs were insufficient. This occurred for firms across the board but particularly so for financially constrained firms. Also in some cases, financially unconstrained firms drew on their cash levels to offer more lenient terms of payment to clients. The literature has further shown that precautionary drawdowns of credit lines and asset sales may have partially offset the downward pressure on cash holdings.

One reason that firms decrease cash holdings during 2007-2008 is that they need to finance daily operations. This is found by Duchin et al. (2010) who employ a difference-in-difference approach to study the beginning of the financial crisis. They show that the cross-sectional average of cash as a percentage of assets fall significantly for U.S. firms from 23% to 18.4%. The study then notes that the drawdown on cash occurred as firms responded to their need to finance day-to-day operations. Based on a CFO survey, Campello et al. (2010) also find a reduction in firms' cash holdings but divide firms according to their financial constraints. It is found that constrained firms decrease their cash-to-assets ratios from 15% in 2007 to around 12% in Q4 2008. Unconstrained firms, conversely, are able to maintain their pre-crisis cash-to-assets ratio. When asked for the reason for the decrease in cash holdings, CFOs also reply that they spent cash on financing daily operations during the crisis. As the crisis progressed, CFOs were furthermore forced to cut investments.

Another reason for the reduction in cash holdings for some firms is the use of cash to pay off maturing debt. This is found by Almeida et al. (2011) who use a difference-in-differences approach to compare firms with long-term debt maturing during the crisis to matching firms. In addition to lowering their investment,

Almeida et al. (2011) report that these firms drew down significantly on their cash holdings in order to be able to pay off their maturing debt. This drawdown was not observed for matching firms.

Garcia-Appendini & Montoriol-Garriga (2013) focused on the topic of trade credit and its impact on cash holdings during the recent crisis. They, too, use a difference-in-differences approach and compare trade credit levels extended by supplier firms to their customers in relation to suppliers' liquidity positions. They bring forward an interesting piece of evidence in that suppliers with high pre-crisis levels of cash extend a larger amount of trade credit to cash-strapped customers during the crisis. Cash-rich suppliers thus use their cash holdings as a competitive advantage over matching firms, but draw significantly on their cash holdings in the process.

An offsetting factor to the drop in cash holdings is that some firms were able to draw on their credit lines instead of their cash holdings. It has been shown that there was a significant drawdown on credit lines for all firms in the U.S. during 2008 (Ivashina & Scharfstein, 2010). Campello et al. (2010) find similar evidence but also find that constrained firms were selling assets to mitigate the drop in OCF. This implies that credit lines and asset sales might have offset the decline in cash to some extent.

2.3.1.2 Cash holdings post-crisis

More recent research confirms the findings above, but also shows a significant increase in cash holdings during 2009 and 2010.

The first paper to describe the u-shaped pattern in cash holdings during the crisis was published by Kahle & Stulz (2013). They study the years from 2006 to late 2010 on a sample of U.S. firms. They show that all firms lower their cash holdings equally from Q3 2007 to Q1 2009. In the period afterwards from Q2 2009 to Q1 2010, however, firms increase their cash holdings sharply and take the cash balances back to around pre-crisis levels. These findings are confirmed by PSW, who focus on the development of cash holdings during 2009-2010 also using a difference-in-differences approach. Likewise, they demonstrate a decrease in firms' cash-to-assets ratios during 2007-2008 followed by a sharp increase in 2009. Interestingly, they also find that there is an 87% increase in abnormal cash holdings from the pre-crisis to post-crisis period for U.S. firms. These abnormal cash holdings are defined as cash holdings that cannot be explained by BKS' empirical model.

Although the papers above agree on the u-shaped pattern of cash holdings, there is much less research on what exactly caused the post-crisis increase. Kahle & Stulz (2013) are for instance mostly concerned with finding evidence against the assertion that a bank lending shock was the sole reason for the crisis. While their focus is on investment levels, they also find that unlevered firms increase their cash holdings by less than bank dependent firms. PSW address cash holdings more directly and dissect their sample according to firm characteristics in order to explain the u-shape in cash holdings. They find that the post-crisis increase in cash holdings is concentrated amongst the most profitable firms. PSW argue that this cash accumulation is consistent with the view that firms lack good investment opportunities. PSW also investigate the tax motive, but do not find that repatriation taxes can explain post-crisis increases in cash holdings. They

furthermore find that the post-crisis increase in cash holdings in the U.S. is not significantly different from that in other advanced countries.

The increase in cash holdings is also attributed to a reduction in trade credit offered by suppliers (Garcia-Appendini & Montoriol-Garriga, 2013). As the crisis progressed, trade credit issuing firms realized that the shock to demand was systematic rather than idiosyncratic. This caused cash-rich firms to begin to increase their own cash holdings instead of extending trade credit to financially constrained customers.

Last, Song & Lee (2012) investigate the Asian financial crisis during the 1990s. They study a sample of Asian firms during the years 1990-2006 and also find evidence of higher post-crisis cash holdings. Their results show that Asian firms became more conservative by decreasing M&A activities and capex after they experienced macroeconomic shocks, increasing cash holdings instead.

2.3.2 The effect of the financial crisis on investment decisions
The past section has made it clear that cash holdings are closely related to investment decisions, particularly during the crisis. We therefore look at how a firm's pre-crisis level of cash affects its investment activity. The literature shows that investments fall for all firms and several findings show that this is more so for financially constrained firms.

Several papers confirm that U.S. firms across the board lower their capital expenditures during the crisis. Duchin et al. (2010) study corporate investments from 2006-2009 and find that these have significantly declined for all U.S. firms since the beginning of the crisis. Campello et al. (2010) confirm this and show that capex, marketing expenditures, R&D expenditures, dividends, and employment have all been cut during Q4 2008. Similarly, Kahle & Stulz (2013) also find a fall in capex for all firms, particularly from Q2 2008-Q1 2010.

When investigating the reasons for this reduction, it makes sense to sort firms according to firm characteristics. Many studies find that constrained firms lower their investments and capex more than unconstrained firms and for different reasons. This is for example found by Duchin et al. (2010) who show that constrained firms lower their investments more than unconstrained firms mainly due to insufficient financial slack. Campello et al. (2010) present similar evidence in that 86% of constrained CFOs had either foregone or postponed investments during the crisis compared to only 44% for unconstrained CFOs. These results are built upon by Campello et al. (2011), who show that firms with lower internal liquidity are faced with limits on their access to credit lines, which leads to a trade-off between savings and investing.

Other studies focus on unconstrained firms. They show that these firms decrease their investments not only due to a lack of funds but also due to a lack of investment opportunities as the crisis progresses. Duchin et al. (2010) show similar tendencies and find a decrease in capex for cash-rich firms after September 2008. Interestingly, the decrease in capex is most significant for firms with a low Tobin's Q, which is a proxy for growth opportunities. Kahle & Stulz (2013) find that high cash firms actually increase capex by 10% during the beginning of crisis. However following the Lehman bankruptcy, the high cash firms decrease their

capex more than highly levered firms. This further testifies to the claim that firms lack growth opportunities as consequence of the general shock to demand.

2.3.3 Section summary

This section shows how the financial crisis clearly affected firms' cash holdings and investment decisions. Available research on corporate cash holdings shows that these follow a u-shaped development during the crisis. Thus, early in the crisis, cash holdings fell significantly for firms across the board. This happened as firms dealt with the adverse demand shocks of the crisis and were largely unable to access external funds. Coming out of the crisis, cash holdings increase again, mainly due to increased profitability and decreased investment. When it comes to investment decisions, the effects of financial slack seem to be changing over the crisis.

3. Media Analysis

In this section, we will elaborate on how we conduct a content analysis of relevant media publications over the last ten years in order to complement the academic literature just reviewed. As mentioned, we believe that this will yield theoretical and empirical contributions. The very contemporary aspect of media publications may for instance add the most recent post-crisis insights not covered by academia. Also, journalists' qualitative research methods may more directly reveal managers' motives for holding cash compared to quantitative research. This may shed light on CFOs' attitude towards certain motives for holdings cash and uncover potential shifts in such attitudes or behavior. We proceed by defining what a content analysis is and why we find it to be the most appropriate research method for our analysis. Following this, we will go through the eight steps of our content analysis and account for sample choice, coding frame, and concerns about reliability and validity. Finally, we will present the results of our media analysis.

3.1 Content analysis and its application

A key concern of all scientific research is to produce insights that are both reliable and valid. This necessitates the choice of proper methodology. We identify content analysis as being the most suitable approach for conducting our media analysis, and we will employ both its qualitative and quantitative aspects, although focusing on the former.

Content analysis as a field has increased in popularity over the last 50 years and is the longest established method of text analysis among the array of empirical methods of social investigation (Titscher, et al., 2000). Generally, it is a research technique allowing researchers to make replicable and valid inferences from texts or other meaningful matter (Krippendorff, 2013). Sullivan (2013) adds to this definition that content analysis is the systematic observation of elements in text, for example by documenting the frequency with which such elements appear. Common to all content analyses is that researches build a coding frame, which allows them to extract relevant information from texts in a systematic way that lends reliability and validity to the results.

Although the fundamentals are similar, content analysis can be divided into qualitative and quantitative aspects. In qualitative content analysis, interpretation is the focus of the research process and meanings and underlying reasons are highlighted. In more general terms, qualitative content analysis is the preferred option if researchers have to engage in some degree of interpretation to arrive at the meaning of their results (Schreier, 2012). That is, the goal is to generate new theories or hypotheses that researchers might not be aware of prior to the study (Kohlbacher, 2006). Our focus on qualitative content analysis therefore directly stems from the fact that we seek to find new explanations and motives for the changes in cash holdings. To capture the chains of causation and mechanisms rooted in such arguments, we need to allow for some degree of interpretation.

Quantitative content analysis is often used for highly standardized meanings that do not require any form of context or interpretation (Schreier, 2012). That is, quantitative content analysis is often used to test known hypotheses and evaluate theories (Kohlbacher, 2006). The same applies if researchers want to count the number of times certain words appear in a very large number of texts. As some of our categories (e.g. if the crisis is mentioned in an article) are fairly straightforward and do not require interpretation, we also make use of quantitative aspects in our content analysis. This is in line with the notion that qualitative and quantitative content analyses should be seen as two end points of a continuum along which researchers often work (Zhang & Wildemuth, 2009; Schreier, 2012).

3.2 Methodology and analysis

Although every qualitative content analysis is unique, it will always involve the same sequence of steps (Schreier, 2012). Therefore, to ultimately enhance the reliability and validity of our results, we rigorously apply the research steps described by Krippendorff (2013) and Schreier (2012). To describe the process of our content analysis, we will now go through each of the eight suggested steps, which we sort into four subsections.

3.2.1 Research question and sample material

The choice of research question is important because it dictates the entire content analysis. This is derived from the fact the research question determines both sample selection and design of the coding frame. Therefore, as only questions related to the coding frame will be answered during the analysis, having the right research question is key (Schreier, 2012). We thus choose to use our original research questions for this analysis. The reason is that our media analysis is applicable to our entire research agenda. To reiterate, we want to know (1) what the determinants of corporate cash holdings are, and (2) how the determinants of corporate cash holdings been affected by the financial crisis.

Once the research questions are defined, the next step is to decide on the material to analyze. This is called a sample plan and several considerations have to be made in relation to sample technique, geography, and time span. By accounting for our choices within each of these areas, we will now document how we reach our final sample of 113 articles.

Every sample plan starts with a sampling technique (Krippendorff, 2013). Sampling techniques within content analysis differ from statistical sampling theory. The latter is a theory of representation, meaning that it is important that the sampling distribution mirrors the population distribution. However, content analysts are rarely concerned about statistical inference or an accurate representation of the textual universe, but instead sample according to their research question (Krippendorff, 2013). Within content analysis, there are several sampling options. We employ relevance sampling, as it is very important that our sample material aims to answer our research questions. This method recognizes that the textual units, i.e. articles, are unequally informative in regards to where the answers may lie and thus aims at selecting the sample that has the highest chance of answering a given research question.

Using relevance sampling, we decide that the following combination of media publications, geography, time span, and search words have a high likelihood of answering our research questions. Via Factiva, we select the top ten newspapers by circulation in the U.S. in 2013 according to Alliance for Audited Media. In addition, we look through the top 100 newspapers by circulation and include the ones directly related to business or finance (Alliance for Audited Media, 2013). We do the same for magazines. To be certain to capture the practical angle on the issue, we also include both CFO Magazine and CFO Insight. Last, we pay close attention to the 'related articles' feature on Factiva to include further relevant articles.

In terms of geography, we only include articles related to the U.S. This means that if an article in a foreign newspaper, e.g. Financial Times, concerns U.S. firms, it is included in our sample. With respect to time span, we include the years 2004-2013. We do this to capture a pre-crisis, during crisis, and post-crisis period.

We use several search words to reach our first sample. In the Factiva subject field 'all of these words', we insert 'corporate, cash, holdings, why, reason'. In the Factiva subject field 'at least one of these words', we insert 'crisis, level, post, pre, during, hoard, excess, pile, determinant, motive'. We mainly apply these words in searches within the newspapers specified in our sample. Again, however, we also apply the search words to Factiva in general, and include the most relevant articles among the vast amount of results this produces.

Our initial sample includes more than 1200 articles. In relevance sampling, however, analysts proceed by refining the sample, often in a multistage process (Krippendorff, 2013). Accordingly, we read through the headline and first paragraph of all the articles and keep only the most relevant ones, as determined by our research questions. This leaves us with 136 articles. Of these, 23 are furthermore excluded due to irrelevance, which becomes clear when we read them thoroughly in the coding stage. In this manner, we arrive at the 113 news articles that constitute our final sample. Please confer Table 18 for a complete overview of our sample.

3.2.2 Units of coding

The third step of a content analysis is defining the units of coding. Units of coding can be a single word, a sentence, or even several sentences. Defining units of coding is important because it influences the subsequent design of our coding frame. The reason for this is that it is ultimately units of coding that contain the information which is put into a specific category of a coding frame (Krippendorff, 2013). In quantitative content analysis focusing on a simple word count, single words are typically the unit of coding. However, for a qualitative content analysis focusing on chains of causations, it is important to realize that meaning might be expressed in anything from a single word to an entire document (Zhang & Wildemuth, 2009). We therefore employ what is known as thematic segmentation to define units of coding[6], meaning that we code themes (e.g. motives for holding cash) in the text regardless of their length (Schreier, 2012;

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[6] Some researchers refer to such units of coding as units of context, emphasizing the importance of the context in which meaning is embedded (Zhang & Wildemuth, 2009; Krippendorff, 2013).

Krippendorff, 2013). In this way we avoid losing valuable insights by for instance confining ourselves to coding a maximum of one sentence per category.

Note that some researchers furthermore start by discussing units of analysis, which are the parts of a sample to which the coding frame is applied (Krippendorff, 2013). In our case, however, these are quite naturally single articles.

3.2.3 The coding frame

Having defined what we want to code, we proceed with the design of our coding frame. As mentioned, a coding frame is of utmost importance as only the information relating to the coding frame is included in a content analysis (Krippendorff, 2013). This is because we analyze article according to our coding frame only. Our coding frame consists of several categories, which specify and sort exactly which information we wish to get out of the articles in order to explain how cash holdings have changed during the crisis. We will now elaborate on our choice of coding frame and the definition of our categories, before evaluating our coding frame through measures of reliability and validity. Importantly, building a coding frame is an iterative process. Improvements of reliability and validity are therefore continually taken into account.

3.2.3.1 Construction of the coding frame

When building a coding frame, a content analyst first has to make a choice on the type of coding frame in order to subsequently define its categories in detail. A coding frame can be concept-driven and/or data-driven, and we employ a combination of both methods. A concept-driven coding frame is used within quantitative content analysis when researchers know prior to the study which factors they expect to find. It can therefore not be used to uncover new arguments (Schreier, 2012). Concept-driven categories use existing studies or theories as a guideline for its categories (Krippendorff, 2013). Accordingly, we use our literature review to construct concept-driven categories, which allows us to study whether there has been a change in the importance or nature of an existing motive for cash holdings during the crisis. An example of such a category from our coding frame is 'low ability of accessing external finance'. However, as concept-driven categories *only* include theories from our literature review, they cannot capture the new chains of causations, which we hope to find.

Therefore, we employ an additional way to design a coding frame by making it data-driven as well. This approach is mostly used for qualitative content analyses and lets the sample material guide the coding frame (Schreier, 2012). Data-driven categories are used for new discoveries that emerge during the analysis. This is done by coding a subsample of the articles and then making a category for any new factors that emerge, and were initially not captured by the concept-driven categories. We do this through iterative pilot coding phases, which we discuss later. An example of such a category is the emergence of the category 'investor pressure'. Thus, along with much other research, we make simultaneous use of concept-driven and data-driven categories to enhance the possibility that our coding scheme will cover both existing and new categories (Schreier, 2012).

Importantly, the next step involves defining the above mentioned categories to determine what information fall into which category. For a coding frame to work properly, and thus enhance the reliability and validity

of its results, several conditions should be fulfilled with regard to what a category includes and when it should be applied (Schreier, 2012; Krippendorff, 2013).

When developing and describing the categories, there is a trade-off between conciseness (reliability) and a loss of meaning (validity). Therefore, we balance these two factors. On the one hand, we make our categories as specific as possible, which ensures that the coding frame is being consistently applied. We do this by constructing a general coding manual with coding instructions and defining our coding frame rigorously according to the principles laid out by Schreier (2012) and Krippendorff (2013). This is exemplified in Table 1. We design our categories to be mutually exclusive, which means that there is a clear distinction between every category and that no code entry, i.e. piece of information, should occur in more than one box. That is, we strive to minimize the amounts of overlaps (Krippendorff, 2013). Additionally, we strive to fulfill the measure of unidimensionality, which means that each subcategory must be a part of the main category and that this connection is clear (Krippendorff, 2013). This reduces intercoder confusion and enhances reliability.

On the other hand, we are concerned about the loss of meaning and exclusion of chains of causation, as these are paramount to our hypotheses building in Chapter 4, as explained earlier. To avoid this, we include qualitative notes in the coding scheme and note chains of causation whenever relevant. Furthermore, we construct our coding frame so that it is exhaustive, which means that the coding frame does not exclude any relevant information due to the lack of descriptive terms or categories (Schreier, 2012). We ensure this by having an additional residual category for new arguments, which increases the validity of our results. Please confer the appendix for our general coding instructions (Table 19), an overview of our categories (Table 20), and the coding manual including complete definitions of our 210 categories, subcategories, and sub-subcategories (Table 21).

Table 1 – Example of Coding Frame Categories
The table summarizes the guidelines we employ for constructing and defining our categories. The guidelines applied are inspired by Schreier (2012) and Krippendorff (2013). Please confer the appendix for the complete coding manual.

Literature guidelines	Example from coding manual
Name: Not overly long and descriptive and not overly short and cryptic	**Name:** Mention of the recent financial crisis
Brief description and when to apply: Single-word designations for categories – proper nouns – are easy to understand but they are often inadequate for recording more complex meanings. If the coder is familiar with the categories, a few sentences will suffice. Also, a description of coding values if the category is present	**Brief description and when to apply:** Used when the article mentions the financial crisis of 2008 in its content. The actual effect of it is not important here, just that the article acknowledges its presence. 0=Not present 1=Present
Indicators/special attention: Synonyms and words that are likely to appear in the presence of the given argument. Use indicators from a sample of texts	**Indicators/special attention:** Recent, 2007, 2008, 2009, credit crunch, subprime, financial crisis, overall, mortgage crisis, slowdown, severe, U.S., recession
Example: Positive and/or negative examples to illustrate the use of the category: Use examples from articles if possible	**Example:** 'Firms across the board were affected by the recent financial crisis'

Literature guidelines	Example from coding manual
Decision rule (if needed): Guides the coder in cases of doubt or if there is a fear of overlapping categories	**Decision rule (if needed)**: Articles before 2007 cannot have a '1' in this category

Overall, we design what Schreier (2012) describes as a coding frame of medium complexity with several dimensions (main categories) and two levels (subcategories). As content analysts often face the trade-off between reliability and complexity, we find that this is a suitable balance. To further reduce the risk of confusion, we do not take ranking into consideration, which is how much emphasis an article puts on a given argument. Note that our assessment of complexity is based on the assumption that coders are familiar with financial theories in general and cash holdings in particular.

As mentioned, the entire process of constructing the coding frame is an iterative process, which gradually optimizes our coding frame. We do this through several pilot coding phases. Our first pilot phase is conducted on a sample of 10 articles followed by an evaluation. Afterwards the same process is applied to 20 further articles before a final coding frame is found. The rationale behind this sample size is that researchers face a compromise between variability and practicability in trial runs. Thus, as a rule of thumb, 10%-20% constitute a reasonable trade-off (Schreier, 2012). As recommended by Krippendorff (2013), we use our entire coding frame during the pilot phases and a random sample of our media articles.

Throughout the pilot phases, we meet and discuss our different coding of categories and overlaps. This process was facilitated through the extensive use of notes described earlier. The result is that through this iterative process, categories are deleted, reorganized, redefined, and added until we arrive at an optimal coding frame (Krippendorff, 2013). Hence, through our discussion and disagreements, we are able to improve our coding scheme in terms of its scope, reliability and validity.

3.2.3.2 Measures of reliability and validity
The sixth step and a major focus in our content analysis is that the results must be both replicable and trustworthy. To test if this is the case, measures of reliability and validity are considered. We will now discuss each concept in turn and see if the numerous means we have taken to ensure a high degree of reliability and validity are sufficient.

Reliability is a criterion that is typically used when evaluating the quality of a specific instrument, e.g. a coding frame (Schreier, 2012). Thus, it deals only with the actual research instrument and is not concerned with the world outside the research process (Krippendorff, 2013). For content analysts to stand on solid ground, different members of a designated community must concur on the readings and interpretation of a given text, using the same instrument (Schreier, 2012). Recall that we ensure this through a rigid construction of the coding frame and trial runs followed by continuous discussions.

When testing the reliability of a coding frame, two methods are important. The first method relates to consistency and involves a comparison of codings across time. This means that the same person codes the same sample of material twice, but at different times. Thus, one of us conducts two similar codings three

weeks apart on a sample of 10% of the articles. By comparing the codings, we calculate the coefficient of agreement of the intracoder reliability. This is defined as the number of units on which the coder agrees divided by the total number of units of coding. We reach a ratio of 0.96, indicating high reliability.

Intersubjectivity is stronger and better indicator of reliability and involves comparisons across coders to see if they independently of one another reach similar results. We do so by comparing our independent codings on a sample of 8% of the articles and calculated a coefficient of agreement of the intercoder reliability on 0.86. Please see Table 22 in the appendix for intra-reliability and inter-reliability coefficients of agreement scores for each coding category. Thus, on the basis of these two different measures of reliability, we believe that our analysis stands up to the test of reliability.

After having establishing that the coding frame has been consistently applied, we now turn our attention towards validity, which concerns the quality of this coding frame. High validity indicates that a given research instrument actually captures what it is supposed to and represents the concepts in the research question. That is, high validity ensures that the results reflect the real world (Neuendorf, 2002).

Two validity aspects are crucial in qualitative content analyses, namely face validity and content validity (Schreier, 2012). Face validity is a very simple form of validity mainly used to assess the validity of data-driven categories. It refers to the extent to which it *looks* like the coding frame measures what it is supposed to, as judged by the researchers. Thus, face validity is established if researchers accept the findings because they make sense and are believable. This calls for a coding frame that is not underdifferentiated and provides an exact description of the material (Schreier, 2012). We ensure this in two ways. First, during our coding and pilot phases, we pay attention to high coding frequencies for residual categories. If these occur, new categories are constructed, such as 'investor pressure'. Second, we look at whether high coding frequencies are present for one category. If so, we split the category in two or include additional subcategories, as in the case of the precautionary motive. This assures an appropriate level of abstraction of our results that increases the validity (Schreier, 2012).

Content validity relates more to concept-driven categories and is examined to ensure that existing categories cover all dimensions of a concept. The literature recommends the use of an expert opinion to assess the coding frame and determine if it is sufficiently valid. We do this by letting one of us design the frame and letting the other review it subsequently. Also, recall that we also include an additional residual category to be certain that we capture all relevant information. This leads to higher content validity.

Additionally, we look into types of triangulation and use methodological triangulation to further test our validity. This involves comparing different studies on the same topic. If the conclusions from each of the methods are the same, then validity is established (Guion & Mcdonald, 2011). To do so, we compare the results of our media analysis, where applicable, to the results of our literature review and establish that many comparable results exist. However, as the media analysis provides novel insights, this is only possible for some results.

3.2.4 Analysis

Only when sufficient consistency is achieved may the coding rules be applied to the entire corpus of texts (Schreier, 2012). Thus, after we test and retest our coding frame several times to reach what we consider an optimal coding instrument, we conduct the main analysis. This means that we apply our optimal coding frame to the sample of 113 articles and insert the entries into a data matrix (Schreier, 2012). Please see Table 23 in the appendix for the frequency statistics of our coding categories.

Upon a complete analysis of the articles, we transform the codings of the disorganized data matrix into results in order to interpret and eventually communicate them. To achieve this, we use of a mix qualitative and quantitative measures.

We mainly use a qualitative strategy of presenting our findings as this is most suitable to describe ideas or theories and not only categories (Schreier, 2012). We do this by organizing the findings by cases that are commented on by a body of continuous text. The cases are presented with various text matrices, which are groupings of texts and quotes in tables often used to describe a small number of cases in depth (Schreier, 2012). As it is common practice to use typical quotations to justify conclusions, this is our main choice (Schilling, 2006). To substantiate the cases, we add quantitative counts that are especially useful for creating an overview of a change in importance of variables (Krippendorff, 2013). However, drawing conclusions from quantitative measures only would lead to distorted findings and not uncover new chains of causations, as will be shown later. It is also for these reasons that we do not produce statistical significance measures of the counts in line with Zhang & Wildemuth (2009). In sum, we use the advantages of both qualitative and quantitative to present our findings in the next section.

3.3 Results

We now turn to the results of our media analysis. We start by providing a short description of our sample. Thereafter, we will illustrate how the media portrays corporate cash holdings post-crisis. This serves as the foundation for the following section, which presents and discusses the main motives for holding cash, as portrayed by the media. Last, we will briefly mention which topics the media did not focus on, although they were mentioned in the literature review.

3.3.1 Sample description

Starting with sample composition, we note that the vast majority (105) of our sample data come from newspaper articles, which are also the target of our analysis. The sample also includes a small amount of blogs (7) and a video (1) found via Factiva, although Schreier (2012) adds that one should be more skeptical towards blogs. Still, the reason for including blogs is that we reckon that new chains of causation or motives may appear in these.

Moving on to the sources of our sample, Figure 2 shows that the intended practical angle in our relevance sampling is evident through the high number of professional CFO publications. What is also evident is that renowned business newspapers and magazines constitute a large part our sample, which arguably adds credibility to the results. Again, please confer Table 18 in the appendix for a complete list of sources.

Sources of Articles
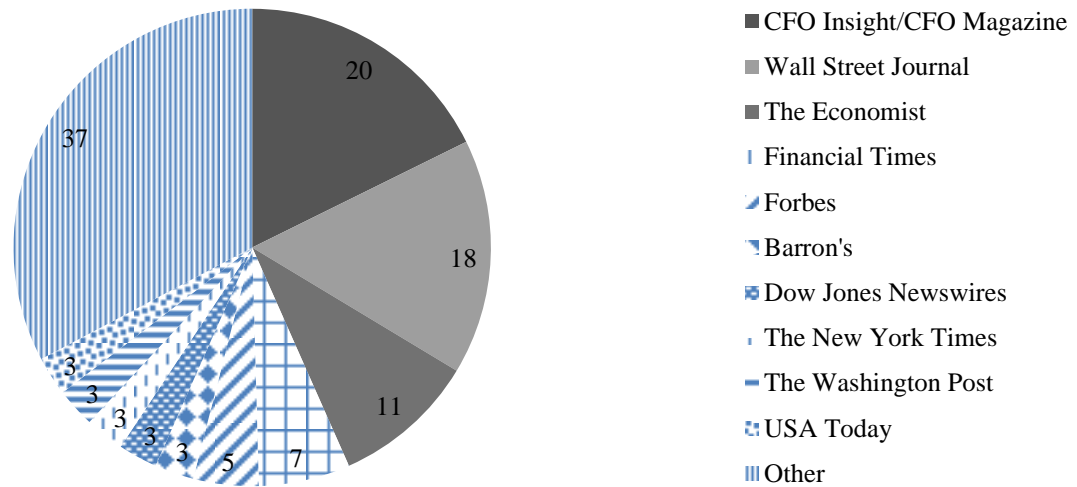
Figure 2 – Sources of Articles. The figure summarizes the sources of our sample of 113 media publications. The 'other' category is mainly comprised of various larger news sources such as Bloomberg or Investor's Business Daily. In total, we have 44 different sources. Please confer table Table 18 in the appendix for a complete list of sources.

Since we ultimately strive to form hypotheses about U.S. firms in general, it is important that our sample articles focus on these. This can be confirmed by Figure 3 and Figure 4. Note that, generally, our figures allow for double counting. Figure 3 shows that 94% of our articles cover the U.S., implying that the geographical focus of our sample matches our research agenda. Figure 4 adds that the same is true for the subject of our articles, since 93% of articles describe firms in general. Interestingly, when dissecting the 'specific' categories in Figure 4, there is a high coverage of the technology sector, which is mentioned 74% of the time a specific industry is mentioned. In accordance, when an article refers to a specific company, this is often either Apple (21%) or Microsoft (20%). This is arguably because the media reports that the technology industry holds a high amount of the overall cash holdings and, as we will return to later, because these two firms hold part of their cash reserves abroad. Overall, however, the articles cover U.S. firms and industries in general, which is in line with our intention.

Geographies Covered by Articles
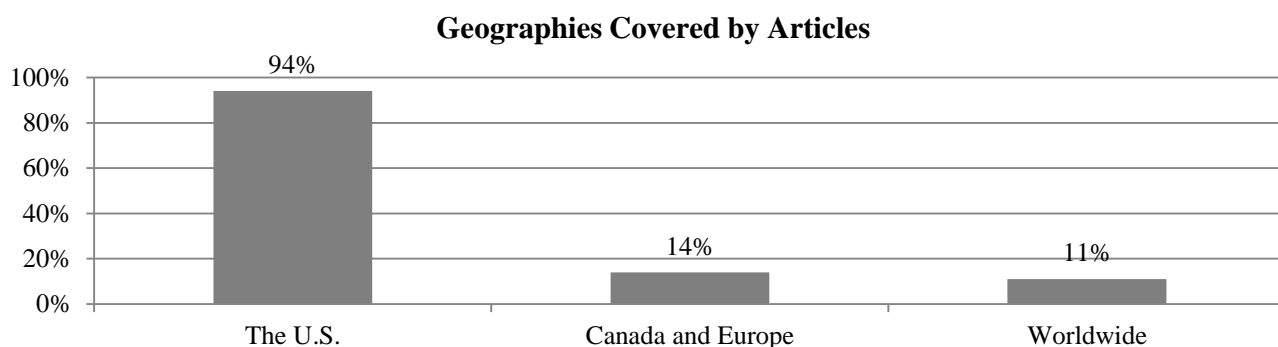
Figure 3 – Geographies Covered by Articles. The figure summarizes the geographical coverage of our sample articles. Double counting is possible and the same article may therefore describe U.S. firms and firms in other countries.

Companies Covered by Articles
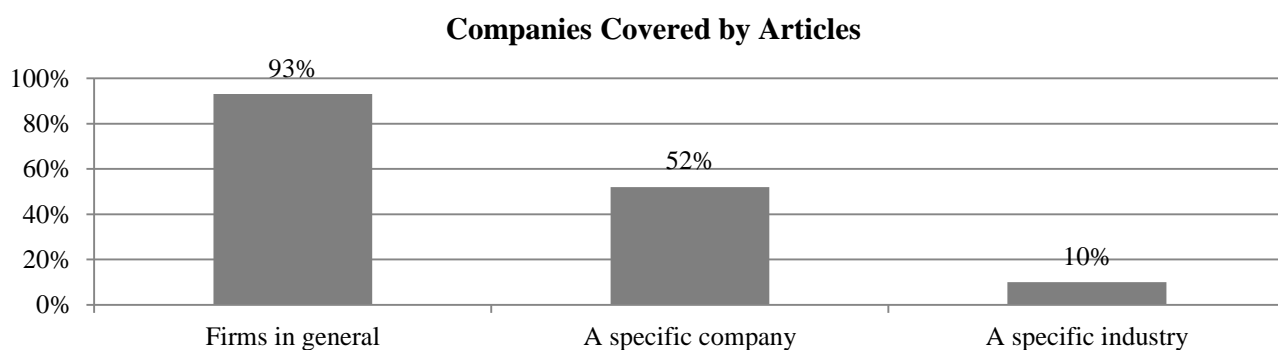
Figure 4 – Companies Covered by Articles. The figure summarizes the coverage of our sample articles with respect to their subject of investigation. Double counting is possible.

Articles Explicitly Citing Subject Matter Experts
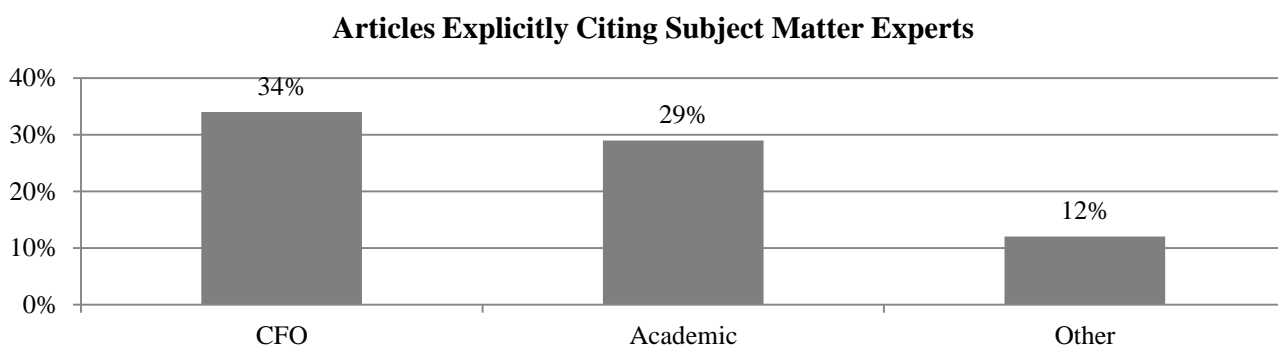
Figure 5 – Articles Explicitly Citing Subject Matter Experts. The figure summarizes the origin of explicitly cited expert opinions in articles. The 'other' category is mainly comprised of financial analysts and investors. Double counting is possible.

We also argue that most articles provide thorough and well-argued investigations. This can for instance be seen from the number of articles that explicitly cite subject matter experts. Figure 5 shows that just over a third of our articles cite a CFO and about as many cite an academic. While the high number of CFO citations can be explained by our sample selection, the high number of academic citations is a bit surprising. This could indicate that the media has a relatively close connection to the academic community. Also, we find six articles that cite both an academic and a CFO. As we expect these articles to have a more objective view and a deeper insight, we pay close attention to these in terms of our analysis later on. The 'other' category mainly includes financial analysts or investors.

Finally, it is critical to note which time period our articles focus on and we have defined three separate time periods in our coding frame. Importantly, these are defined according to which time period an article actually describes rather than its publication date. This definition is based on the observation that an article published in the post-crisis period may also describe earlier time periods. The pre-crisis period includes the years from 2004 until mid-2007. During the crisis is defined as the time period from mid-2007 to mid-2009. Last, the post-crisis period ranges from mid-2009 until September 2013. As can be seen from Figure 6 below, there is a skew towards post-crisis articles. This can be explained by two factors. First, the post-crisis period includes more years than the during-the-crisis period. Second, there is an increased media focus on cash holdings post-crisis, which indicates the relevance and contemporary aspect of the topic. Since the post-crisis period is an essential part of our paper, and also the one least investigated by academia, we consider the skewed distribution an advantage.

Time Period Covered by Articles
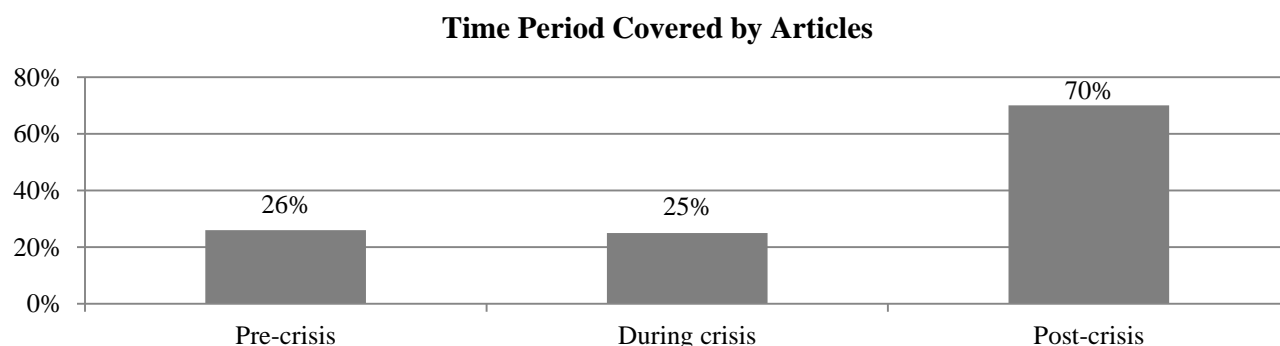
Figure 6 – Time Period Covered by Articles. The figure shows which time periods the articles examine and allows for double counting. Note that the coverage period may be different from the publication date period. Pre-crisis is defined as any time before mid-2007. During crisis is defined as the time period from mid-2007 to mid-2009. Post-crisis is defined as any time after mid-2009 up until September 2013.

3.3.2 High cash holdings post-crisis

Having established that our sample meets our research requirements, we now turn to what the media actually says. The media analysis shows that post-crisis levels of cash holdings are portrayed as being very high, and also indicates that the crisis directly affected cash holdings. In addition, we provide an overview indicating how the motives for holding cash, according to the media, may have changed over time.

Media Portrayals of Post-Crisis Cash Holdings
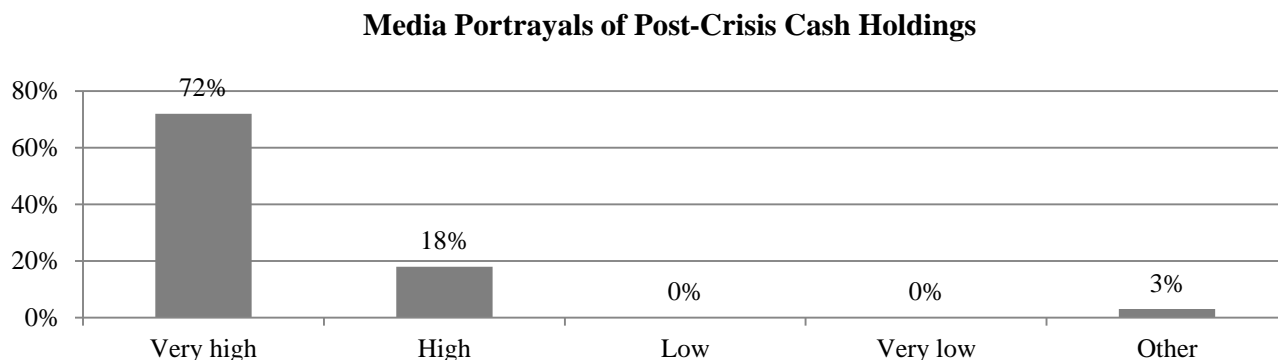
Figure 7 – Media Portrayals of Post-Crisis Cash Holdings. The figure shows how the level of post-crisis corporate cash holdings is described by media articles. Please confer the coding manual for a definition of each category. The 'other' category mainly includes article commenting on cash and cash equivalents separately.

Figure 7 shows that the majortity (72%) of post-crisis articles classify the level of cash holdings as very high. According to our coding manual, this means that the mentions of cash holdings since mid-2009 have often been described with such phrases as 'massive', 'bigger than ever', or 'historically high' as also shown in Table 2 below. In line with this, it is also interesting to note that none of the articles argue that the cash holdings are low or very low. The insight that the post-crisis level of cash holdings is very high may indicate that the crisis had an effect on U.S. firms' cash holdings. To examine this in greater depth, we note how many of the post-crisis articles refer directly to the financial crisis. This is the case for 76% as shown by Figure 8, which further suggests that the crisis directly affected cash holdings.

Post-Crisis Articles: Mentions of the Crisis
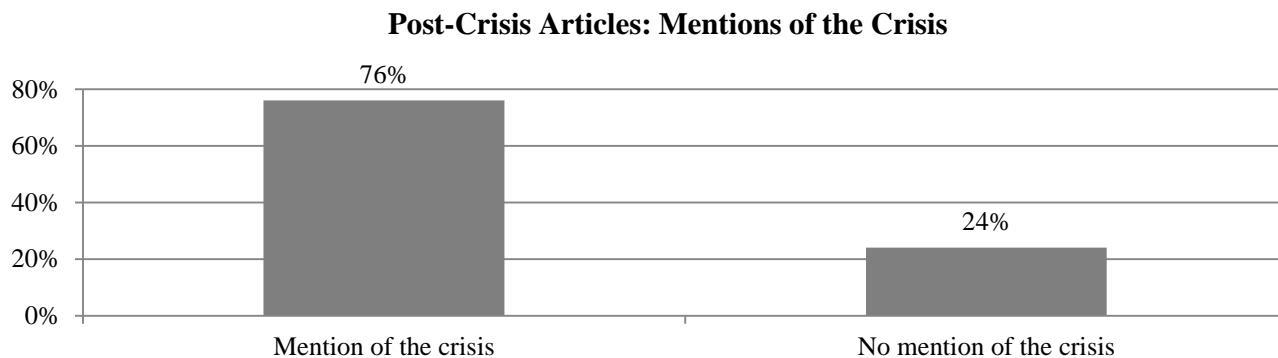
Figure 8 – Post-Crisis Articles: Mentions of the Crisis. The figure summarizes how many of the articles covering the post-crisis period mention the recent financial crisis in their content. Please confer the coding manual in the appendix for a definition of each category.

This link between the financial crisis and the post-crisis level of cash holdings becomes particularly evident when referring to Table 2. The table includes several media publications mentioning that firms have massive piles of cash and that these have increased in every quarter since the crisis (Financial Times, 2013). In accordance, one article furthermore adds that the sudden nature of the crisis directly caused firms to hoard cash (Financial Times, 2010).

Table 2 – Media Portrayals of Cash Holdings Post-Crisis
The table includes quotes from the articles describing the post-crisis level of cash holdings. The source of the quote is shown on the left. The actual quote demonstrating chains of causations and arguments are shown in the middle column and fall along the category described to the right.

Source/Year	Cash holdings since the crisis	Category
The Washington Post, 2010	*"Corporate America is hoarding a massive pile of cash. Nonfinancial companies are sitting on $1.8 trillion in cash, roughly one-quarter more than at the beginning of the recession"*	Cash holdings up post-crisis
Financial Times, 2010	*"Businesses are flush with cash. The sudden nature of the crisis in the 2008 caused companies to conserve cash"*	Cash holdings up post-crisis
USA Today, 2010	*"The level of cash being built up by companies is staggering. Companies' cash piles are bigger than ever. The $837 billion in cash and short-term investment companies hold as of Q1 is not only a record, but up 26% compared to a year ago. Companies are holding cash equal to 10% of their total value. That's up from normal levels"*	Cash holdings up post-crisis
Financial Times, 2013	*"American companies are sitting on oodles of spare cash and it is crystal clear that this cash hoard has been rising. AFP treasurers have been increase their cash balances in every quarter since the financial crisis struck"*	Cash holdings up post-crisis

To further investigate the effect of the crisis, Figure 9 illustrates how different motives for holding cash have been mentioned by the media with respect to different time periods. Recall that said periods do not refer to an article's publication date but rather to the exact time frame studied by the article. As can be seen from Figure 9, there has been a change in almost all motives during the three time periods, which substantiates the claim that the crisis has had a significant impact on corporate cash holding policies. Importantly, the figure only provides a quantitative overview of the *mentions* of said categories in articles and does therefore not provide the full picture. For instance, the figure does not explain the underlying reasons and mechanisms of the fluctuating motives in detail. To uncover these chains of causation and why cash holdings are so high post-crisis, we will therefore now to turn our main insights. Please note that we will refer back to Figure 9 several times during the next section.

Media Portrayals of the Causes of Cash Holdings by Time Period

■ Pre-crisis ■ During crisis ■ Post-crisis
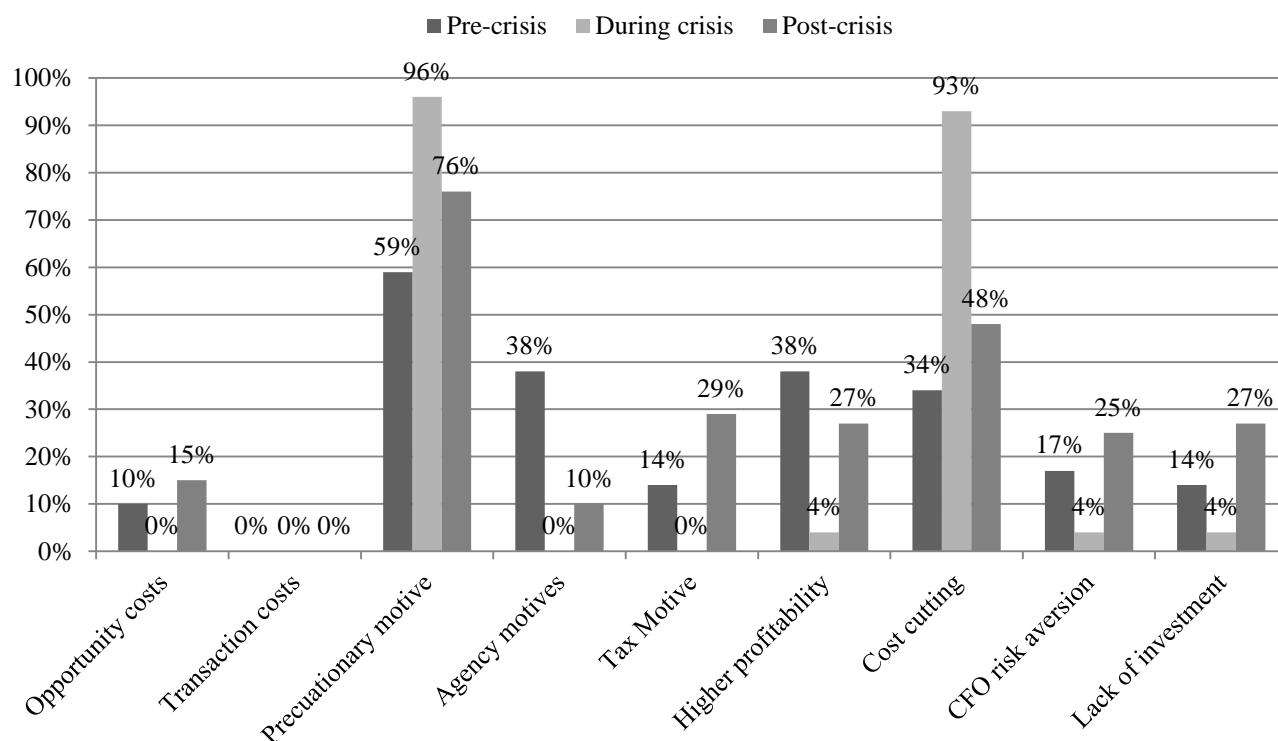
Figure 9 – Media Portrayals of the Causes of Cash Holdings by Time Period. The graph summarizes corporate motives for holding cash during a given time period as described by media articles. The percentages are calculated as the total number of articles covering a specific time-period divided by number of articles mentioning a specific motive during that time period. Please confer the coding manual in the appendix for a definition of each category.

3.3.3 Main insights

The results of our media analysis reveal a media focus on three dominating motives affecting a firm's level of cash. We coin the first two 'a shift in attitude' and 'stacking dry gunpowder' and show that these two findings are often cited by the media as explanations for the post-crisis increase in cash holdings. In addition, we present a novel motive that may limit cash holdings, which we call 'a public outrage constraint'. We will now discuss each insight in turn.

3.3.3.1 A shift in attitude

The first explanation for the post-crisis increase in cash holdings portrayed in the media can be attributed to what we coin a shift in attitude. The roots of the shift in attitude can first and foremost be traced to what the media denotes 'a new normal'. This is shown through Table 3, which presents articles that either explicitly use the term 'a new normal' or explain the phenomenon in other words. Importantly, the new normal category was only added during the coding process, since the literature review did not mention this phenomenon.

Table 3 – Media Portrayals of the New Normal

The table includes the most relevant quotes from the articles coining the term 'a new normal' and describing it. The source of the quote is shown on the left. The actual quote demonstrating chains of causations and arguments are shown in the middle column and fall along the category described to the right.

Source/Year	A new normal	Category
CFO Magazine, 2009	*"The vast majority of finance executives anticipate what some refer to as a new normal meaning that CFOs do not expect their companies to return to business as usual after the economy recovers. That is, responding to new competitive challenges and dealing with new (and generally unwelcome) regulation"*	New normal
The Wall Street Journal, 2012	*"The question is what is the new normal. I am not sure if the last ten years of leverage is a benchmark for the future, so that's why I would tend to hold more cash to keep my flexibility in my own hands rather than be dependent on banks, who might not be around next time"*	New normal
The Globe and Mail, 2013	*"Large cash balances are a 'new and necessary normal' for North American public companies. One CFO revealed that 'institutions are willing to lend at very good rates and that the future economic environment is uncertain. Therefore, we beef up our balance sheet to put our organization on a solid footing for tougher future times'"*	New normal
CityAM, 2013	*"There are good reasons to believe that elevated levels of cash piles are the new normal"*	New normal
The Wall Street Journal, 2010	*"In the aftermath of the Financial Crisis, there are worries about financial markets: A longer-term behavioral shift might be possible where CFOs have realized a new importance of liquidity"*	New importance of liquidity
CFO Magazine, 2011	*"More than 40% of CFOs say they wish their companies had more cash, even though 30% say they hold somewhat or substantially more than they would hold under normal market conditions"*	Uncertain environment
Financial Times, 2012	*"The cumulative impact of the shocks of the last five years may now have scarred, and scared, company executives to such a degree that they have become addicted to their cash security blankets"*	Scarred by the crisis
The Wall Street Journal, 2013	*"Treasurers might have a bit of post-recession stress disorder and want to hold higher levels of cash than previously. A lot of firms had problems accessing capital markets and might therefore take their time before spending"*	Scarred by the crisis

These articles present evidence that firms' cash levels are a new and necessary normal due to a general increase in uncertainty of the overall economic environment (The Globe and Mail, 2013). It is thus argued that firms are permanently scarred from the past crisis and suffer from a post-recession disorder (The Wall Street Journal, 2013). This, together with a vast amount of current and future uncertainty, has made firms raise their cash holdings to higher levels than what they would under normal market conditions. One article then concludes that the past is not a proper benchmark for firms' current and future level of cash (The Wall Street Journal, 2012b). That is, a new normal level of cash holdings is seen as a response to a new normal level of uncertainty.

The phenomenon of a new normal can also be seen when referring back to Figure 9, showing the overview of motives mentioned by the media across time periods. Interestingly, the figure shows an increase in mentions of the precautionary motive from the pre-crisis to the post-crisis period. The graph also shows that mentions of the precautionary motive remain dominant through all periods. Thus, to see which exact factors have changed, we dissect the precautionary motive into its subcategories for each period as shown by Figure 10.

Media Portrayals of the Precautionary Motive by Time Period

■ Pre-crisis   ■ During crisis   ■ Post-crisis
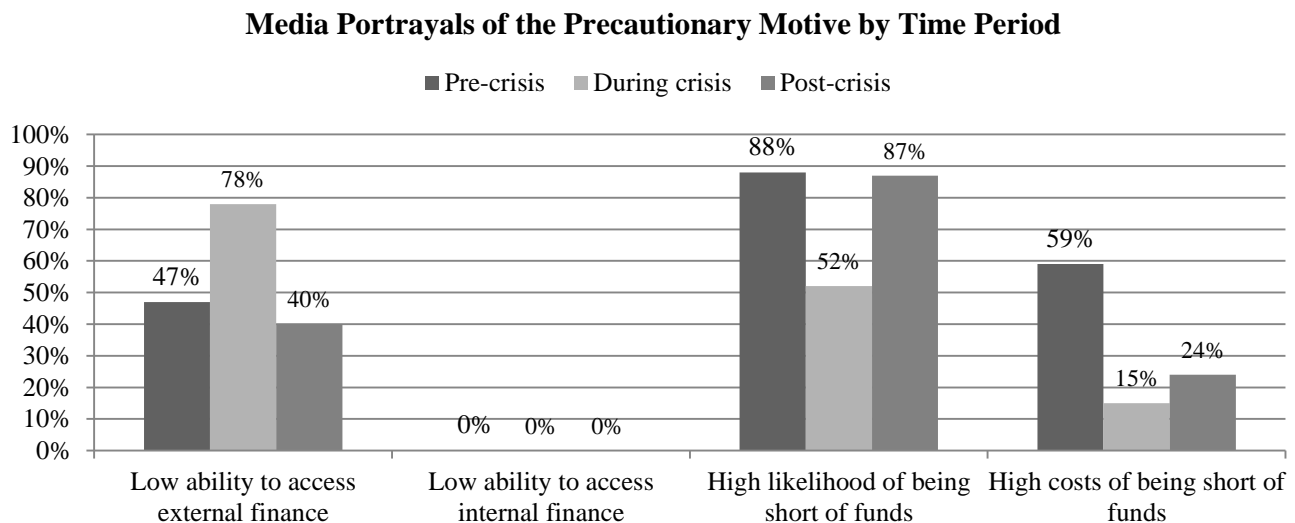
Figure 10 – Media Portrayals of the Precautionary Motive by Time Period. The graph shows the composition of subcategories of the precautionary motives across time as described by media articles. Please confer the coding manual in the appendix for a definition of each category.

Several noteworthy pieces of information appear from this figure. Concerning the pre-crisis period, both mentions of the likelihood and costs of being short of funds prevailed. This happened as firms initially were nervous in the wake of the IT-crisis and later, as the environment turned more stable, became more worried about being able to exploit investment and acquisition opportunities (The New York Times, 2004; CFO Magazine, 2006). During the crisis, the media principally focused on firms' low ability to access external finance. Although the environment was very uncertain as well, we argue that the media focus on this because it was the most imminent and easily observed effect. Regarding the post-crisis period, the focus on firms' inability to access external finance fell but was still mentioned in 40% of the articles. More remarkably, however, the mentions of the fear of being short of funds again increased rapidly. This must then be the main source of the new normal, which we aim to understand. To do so, we separate the post-crisis subcategory 'high likelihood of being short of funds' into its sub-subcategories as shown by Figure 11 and include Table 4. These two in combination describe where the uncertainty stems from.

Post-Crisis Articles: Sources of Uncertainty
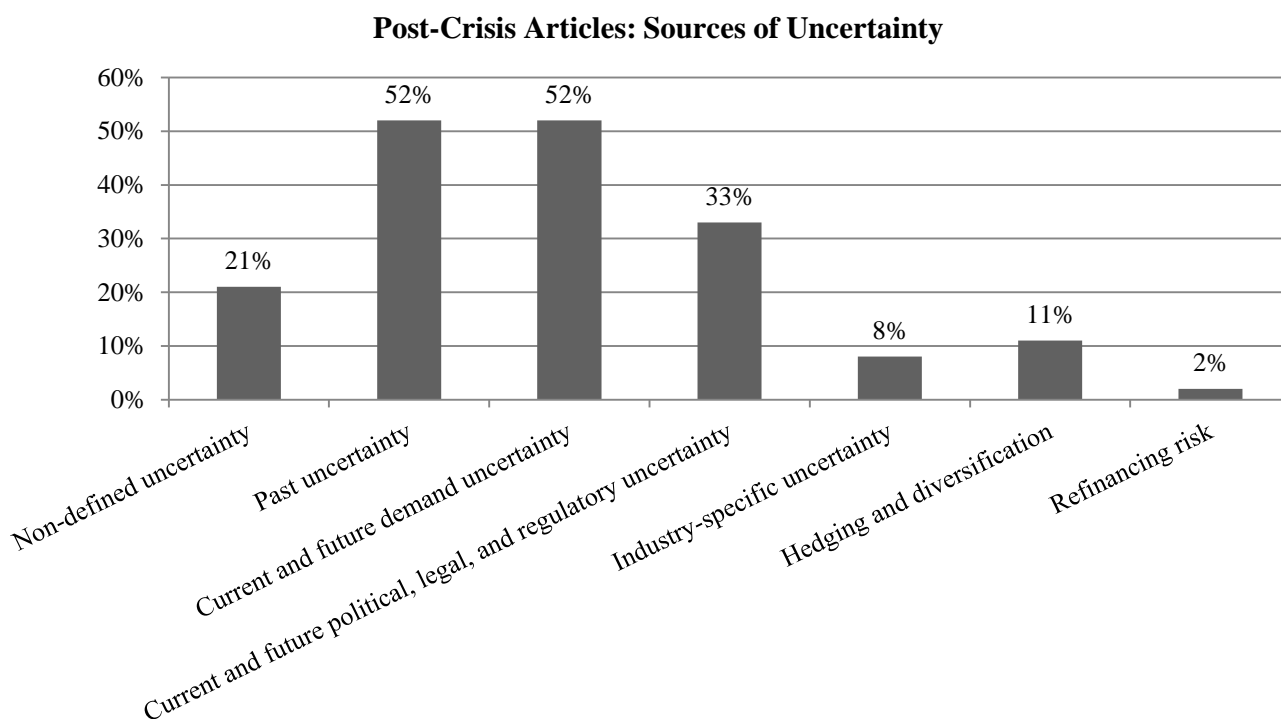
Figure 11 – Post-Crisis Articles: Sources of Uncertainty. The figure shows a further segmentation of mentions of the precautionary motive. It presents the subcategories of 'likelihood of being short of funds' post-crisis as described by articles covering the post-crisis period. Please confer coding manual in the appendix for a definition of each category.

Table 4 – Media Portrayals of Sources of Post-Crisis Uncertainty

The table includes the most relevant quotes from the articles explaining where the new normal of uncertainty stems from. The source of the quote is shown on the left. The actual quote demonstrating chains of causations and arguments are shown in the middle column and fall along the category described to the right.

Source/Year	Sources of post-crisis uncertainty	Category
CFO Magazine, 2009	*"One CFO commented: 'Accessing credit at a predictable price, I don't expect to see those days for quite some time'"*	Fear of future access to finance
The Wall Street Journal, 2010	*"Even larger companies faced the threat that they wouldn't be able to access funds"*	Fear of future access to finance
The Economist, 2010	*"When banks are in bad shape they cannot provide lines of credit. Evidence suggests that they invoked covenants in lines of credit more often than they usually do and refused to honor or roll over lines to some of their corporate clients. The revolving credit lines have proved a thing of the past and bond markets cannot be relied upon to be always open in these troubled time"*	Credit lines
The Atlanta Journal, 2011	*"There is an environment of tight credit and a lack of credit lines. Many firms have brought up cash levels 'til where they had a credit line before'"*	Credit lines

Source/Year	Sources of post-crisis uncertainty	Category
CFO Magazine, 2010	*"Following the crisis, CFOs put a premium on liquidity and safety, building a 'fortress' balance sheet"*	Past uncertainty
USA Today, 2010	*"Managers are being overly conservative until they're positive the crisis is over. They save money for a rainy day and don't want to be caught in a bind like many were when credit markets froze in 2007-2009. People didn't realize how rainy it could get"*	Past uncertainty
The Atlanta Journal, 2011	*"The current level of economic uncertainty is higher than at any time I can remember in this period with unemployment on the rise and uncertain future consumer spending"*	Current and future demand uncertainty
City AM, 2013	*"Companies are worried about the future demand and that the economy hits the rock again and cash flows suddenly collapse"*	Current and future demand uncertainty
Market Watch, 2011	*"The financial conditions are today worse than they were prior to the crisis in 2008. The fiscal deficits have exploded and the political system in US and Europe has become dysfunctional. Also we see inflationary government policies, high unemployment, social and income disparity etc.: thus, corporations are hoarding cash out of concern that slow global economic growth will slam profits"*	Political, legal, and regulatory uncertainty
Financial Times, 2012	*"The oft-mooted explanation of anxiety over the looming 'fiscal cliff', not to mention the still shaky global economy, seems credible as an explanation for high the cash holdings"*	Political, legal, and regulatory uncertainty
The Economist, 2012	*"Companies face an environment with weak demand, high unemployment, consumers under pressure from austerity and higher commodity prices combined with the threat of the Eurozone Crisis. In addition to this, the fear of excessive regulation and the upcoming U.S. election affect firms"*	Political, legal, and regulatory uncertainty

These findings boil the uncertainty, as described by the media, down to four main sources. First, coming out of the crisis, firms feared for their access to future financing. This occurred as banks were reluctant to lend to firms and in particular smaller firms. At the same time, credit lines could not be relied upon and some firms chose to elevate cash levels to where they had had their credit lines before (The Atlanta Journal, 2011). These two factors were more prevalent immediately after the crisis. Second, past uncertainty still affects firms, as mentioned earlier (USA Today, 2010). Third, consumer spending is low and unemployment is high in the aftermath of the crisis, which make firms uncertain and pessimistic about future demand. Last, uncertainties about future corporate tax treatments and in particular worries over the U.S. fiscal cliff have further amplified the uncertainty. Hence, according to the media, these four factors in combination represent the abnormally high riskiness and uncertainty in the economy that has been coined a new normal.

The media asserts that the consequence of the above has been a shift in the attitude of CFOs, reflected in increased risk aversion and changed perceptions of the opportunity costs of cash holdings. This is, once again, indicated by Figure 9. It can be seen that mentions of CFO risk aversion and opportunity costs by the media increase from pre-crisis levels of 17% and 10% to post-crisis levels of 25% and 15%, respectively.

During the crisis both factors are negligible. It should be noted that although related to the precautionary category, the category 'risk aversion' is directly concerned with mentions of actual CFO behavior. Accordingly, Table 5 elaborates and includes explicit mentions of altered CFO behavior revolving around risk aversion. It shows that the risk aversion is reflected by the observation that many CFOs fear losing their jobs and keep high levels of cash to prevent this. Also, many CFOs moved funds from short-term investments to actual cash during 2009-2010, as the capital market returns did not justify the risk. This is directly connected to CFOs' view on opportunity costs post-crisis and that they are satisfied incurring opportunity costs as long as they have safety in the form of cash (USA Today, 2012). This is also because opportunity costs, i.e. interest rates, are historically low post-crisis. Last, it should be noted that the most recent articles point towards that this risk aversion may be temporary rather than permanent in nature. Thus, as some firms are slowly starting to invest again, this could indicate a rising confidence about the future of the economy and that opportunity costs are starting to play a role once again. However, as most of these investments are in very safe assets and many firms are still clinging to their cash, the main conclusion of this part of the media analysis is that the crisis is hardly forgotten (CFO Magazine, 2013).

Table 5 – Media Portrayals of CFOs' Risk Aversion
The table includes the most relevant quotes from articles exemplifying the increased CFO risk aversion post-crisis. The source of the quote is shown on the left. The actual quote demonstrating chains of causations and arguments are shown in the middle column and fall along the category described to the right.

Source/Year	CFO risk aversion	Category
Financial Times, 2012	*"They don't believe that capital market returns justify the risk. Also, a change from buying long-term instruments to ultra-low short-term debt is seen. Lastly, the opinion is that bank deposits are relatively safe due to the federal deposit insurance corporation"*	Cash over investments
Financial Times, 2013	*"Before 2007, most companies kept their spare cash at modest levels - and corporate treasurers put this into capital market instruments and banks to earn a reasonable return. But these days, companies are stuffed with unused cash. CFOs are running from capital markets too. In 2006, corporate treasuries placed a mere 24% of their funds in banks. But last year, the proportion of funds in banks doubled and this year it rose to above 50%"*	Cash over investments
CFO Magazine, 2010	*"You can miss your earnings target and survive, but you can only run out of cash once"*	Fear of losing job
CFO Magazine, 2013	*"If I miss my return by two or three basis points, I still have my job. If I lose money, you probably wouldn't be talking to me"*	Fear of losing job
The Australian, 2009	*"Very low interest rates mean low punishment for hoarding cash. The cash provides operating and strategic flexibility. We're very happy to have it sit in our bank account and earn modest interest"*	Low opportunity costs
USA Today, 2012	*"Never mind that this [hoarding] is producing negative returns, it does at least promise to return the cash. And that is important in a world where 98% of treasurers are now also telling the AFP that their top priority is to protect their money, not earn yield. Getting a low return on cash is the second-worst thing companies can do. The worst thing is to waste cash"*	Low opportunity costs

Source/Year	CFO risk aversion	Category
The Wall Street Journal, 2012	*"Some firms turn to safer corporate bonds but illustrate that low-risk is still the key. 'We're not trying to hit a home run here. Some ABS yield as little as 0.5% but more than treasuries yielding 0.2%'"*	Recent trend
CFO Magazine, 2013	*"Firms are struggling to find investments that justify taking on risk in the face of uncertainty. One CFO adds 'we are generally more cautious'"*	Recent trend
The Globe and Mail, 2013	*"CFOs have allocated more of their portfolio to corporate and municipal bonds, ABS and other kinds of fixed-income securities that carry risks. Meanwhile, traditional instruments with close to negative yields, such as government agency bonds, are out of favor. The companies with billions on their balance sheets have been taking a lot more-interest rate and credit risk with their money. However, the bulk of investments are still highly conservative because some got burned during the crisis"*	Recent trend

The uncertain environment has not just affected CFOs but other stakeholders as well. This causes pressures that further intensify firms' precautionary motives to hold high levels of cash. Table 6 shows that investors, too, are nervous and perceive firms with cash holdings as safer to invest in. Interestingly, this also helps explains the general shift of media focus from the agency motive to the precautionary motive in the post-crisis period seen from Figure 9. This is demonstrated by the following quote:

> *"Investors are less concerned about the agency problem right now. An agency problem is something that puts you out of business slowly, but the lack of cash immediately puts you out of business"* (CFO Magazine, 2010a).

The same nervousness applies for banks, which are afraid that firms may not be able to repay their loans in this environment. Consequently, the banks are only willing to lend to quality businesses, which are often larger, investment grade firms (CFO Insight, 2012). Another interesting finding, shown in Table 6, is that business partners and customers are nervous as well. Hence, firms in a healthy financial condition can use a sound balance sheet as a marketing tool in order to such partners and customers (Financial Times, 2009). This provides firms with yet a further incentive to hoard cash.

Table 6 – Media Portrayals of General Nervousness
The table includes the most relevant quotes from media articles showing the increased general nervousness from various stakeholders post-crisis. The source of the quote is shown on the left. The actual quote demonstrating chains of causations and arguments are shown in the middle column and fall along the category described to the right.

Source/Year	General nervousness	Category
Ritholz, 2013	*"There is a renewed emphasis that investors may be placing on balance sheet liquidity, particularly in the aftermath of the commercial paper defaults at the end of the previous expansion. Consequently, many firms raised cash holdings to mitigate these concerns"*	Investors
CFO Magazine, 2010	*"Investors are less concerned about the agency problem right now. An agency problem is something that puts you out of business slowly, but the lack of cash immediately puts you out of business"*	Investors

The Washington Post, 2010	*"Banks are looking to lend to quality businesses, which has increased the importance of a growing balance sheet"*	Banks
CFO Insight, 2012	*"A wider gap between cash-rich and cash-poor companies has emerged. Firms that already have sound balance sheet can easier access more capital. On the other hand, this has gotten much more difficult for SMEs in a precarious cash position"*	Banks
Financial Times, 2009	*"In these circumstances, a rock-solid balance sheet is an invaluable marketing tool, without which customers and business partners will be reluctant to make 'co-investments' required to train employees or develop complimentary products"*	Customers
Phys, 2013	*"One study suggests that managers' experiences change their beliefs and preferences for taking risk. If a manager worked for a firm that had financial difficulties in the past, they will overestimate the need for cash and adopt a more conservative financial policy at the firm where they are currently employed—even if that higher level of cash is not needed for precautionary savings at this firm"*	Executives
CFO Magazine, 2010	*"Before the financial crisis, many would have viewed these levels of cash as excessive. After all, there were too much negatives involved: the cost of carry, the tax expense on interest income, the perception that firms holding too much cash were run inefficiently, and the possibility that a large of cash would attract unwelcome takeover offers. Now, however, the thinking about cash has shifted. With apologies to James Bond, the financial crisis has given CFOs a license to hold cash. The top motivation for holding large amount of cash is concerns about the overall economic environment, the need to show investors and banks a healthy balance sheet and no good option for putting cash to use according to a survey of 400 finance executives"*	Overall

In sum, the media analysis indicates that an overall uncertain economic environment has left both CFOs and other stakeholders nervous, which has given firms a so-called license to hold very high levels of liquidity (CFO Magazine, 2010a). Whereas in the pre-crisis period, too many negatives were associated with high levels of cash, such as the cost of carry and the suspicion that firms were inefficiently run, the thinking had shifted as a consequence of the crisis. Hence, in the post-crisis period, the media portrays a consensus that high precautionary levels of cash have an increased legitimacy caused by general uncertainty about the economic environment.

3.3.3.2 Dry gunpowder

The second key finding of our media analysis is that firms are stacking dry gunpowder post-crisis, meaning that they conserve cash now in order to spend it at a better time in the future. The media relates the phenomenon to that, coming out of the crisis, firms are more profitable, external finance is cheap and easy to access, and there is a lack of appealing investments opportunities.

The media argues that firms are more profitable post-crisis because costs were cut during the crisis and post-crisis period, and that revenues rebounded post-crisis.

Media Portrayals of Firms Seeking Funds Internally

■ During crisis ■ Post-crisis
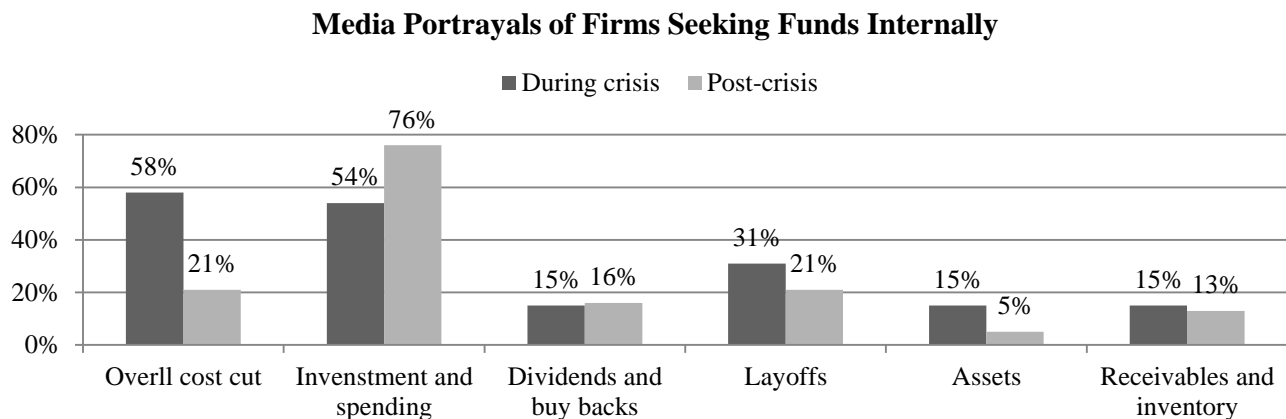
Figure 12 – Media Portrayals of Firms Seeking Funds Internally. The graph shows the subcategories of the high internal access to financing categories during and post-crisis as described by media articles. Please confer the coding manual in the appendix for a definition of each category.

Our overview graph, Figure 9 illustrates these effects. According to the media, firms seem to have cut costs drastically and became very lean during the crisis, since this was mentioned by 93% of the articles, compared to only 34% pre-crisis. This was done to offset the falling sales. Figure 12 elaborates and shows how firms mainly did this, usually by an overall cost cut, reducing investments and spending, and laying off workers. These mechanisms were summed up by CEO of GE, Jeffrey Immelt, who noted that:

> "[…] *the crisis was more of 'radical reset' than a normal cyclical crisis that forced companies to tighten their belts quickly and drastically, cutting costs and jobs while conserving cash"* (Financial Times, 2010, p. 2).

Figure 9 also shows that the process of lowering costs continued to be emphasized by the media in relation to the post-crisis period, albeit to a lesser degree, and that sales were reported to be increasing for some firms. This means that, although revenues were stable or only slightly increasing, profits often increased by a larger percentage as firms were now operating with lower costs. The higher profits, in turn, were conserved as cash by firms as indicated by the content of Table 7.

Table 7 – Media Portrayals of Firms' Increased Profitability Post-Crisis
The table includes the most relevant quotes from media articles showing that firms have higher profits post-crisis. The source of the quote is shown on the left. The actual quote demonstrating chains of causations and arguments are shown in the middle column and fall along the category described to the right.

Source/Year	Firms are more profitable post-crisis	Category
CFO Magazine, 2009	*"As credit dries up, it becomes a good time for companies to turn their gaze inward, seeking opportunities to cut capital consumption and deploy assets more efficiently. It's back to business fundamentals, hunkering down and living within your meaning. It's critical to have substantial cash reserves and not overleverage"*	Lean during crisis

Source/Year	Firms are more profitable post-crisis	Category
Financial Times, 2010	*"According to Jeffrey Immelt, the CEO of General Electric, the crisis was more of 'radical reset' than a normal cyclical crisis that forced companies to tighten their belts quickly and drastically, cutting costs and jobs while conserving cash"*	Lean during crisis
Financial Times, 2010	*"Some groups registered soaring sales but another driver of profitability has been the ability of American and European companies to eke out handsome increases in earnings even where top-line revenues were not growing as fast as before the downturn, or were in some cases even falling. The phenomenon - known as operating leverage - is typical of a post-crisis period and results from sharp cost cutting. As companies become leaner, a higher proportion of revenues drop to the bottom line. E.g. Eaton's profit rose more than sevenfold even though its revenues increased by only 16%"*	Lean during crisis and post-crisis earnings
The Chicago Tribune, 2011	*"Higher cash holdings are buoyed by higher revenues since the official end of the recession in June 2009. Also, helping cash levels were improved operating profits, partly due to layoff and other cost-cutting"*	Post-crisis earnings
Financial Times, 2012	*"Increasingly the hoard is being fed by operating cash flows as opposed to bond lending earlier. Corporate margins on both sides of the Atlantic are improbably high"*	Post-crisis earnings

A second factor that has allowed firms to stack more gunpowder is that it has been historically cheap to access external finance post-crisis. This is indicated by media portrayals of cheap and easy access to finance in Figure 13, which also substantiates that credit dried up during the crisis.

Media Portrayals of Cheap and Easy Access to Finance
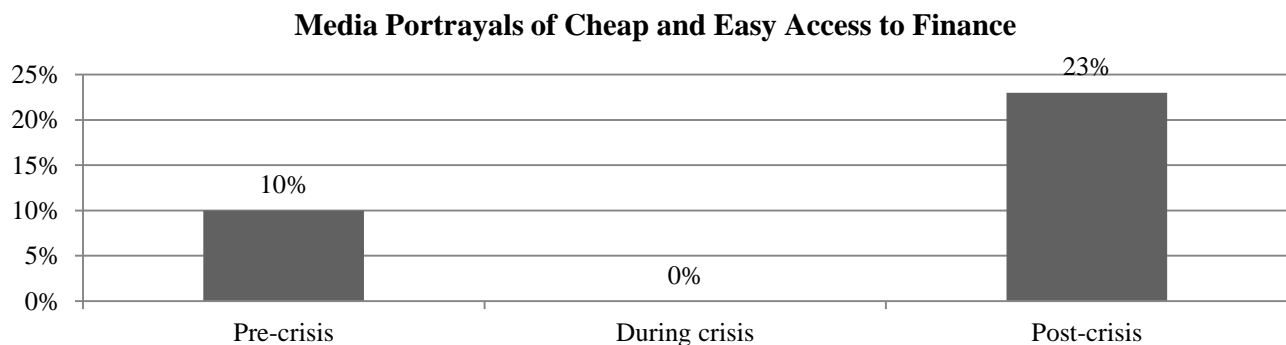
Figure 13 – Media Portrayals of Cheap and Easy Access to Finance. The figure summarizes how many articles describe firms' access to external finance as cheap and easy. Included are the explicit mentions of cheap and easy access to finance included in the category 'ability to access external finance'. Please confer the coding manual in the appendix for a definition of each category.

Table 8 expands on this and exemplifies how firms, according to the media, exploit the historic low borrowing costs in a number of ways. First, firms issue debt simply because they can and even though they may not necessarily have any good purpose for the money. Second, because debt is so cheap, dividends and

investments are often financed by debt rather than cash, which make firms' cash levels increase rapidly. And, third, firms are refinancing their existing loans at very low rates to put themselves in a better position in the future. It should be noted that these remarkably low rates apply mainly to larger, investment grade companies that have had an enormous demand for their bonds, which has reduced the rates. The reason behind this is that investors and banks are still nervous and will sacrifice a higher return for the certainty of getting their money back. For the exact same reasons, smaller firms have experienced difficulties raising capital, which has led the media to talk about a divide between the have and have-nots.

Table 8 – Media Portrayals of Cheap and Easy Access to Finance
The table includes relevant quotes from media articles showing that firms face very favorable borrowing conditions post-crisis. The source of the quote is shown on the left. The actual quote demonstrating chains of causations and arguments are shown in the middle column and fall along the category described to the right.

Source/Year	Cheap and easy access to finance	Category
Financial Times, 2010	*"Businesses are flush with cash as they reap the benefits of historic cost cutting and historic low borrowing costs"*	Historic low
The Globe and Mail, 2013	*"Record low interest rates have reduced borrowing costs, adding roughly a percentage point to American profit margins"*	Historic low
Market Watch, 2010	*"Toda"s low interest rates are a contributing factor to the big buildup in corporate cash levels. Firms are issuing debt simply because they can and parking it in the cash account with no good use for it"*	Issue debt without a specific purpose
Financial Times, 2009	*"The historic low borrowing rates are being exploited by companies. IBM recently issued a three-year bond at a low record rate of 1%. This is the story of a two-tier system of haves and have-nots. But for the haves, these are the lowest corporate bond rates in history"*	Have vs. have nots
The Globe and Mail, 2013	*"Firms are faced with historic low interest rates and are refinancing existing borrowing at good terms"*	Refinancing

While the coexistence of more profitable firms and an easy access to cheap finance explains why firms have more cash, it does not necessarily explain why they do not spend it. To understand this, we now look at the last argument, a lack of growth opportunities.

The first indication of this argument can be seen when referring to Figure 9 once more. The figure illustrates how references to firms' lack of investment opportunities have almost doubled from the pre-crisis period to the post-crisis period, from 14% to 27%. The post-crisis increase is particularly strong compared to during the crisis (4%). This claim is further augmented when looking at both Figure 12 and Table 9. Figure 12 shows the difference in how firms raise finance internally between the crisis period and the post-crisis period according to the media. While mentions of almost all parameters fall from the during the crisis to the post-crisis period, indicating a lower focus on cutting costs, the mentions of spending and investment cutting actually increases from 54% to 76%. In other words, the main source of raising internal cash has shifted from an overall cost cut to a lack of investment initiative. This mechanism is also indicated by Table 9, which shows that a lack of investments opportunities received increased media coverage. The main

reason for this is argued to be a lack of current and future demand. The current sluggish demand is prevalent through the observation that, since firms are already operating with low utilization levels, they see no reason for spending cash on expanding capacity. Additionally, the future demand uncertainty presents itself in that firms lack confidence and are pessimistic about the future, which further disincentivizes new spending decisions.

Table 9 – Media Portrayals of a Lack of Investment Opportunities
The table includes the most relevant quotes from media articles showing that firms face an environment with few appealing growth opportunities post-crisis. The source of the quote is shown on the left. The actual quote demonstrating chains of causations and arguments are shown in the middle column and fall along the category described to the right.

Source/Year	Lack of investment opportunities	Category
The Economist, 2012	*"Demand has been sluggish, which keeps businesses from investing as they already have much excess capacity"*	Lack of demand
Bloomberg, 2013	*"Companies invest less as demand is more uncertain. They feel comfortable they can meet the demand of their customers with the capacity they have"*	Lack of demand
CFO Magazine, 2013	*"The low utilization levels diminish incentives for capacity expansion"*	Lack of demand
CFO Insight, 2012	*"Companies can't figure out what to do with the cash and see no real opportunities for growth and thus currently spend money on buying back their shares and restructuring their capital instead. And you can do a lot worse than letting your cash mount up"*	No growth opportunities
CFO Magazine, 2011	*"Asked what would prompt their companies to part with some of their liquid assets, 40% of CFOs say a compelling acquisitions opportunity could spur them to spend. Another 30% say an increase in demand for the company's product or services would be the most important factor driving spending decisions. One CFO says he think his company is holding too much cash but that right now there aren't any real incentive to hove it into other investment vehicles"*	No growth opportunities
The Los Angeles Times, 2013	*"The cash accumulation is in particular happening outside America as firms see more opportunities for growth in other markets"*	Better opportunities abroad
CFO Magazine, 2013	*"Firms cannot seem to find organic growth and as a consequence turn their attention to acquisitions"*	M&As
Financial Times, 2010	*"It is as if the managements are saying they do not know how to generate growth and would rather shift the responsibility to investors"*	Leave responsibility to investors

The table also indicates that firms, according to the media, instead do a number of other things with their cash, which is confirmed by Figure 14. It is interesting to see that firms seem to spend money on both buy backs and dividends, which implies that they do not know how to generate growth and leave the responsibility to investors (Financial Times, 2010). Also, even though 23% of the articles mention that firms actually do spend money on investments, Table 9 reveals that a large part of this occurs overseas where better opportunities present themselves. Along the same lines, as firms cannot find organic

investment opportunities, they spend money on M&As both domestically and abroad. Nevertheless, the majority of the articles still mention that by far the main use of the cash is to not spend it at all and let it accumulate inside the firm.

Post-crisis: Media Portrayals of How Cash is Spent
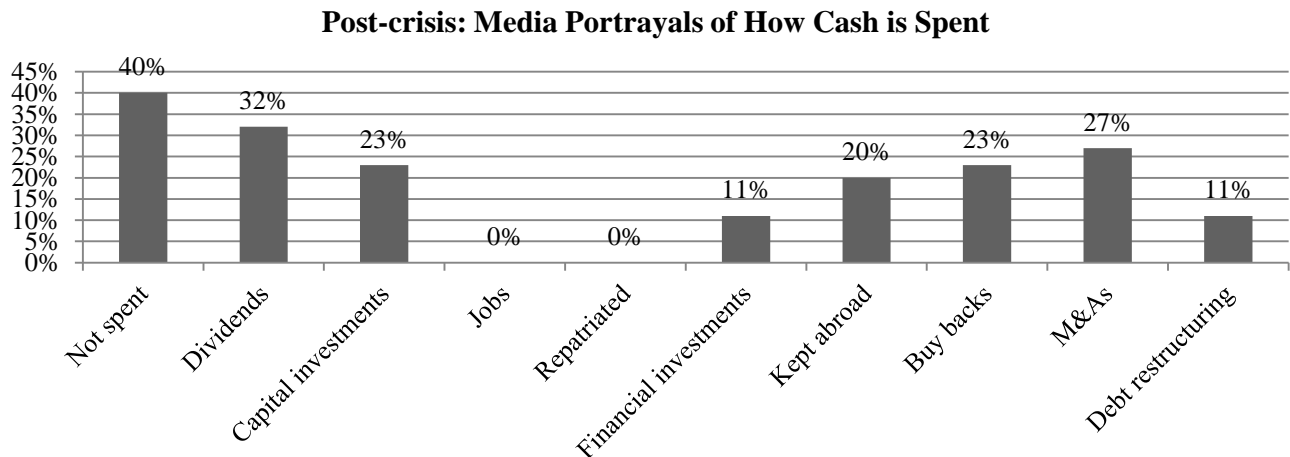
Figure 14 – Post-crisis: Media Portrayals of How Cash is Spent. The figure summarizes how U.S. firms choose to spend their cash in the post-crisis period according to media articles. Please confer the coding manual in the appendix for a definition of each category.

In sum, firms see no real opportunities for growth and instead conserve cash, as they await better future opportunities. Thus one CFO explains:

> *"Companies can't figure out what to do with the cash and you can do a lot worse than letting your cash mount up"* (CFO Insight, 2012, p. 3).

This mechanism was also summarized by the late Steve Jobs who in 2011 noted:

> *"We'd like to continue to keep our powder dry because we do feel that there are one or more strategic opportunities in the future. That's the biggest reason"* (International Business Times, 2011, p. 2).

3.3.3.3 Public outrage constraint

While the two previous findings illustrate developments that can explain the significant post-crisis increase in U.S. firms' cash holdings, we now turn to a third finding that affects firms' cash holdings more generally. We define this as a public outrage constraint, which may reduce the amount of cash firms choose to hold. It can be observed via three factors that we will now explain: Investors' pressure to make companies tap on their cash reserves, the media's portrayal of the high cash holdings as a problem, and the increased media focus on the tax motive. Surprisingly, this factor has not received much attention in the academic literature.

Many articles report that investors inflict pressure upon firms in order to make them spend their cash holdings on either dividends or buy backs (Forbes, 2013b). Specifically, investors argue that they get no

return on their stocks and that firms should return some of their cash hoards as indicated by the content of Table 10. Although not part of our original coding frame, we end up with 24 articles mentioning the presence of investor pressure, which indicates that the media paid great attention to this factor. When looking at these mentions across time periods, we see that references to investor pressure mostly occur in articles relating to the pre-crisis (28%) or post-crisis period (23%). Also, media articles during the crisis do not focus much on this issue (7%). Interestingly, the content of table 10 also indicates that the nature of the investor pressure seems to have changed over time. Whereas the pre-crisis investor pressure mostly affected firms in general, it seems that this pressure has become more targeted towards a small number of companies post-crisis. Thus, many of the post-crisis articles that revolve around investor pressure also specifically mention Apple (39%) or Microsoft (28%). This indicates that the media attention is often directed towards a few selected victims where the cash holdings seem excessive rather than justified.

Table 10 – Media Portrayals of Investor Pressure
The table includes the most relevant quotes from media articles showing that investors are pressuring firms to spend some of their cash. Such instances were found both pre- and post-crisis but not during the crisis. The source of the quote is shown on the left. The actual quote demonstrating chains of causations and arguments are shown in the middle column and fall along the category described to the right.

Source/Year	Investor pressure	Category
The Australian, 2005	*"Instead, the fact that US companies are accumulating cash at an unprecedented rate has largely been an issue for investors - who have pressured firms to return cash, with some success"*	Pre-crisis: Investor pressure
Forbes, 2013	*"Apple's cash pile has drawn the eye of Greenlight Capital's David Einhorn, who wants the company to issue dividends. Many investors see a massive cash cushion in calmer times as a waste"*	Post-crisis: Investor pressure

A second indication of the public outrage constraint is provided by the media, which generally has a negative view on high cash holdings. Figure 15 shows that this is particular so for the pre-crisis and the post-crisis period. Thus, for both these periods it is shown that around twice as many articles cite problems related to high cash holdings than articles providing counterarguments. Again, during the crisis, the opposite is true. In order to understand how exactly high cash holdings are seen as a problem both pre-crisis and post-crisis, Figure 16 presents the three reasons often referred to by the media.

Media Portrayals of Cash Holdings as a Problem by Time Period

■ Yes ■ No ■ No mention
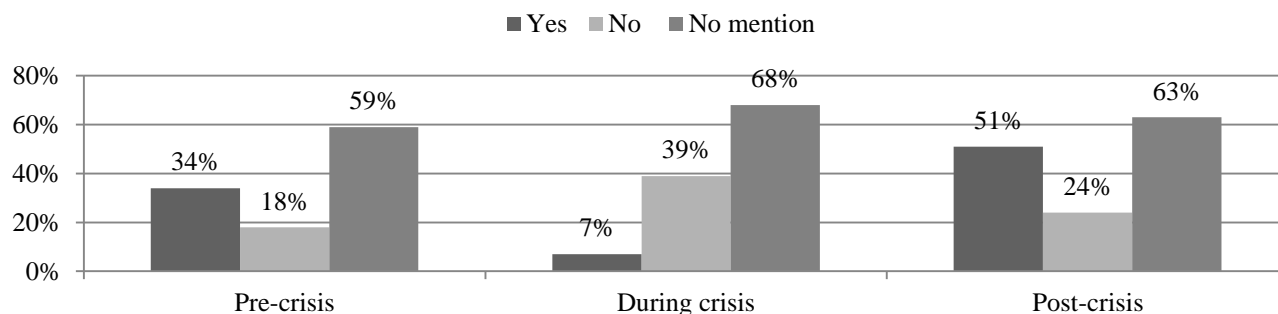
Figure 15 – Media Portrayals of Cash Holdings as a Problem by Time Period. The figure summarizes how many media articles mention problems associated with cash holdings, how many mention the opposite, and how many do not take a stance on the matter. Please confer the coding manual in the appendix for a definition of each category.

Media Portrayals of the Specific Problems of High Cash Holdings Pre-crisis and Post-crisis

■ Pre-crisis ■ Post-crisis
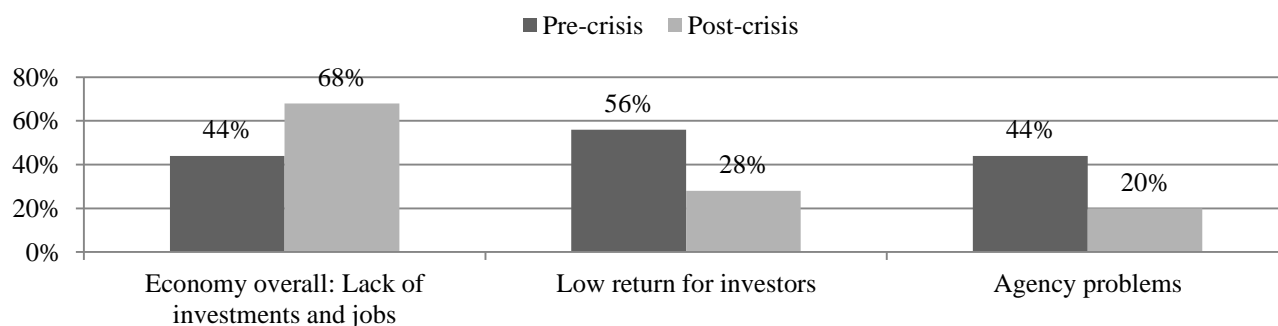
Figure 16 – Media Portrayals of the Specific Problems of High Cash Holdings Pre-crisis and Post-crisis. The figure shows the articles, both pre-crisis and post-crisis, that depict cash holdings as a problem and shows the exact reasons hereof. Please confer the coding manual in the appendix for a definition of each category.

Interestingly, the figure indicates that there has been a change in focus of the media from pre-crisis to post-crisis. Post-crisis, the main problem cited is that high cash holdings hurt the economy overall. This is mentioned by 68% of the articles mentioning problems and also shown in Table 11 below. Thus, many articles point to Keynes' paradox of thrift and argue that as long as firms do not spend or invest, no jobs will be generated and the economy will suffer (The Economist, 2012). The general public, politicians or economists typically voice these concerns. However, other problems are often cited by the media pre-crisis. In this period, the media often claimed (56%) that the idle cash generates a low return for investors, which also confirms the investor pressure discussed above. Similarly, the media attention on the last problem, agency problems, was more prominent pre-crisis than post-crisis, as seen by the decrease in mentions from

44% to 20%. Such articles mostly describe the fear that management is becoming too comfortable and spend cash on unwise acquisitions or bonuses, which is not in the interest of shareholders.

This indicates that the problems mentioned by the media pre-crisis were more related to firm-specific problems, and in particular relating to concerns regarding bad management of firms. Post-crisis, however, the problems cited were more related to the economy at large, where firms were blamed for slowing down the recovery of the economy.

Table 11 – Media Portrayals of Cash Holdings as a Problem
The table includes the most relevant quotes from the media articles demonstrating the problems associated with high cash holdings often voiced by the articles. Such instances are both pre- and post-crisis but not during the crisis. The source of the quote is shown on the left. The actual quote demonstrating chains of causations and arguments are shown in the middle column and fall along the category described to the right.

Source/Year	Cash holdings as a problem	Category
The Economist, 2012	*"If companies and households attempts to save hard even as the state tries to borrow less, the economy will falter. But if companies, in particular, stop hoarding cash and instead use it to invest and hire, the government could safely cuts its borrowing without choking recovery"*	Economy overall
Market Watch, 2011	*"Corporations are hoarding cash out of concern that slow global growth will slam profits. Such a misery attitude can become a self-fulfilling prophecy"*	Economy overall
The New Yorker, 2004	*"Shareholders lose, too. They give companies their money in order to get a good return on it. If a company can't find anything fruitful to invest its cash in, it should give it back to the shareholders so they can put it to productive use"*	Low return for investors
The Wall Street Journal, 2005	*"Managers may hoard cash to guarantee their own emoluments or to expand an 'empire', even though a payout would be more in the shareholders' interest. They may use corporate funds to overpay other employees and avoid the headaches of labor strife. Or they may use corporate funds for nonprofitable ventures or 'social' purposes, justified as part of the corporation's 'social responsibility', but not in the shareholders' interest. We can, and do, see all of these things happening today and in greater amounts than ever"*	Agency problems

The last piece of evidence supporting the public outrage constraint can be found by once again referring to Figure 9. The figure shows how the mentions of the tax motive have more than doubled from 14% pre-crisis to 29% post-crisis. Recently, the media has argued that the corporate cash holdings kept abroad severely hamper the recovery of the U.S. economy and some have even gone as far as proposing a tax on cash holdings (The Washington Post, 2010). This is shown in Table 12. Interestingly, however, the table also shows that the media's tax indictments are often related to other factors, such as foreign growth opportunities, which infers that the relevance of the tax motive may be overstated. Accordingly, it is significant to note that no mentions of the tax motive were observed during the crisis and also that some articles leaning towards the academic community actually dismisses the tax motive (CNN Money, 2012). Last, Table 12 indicates that the media picks certain scape goats when it comes to the tax motive such as

Apple and Microsoft. This is further indicated by the observation that 34% of the articles referring to the tax motive post-crisis also mention Apple specifically. The same applies for Microsoft. Interestingly, this hints that the media choose to the same prolific victims as the investors, perhaps in an attempt to boost news value of their articles.

Table 12 – Media Portrayals of the Tax Motive Post-Crisis
The table includes the most relevant quotes from the media articles related to the tax motive. The source of the quote is shown on the left. The actual quote demonstrating chains of causations and arguments are shown in the middle column and fall along the category described to the right.

Source/Year	Post-crisis: The tax motive	Category
The Washington Post, 2010	*"As much as two-third of corporations' excess cash is held outside the U.S. to avoid the repatriations taxes and the mobilization of that cash hoard can prove critical to reviving the economy. Therefore, the potential effect of a temporary 2% tax on corporations' 'excess' cash holdings should be considered"*	Tax on excess cash
The Los Angeles Times 2013,	*"The amount overseas reflects the relative strength of most emerging market economies over the last few years and the negative tax consequences of permanently repatriating money to the U.S."*	Foreign growth opportunities
Forbes, 2013	*"Several factors, including the high tax cost of repatriating the money, have pushed companies to sit on it abroad. Based on better overseas growth and domestic cash consumption, we expect overseas cash balance will continue to grow unless tax laws encourage U.S. companies to repatriate the money"*	Foreign growth opportunities
CNN Money, 2012	*"Even though Republicans claim that this could be a reason, a study by three finance professors, Pinkowitz, Stulz and Kahle, find no support for the tax argument"*	Dismissal of tax motive
The Washington Post, 2010	*"Microsoft is reluctant to repatriate the money because it would get a huge corporate tax bill"*	Mention of Microsoft
The New York Times, 2013	*"Apple may wait to repatriate its earnings as a tax relief is possible down the road"*	Mention of Apple

In sum, our media analysis reveals what we coin a public outrage constraint, which may add a dimension to why managers choose a given level of cash holdings. We find that the public outrage constraint applies to firms in general in the pre-crisis period. During the crisis and early post-crisis, however, we see a significant decrease in media mentions of investor pressure, media citations of problems related to high cash holdings, and media references to the tax motive. This is particularly true during the crisis where almost no such references were observed. These findings add to the observed acknowledgement of the new normal of uncertainty by the media and investors. Consequently, it seems that the threshold for the public outrage constrained may have been elevated as a consequence of the crisis, i.e. there is an increased acceptance of high cash holdings by external stakeholders. More recently, the media has renewed their attention on the tax motive. However, these indictments are often aimed at a few prolific companies. Furthermore, recent criticism of high cash holdings is aimed at problems for the economy at large, rather

than inefficient management or wasteful use of cash. Hence, managers are likely to experience less external pressures to abandon their high cash holdings post-crisis.

3.3.4 Motives that were not mentioned by the media

While the media has had a clear focus on the findings just described, some factors have received little or no attention. Nonetheless, this could bring along important insights as well and we identify two such factors.

At first it seems that the media paid more attention to the easily observable motives for holding cash than the deeper theoretical motives. For instance the divide often described in the academic literature between constrained and unconstrained firms in regards to performance and investment level has received very little attention from the media. Even though we allowed for such mentions in our coding frame, only very few mentions were observed. The same is true for arguments explicitly referring to either the dynamic perspective or the pecking order theory of which we recorded none. One reason for this could be that the media articles face length- and time-constraints and naturally operate at a more superficial level than the academic literature.

Additionally, none of the 113 articles included any reference to the transaction costs motive during any of the periods. We argue that this could be due to two factors. First, other factors' prevalence overshadowed a focus on the transaction costs motive. Second, and more importantly, the argument that firms need a certain amount of money to conduct its business may simply be too obvious to write about.

3.4 Chapter summary

This section describes the methodology and results of our media analysis. We argue that content analysis is most suitable for our research agenda. Using relevance sampling, we reach a final sample of 113 articles that we analyze according to our coding frame. We build our coding frame and categories through a mix of the relevant concepts from our literature review and new insights that we add along our pilot coding phases. These categories and their application are thoroughly described in a coding manual. Also, reliability and validity of our results are key concerns to us. We ensure reliability by repeatedly optimizing our coding frame as recommended by the literature and measure this using intra- and intercoder coefficients of agreement. Validity is dealt with by continually looking at face validity, content validity, and methodological triangulation. Through our data description we show that our sample matches our research questions. Following this, it is shown that a post-crisis increase in cash holdings of U.S. firms has taken current cash holdings to very high levels, which indicates that the crisis did indeed have an effect on corporate cash holdings.

Our results reveal that the media provides two explanations for this. The first explanation involves a shift in attitude. The shift stems from an unprecedented amount of current and future uncertainty that together with the memory of the past financial crisis has had a lasting impact. This new normal of uncertainty has lead firms in particular, but also banks, investors and customers to become more nervous and put a heavy emphasis on liquidity. The most recent evidence, however, indicates that the general nervousness may eventually be decreasing. The second explanation involves firms stacking dry gunpowder. This happens

since firms have more money post-crisis, partly as they are more profitable coming out of the crisis and partly as borrowing costs are historically low. In addition to this, there is a lack of demand and growth opportunities. This decreases the incentive for firms to spend the money and, as a consequence, they wait for better future opportunities.

Besides to the two main insights explaining the post-crisis increase in cash holdings, the media analysis suggests a third general factor influencing cash targets, namely the public outrage constraint. This adds a reason for why managers may choose to hold less cash, i.e. it is equivalent to a cost of holding cash. We observe the factor through a combination of investor pressure, a media focus on the problems of high cash holdings, and an increased focus on the tax motive. The phenomenon seems most prevalent before the financial crisis and its recent focus has mainly been on a few large companies. This further testifies to the increased legitimacy of corporate cash holdings during and immediately after the crisis.

4. Hypotheses

The two previous chapters have accounted for the theoretical body of our thesis as well as the results from our media analysis. The purpose of this section is to synthesize those chapters into hypotheses in order to create a basis for our empirical analysis in chapter four. We realize that virtually every aspect of business is likely to have been affected by the financial crisis, and we will therefore keep our focus on the most important factors identified in the preceding two parts. The result is that we have developed four hypotheses in total. The first hypothesis articulates our understanding of the general mechanisms that can explain observed cash holdings. It therefore serves as a foundation for the subsequent hypotheses, which are concerned with the interplay of said mechanisms during and after the crisis. In terms of our research questions, Hypothesis 1 therefore relates to the first sub-question, whereas Hypotheses 2-4 relate to the second.

4.1 Hypothesis 1: The determinants of cash holdings

Hypothesis 1: The financial crisis has influenced corporate cash holdings through two mechanisms; changes in targeted cash holdings <u>and</u> shock that cause deviations from targeted cash holdings.

The underlying assumption of Hypothesis 1 is that the financial crisis has indeed influenced corporate cash holdings. This is rather uncontroversial since the two previous chapters have shown that the financial crisis affected almost every aspect of the economy, including corporate cash holdings. Following this, explanations for the wide fluctuations of cash holdings have included everything from a drop in income and dearth of external finance to, later, a lack of growth opportunities and low interest rates (e.g. Financial Times, 2010; Campello, et al., 2010; Kahle & Stulz, 2013). Hence, what is clearly needed is an understanding of how these contrasting influences have interacted over time. We therefore hypothesize that observed cash holdings must be understood as a combination of two mechanisms: The cash holdings targets set by companies and shocks that cause deviations from said targets. This dichotomy has wide-ranging implications for our research because a change in cash holdings can thus be attributed to either a shock to cash holdings, a change in targeted cash holdings, or both.

Each of the two mechanisms has its roots in one of the major theories presented earlier; namely the static trade-off theory and the dynamic trade-off theory. From a static trade-off perspective, the crisis could have changed the desired level of cash holdings due to for instance a strengthened precautionary motive. From a dynamic perspective, however, unforeseen shocks related to the crisis may keep companies away from their cash holdings targets, for instance because the costs of immediately adjusting outweigh the benefits. This, in turn, brings along a period of adjustment where firms close the gap between actual cash holdings and their cash holdings target.

The key to investigating the existence and interplay of both mechanisms is the identification of factors that influence them individually. It is therefore important to realize that, like a pool of liquid, a corporate pool of

liquidity can only change if there is a flow of cash in or out of the pool. Therefore, a shock to cash holdings can only be caused by changes to in- or outgoing cash flows. Moreover, shocks to in- or outgoing cash flows should only have a temporary impact on cash holdings according to the two theoretical perspectives employed here. This is because a permanent increase in one flow (e.g. revenue) should eventually be adjusted for by an increase in another flow (e.g. dividends) in order to bring cash holdings back on target. Hence a permanent increase in a flow should not lead to higher cash holdings per se[7], but only if it proxies for some other condition that alters the cash holding target. Consequently, we can investigate the two mechanisms' impact on cash holdings through cash flow shock variables and cash holdings target variables. The latter may consist of both non-flow variables and the 'normal' level of flow variables, if these proxy for determinants of targets. This leads us to the following simplified model of cash holdings:

$$Cash\ holdings = \beta_1 \times Shock\ variables\ +\ \beta_2 \times Target\ variables$$

The equation once again highlights that observed cash holdings are an amalgam of a target component and a shock component. However, it also clarifies that each component's impact consists of two parts, namely a coefficient and variable. This leaves us with a total of four causal links in which we hypothesize that cash holdings may have been influenced by the financial crisis. These are summarized in Table 13 and will be briefly explained before we proceed with our more specific hypotheses.

Table 13 – The Determinants of Corporate Cash Holdings According to Hypothesis 1

	Variable change	Coefficient change
Target component	Change in a decision variable	Policy change
Shock component	Direct shocks to cash flows	Adjustment time change

Starting with the target component, a change in a decision variable, as the name suggests, presents itself if the input variables (e.g. OCF volatility) used to determine companies' cash holdings target have changed. This will lead to a new desired target for cash holdings. A policy change, on the other hand, indicates that the reaction to a given variable has changed. A higher coefficient for OCF volatility, for example, indicates that CFOs pay more attention to this variable when setting target cash holdings.

The interpretation of shock variables is quite different from that of target variables. Here a change in the variable, a shock, will mechanically cause a change in cash holdings. This will lead to deviations in actual cash holdings from target cash holdings that last until they have been addressed by the firm. Hence, for shocks it is a change in cash holdings that lead to adjustment by management, while for target variables it is adjustment by management that lead to a change in cash holdings. However, note that a shock to cash holdings must not necessarily be purely external. It can also be caused by a management decision not directly related to cash holdings, like a financing or investment decision, which nonetheless affects cash

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[7] The pecking order theory, of course, predicts the opposite.

holdings. The coefficient of a shock variable informs about the longevity of the effect of a shock, i.e. how much of a given shock during an accounting period is still present in cash holdings when these are reported. Hence, it is a measure of how fast or slow management has reacted to the shock, assuming that it has not been offset by other shocks.

The theoretical framework laid out here is central to answering our research question because it allows us to disentangle the opposing effects of the financial crisis. This gives rise to three distinct hypotheses on the development of cash holdings during and after the crisis. The developments of targeted and actual cash holdings for a typical firm following these hypotheses are sketched in Figure 17. We state in Hypothesis 2 that the immediate impact of the financial crisis was a shock to cash holdings, which pushed them below their target. Next, we argue in Hypothesis 3 that firms have become both more risk averse and exposed to more risk as a result of the crisis and have therefore raised their cash holdings target. We then state in Hypothesis 4 that not only did firms realign cash holdings with their new target post-crisis, but that cash holdings actually increased above target. This positive shock to cash holdings, we argue, is due to a lack of growth opportunities in the presence of recovered incoming cash flows. These hypotheses will be discussed in greater detail in what follows.

Figure 17 – Sketch of the Hypothesized Development of Cash Holdings
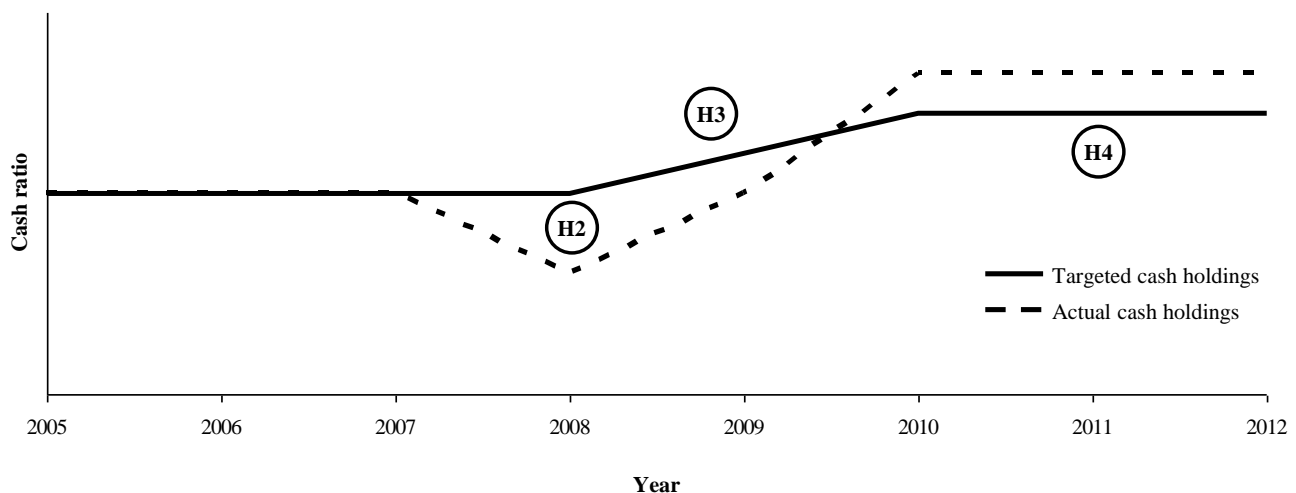
4.2 Hypothesis 2: The cash crisis

Hypothesis 2: The immediate impact of the financial crisis was a negative shock to cash holdings caused by the recession and credit crunch.

We hypothesize that companies were caught off guard by the financial crisis and saw their cash holdings deplete. This happened as OCFs dried up due to a drop in demand caused by the recession. As CFOs tried to limit the depletion of cash holdings, they turned towards external financing to fund their daily operations and, possibly, investments. However, due to the credit crunch, firms found themselves unable to access external funds, which arguably amplified the drop in cash holdings. Our second hypothesis thus states that the causal link between the two main economic effects of the crisis and the drop in cash holdings is a shock, i.e. a deviation from targeted cash holdings forced upon companies.

The three main ingredients of Hypothesis 2 have already been investigated in the previous literature. The drop in cash holdings during the crisis has for instance been documented by Kahle & Stulz (2013), PSW, and Campello et al. (2010). A drop in revenues due to a decline in demand has furthermore been found by Garcia-Appendini & Montoriol-Garriga (2013). Other studies explain how the third ingredient, the credit crunch, exacerbated the fall in cash holdings as firms failed to access alternative types of external funding. Specifically, firms faced quantity constraints on financing, higher costs of external funds, and difficulties in renewing a credit line or loan (Campello, et al., 2010; Duchin, et al., 2010).

These findings were confirmed by our media analysis where some articles note that firms faced a steep falloff in consumer demand that, together with falling prices, decreased overall sales (Investor's Business Daily, 2008; CFO Magazine, 2009). The credit drought received even more attention as 78% of the articles reporting on the crisis mentioned that firms had a low ability to access external finance.

In our empirical analysis, the shocks should be observable primarily through variable changes. These changes should occur in two main ways. First, we expect a drop in OCFs which follows from the drop in demand. Second, lower values for financing cash flow variables should be identifiable as a direct consequence of the credit crunch. Furthermore we may also be able to observe a change in adjustment time, since the credit crunch should make it more difficult to re-adjust cash holdings to targets.

4.3 Hypothesis 3: A new normal

Hypothesis 3: The financial crisis has made the precautionary motives for holding cash more important, leading to higher targeted cash holdings.

We hypothesize that the new environment of increased risk and uncertainty that firms faced as a result of the crisis made CFOs raise their cash holdings target for precautionary reasons. Many firms struggled during the financial crisis and saw their cash holdings deplete severely. Most CFOs had never suspected things to get this bad, and the vivid memories of these events were exacerbated by uncertainty about future

product demand and access to external finance. This brought along a new climate of risk which made firms set a new and higher target for their cash holdings.

We mainly find inspiration and support for our third hypothesis in the results of our media analysis. The public debate has even coined the term 'a new normal' in order to describe a significantly increased level of uncertainty in the economy. This uncertainty, we find, may have increased targeted cash holdings through three major mechanisms. First, the media analysis shows that firms perceive an increased risk of negative shocks to OCF after having just been so forcefully reminded of their impact. This causes firms to focus on safety and make liquidity a top priority. Second and similarly, it also shows that firms are concerned about their access to external finance since they just witnessed the speed at which it could vanish. Both of these factors increase the corporate demand for a cash buffer. Third, and maybe less obvious, semi-external stakeholders may also have contributed to an increase in targeted cash holdings. Customer and investors, for instance, started valuing corporate liquidity higher according to our media analysis. Likewise, board members, analysts, and other influencers, in response to the above, were more likely to approve of higher cash holdings. It is especially with respect to this last point that our media analysis is not only providing theoretical input but actually constitutes a form of evidence in and of itself. This is because we assert that interviews, the workhorse of journalism, are actually able to directly uncover the opinions, and consequently actions, of decision makers regarding cash holdings. In the furthest extent, there may even be a causal link between media articles and cash holdings if reports of the increased legitimacy of cash holdings by itself further increases their legitimacy. The relevance of this legitimacy is provided by the public outrage constraint, which shows that the outside stakeholders are concerned with corporate cash holdings.

A few pieces of evidence on increases in precautionary cash holdings can also be found in the academic literature. Kahle & Stulz (2013) point in the direction of a general increase of uncertainty to explain reductions in capex. However, research is scarce on cash holdings and the post-crisis period in the U.S. As mentioned, stronger evidence is found during earlier crises and Song & Lee (2012) show that East Asian firms increased their cash holdings in the aftermath of the crisis in 1997-1998.

Empirically speaking, we expect the hypothesized 'new normal' to be evident in a policy change, i.e. a change in the coefficients of variables associated with cash holdings targets. Following the above, leading candidates for such an observation would be variables associated with the likelihood of being short of funds and the access to external finance. Theoretically, we should also be able to observe increases in risk variables themselves. The problem, however, is that we have no access to measures of firms' expectations of the future development of risk variables, like forecasts of OCF[8].

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[8] More generally, this highlights the problem of using accounting data from the past to assess business risk of the future (or perceptions thereof).

4.4 Hypothesis 4: Dry gunpowder

Hypothesis 4: Post-crisis, firms experience a positive shock to cash holdings due to a lack of growth opportunities in the presence of recovered incoming cash flows.

We hypothesize that, post-crisis, firms' cash holdings not only recovered but actually exceeded their target. In other words, firms were stacking dry gunpowder. This was caused by two reinforcing effects. First, firms had higher incoming cash flows because they exploited the historically low interest rates and because OCFs had increased. Second, firms spent less as they seemed unable to find good investment opportunities.

Again, our media analysis was valuable in identifying the effects underlying this hypothesis, not least because the growing cash holdings of companies like Apple received considerable public attention. Starting with the inflow part of the hypothesis, three effects were at work according to the media. First, the end of the recession in U.S. meant that revenues were reproaching normal levels. Second, firms had initiated cost-saving programs during the crisis, which was also documented by Campello et al. (2010). This in turn amplified the effect of increasing revenues on OCF. And third, firms exploited historically low interest rates and issued debt without any specific purpose for the funds. This has also been referred to as the pre-borrowing motive and constitutes a complete reversal of the dearth of finance experiences just a few years earlier. We therefore conjecture that incoming cash flows were back at normal levels post-crisis, and possibly even above that.

Continuing with the shock to the outflow of cash, the media analysis indicates that firms held back on investments post-crisis since demand was sluggish, although recovering, and companies saw no real opportunities for growth. Importantly, this decrease in investments is different from the one that may have been caused by the drop in available funds described in Hypothesis 2. During the crisis, it was the unavailability of cash inflows that constrained investment outflows, thereby actually mitigating the negative shock to cash holdings. Post-crisis, it was the unavailability of investment opportunities that constrained outflows, thereby creating or amplifying the positive shock to cash holdings. Hence, our hypothesis predicts that the drop in investment outlasted the drop in incoming cash flows, which means that there must have been a drop in investment opportunities. This is also why conceptually the effect is a shock, because cash holdings were at the receiving end of a disturbance to the normal balance of in- and outflows of cash. PSW found some evidence consistent with the view laid out here. Specifically, they show that the post-crisis cash holdings increase was concentrated among the most profitable firms, which they attribute to the notion that those firms lack good investment opportunities.

Evidence confirming this hypothesis might be shown in variable and coefficient changes. The variables in questions are OCF, net debt issuance and investments, where we expect the first two to increase and the last one to decrease. We may also be able to observe coefficient changes on OCF shocks and net debt issuance because the pre-borrowing motive would suggest that adjustment times have increased since incoming cash is kept in the company for longer.

4.5 Chapter summary

In this section we synthesize the main parts of our literature review and media analysis to formulate the four hypotheses just presented. Hypothesis 1 explains, by taking both a static and a dynamic perspective, how changes in cash holdings during the crisis can be caused by changes in targeted cash holdings and shocks to cash flows. On the basis of this theoretical framework, we are able to disentangle the opposing effects of the financial crisis and formulate Hypotheses 2 to 4. Our second hypothesis states that the immediate effect of the crisis was a negative shock to cash holdings due to the recession and credit crunch. Thus, actual cash holdings fell below targeted cash holdings. At the same time, we argue in Hypothesis 3, firms were actually increasing their cash holdings target due to a 'new normal'. Hypothesis 4 then explains how firms' actual cash holdings have surpassed their targeted cash holdings in the aftermath of the crisis. These excess cash holdings, or dry gunpowder, are caused by a combination of abundant OCFs together with a lack of investment opportunities.

5. Empirical Analysis

The previous chapter synthesized our literature review and media analysis into hypotheses and we now want to test these. Our approach for doing so follows normal practice for econometric studies. Hence, we start by briefly presenting our sample and sources. We then discuss the construction and purpose of variables which we believe will help us investigate our hypotheses. Third, we will elaborate on our choice of econometric model and specification. The fourth section discusses our results for each of the hypotheses as well as the applicability of our empirical model in general. Last, we check for the robustness of our results with respect to some peculiarities of time series data. Unless otherwise indicated, all econometric discussions in this chapter are based on Wooldridge (2009) or Gujarati & Porter (2009). We use Excel for most data preparation and variable construction and STATA 13-IC for statistical analyses.

5.1 Sample and sources

We construct our sample using the S&P Compustat North America database, which is provided by Wharton Research Data Services (WRDS). Compustat offers very comprehensive information on all active and inactive publicly held corporations in the U.S. and Canada. Importantly, the information in the database is standardized which increases comparability. We apply several restrictions to the years, firms, and firm-year observations included in our sample to ensure the relevance of our statistical analyses. The restrictions follow usual practices in the literature and will be discussed in turn.

Our sample period extends through the fiscal years 1998-2012. The start-year follows PSW and allows us to include several non-financial crisis years while not extending too far in the past and thereby risk losing relevance for the financial crisis[9]. The end-year is simply the most up-to-date information available. Note that Compustat defines a fiscal year as the calendar year in which most of the months of the fiscal year are situated. Thus, if a firm's fiscal year ends in March 2008 it will be categorized as 2007. Potentially, this could cause some firms to be affected by the crisis already in 2007. However, for the vast majority of firms in our sample the fiscal year follows the calendar year. Hence, the start of the crisis is predominantly reflected in fiscal results for 2008.

With respect to companies, we include both surviving and non-surviving firms as long as they were active at any time during the sample period, but restrict our sample to those currently incorporated in the U.S. We exclude financial firms (SIC codes 6000-6999) because their business logic for holding cash is likely to be different from that of non-financial firms and because they may be subject to capital requirements. Likewise, we exclude utilities (SIC codes 4900-4999) because they are often regulated (BKS).

We furthermore require individual firm-year observations to fulfil certain criteria in order to filter for nonsensical data. Hence, we exclude firm-years with negative or zero values for sales or total assets. We also exclude firm-years with negative cash holdings but keep those with zero cash holdings. Last, we remove firms with less than five firm-year observations during the sample period because this is the

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[9] In unreported regressions, we extend the sample period to 1995. This does not affect our results.

minimum amount necessary to construct several of our variables. This leaves us with a potential Compustat sample of 6,356 firms and 66,797 firm-year observations across 15 years.

We complement data from Compustat with data from three other sources. The first two are the Federal Reserve Bank and the Bureau of Labour Statistics, which we use for macroeconomic variables. Third, we use the data from the Chicago Board Options Exchange (CBOE) for the S&P VIX. Unless otherwise stated, complementary sources were accessed through WRDS as well.

5.2 Variables

This section will discuss the variables we use for our empirical model of cash holdings. While some of these variables are already included in the well-known empirical models of BKS and OPSW, others are based on recent advances in the literature or are our own contribution. Extending earlier empirical models by jointly applying these new insights is a main contribution of our research. We will start by discussing our choice of dependent variable. Second, we will turn to explanatory variables that are not themselves a cash flow and associated with the static-trade-off perspective. Third, we will discuss explanatory variables that are a cash flow and therefore critical to understanding deviations from targeted cash holdings. Table 24 (appendix) furthermore provides an overview of all variables used in our empirical analyses as well as their Compustat data codes, where applicable.

5.2.1 Dependent variable

We use the cash ratio as our main dependent variable. It is defined as cash and short-term investments divided by total assets. This is the dependent variable used by the bulk of academic articles on cash holdings and employed by both BKS and PSW. The reason that short term investments are included is that for most intents and purposes they are equivalent to cash. This is particularly so for the important precautionary motive. A potential drawback of this aggregated variable, as discussed in the theory section, is that it adds to the problem of measuring the opportunity cost of cash holdings. However, the impediments to correctly assessing said costs are not resolved by separating the variables, which removes the attractiveness of doing so. The reason for scaling cash holdings by total assets is that we wish to remove the natural effect of firm size, i.e. that firms with more activities hold more cash. Most of our variables will be scaled by total assets to account for their straightforward relation with firm size. Scaling also has the advantage of automatically adjusting for inflation. A drawback is, however, that simultaneous drops in cash holdings and assets will at least partially offset each other.

A few alternatives to our dependent variable have been employed by other researchers, although mainly in early papers. OPSW for instance use the natural logarithm of cash-to-assets net of cash. However, doing so aggravates problems with outliers, since the denominator is reduced in proportion to the increasing nominator (BKS). Notably, in the later paper by PSW, which is written by three of the four authors of the OPSW paper, cash-to-assets is used as the dependent variable. We furthermore realize that the natural logarithm has desirable properties with respect to the sample distribution of the cash ratio. However, we generally refrain from using it because it changes the interpretation of our coefficients in way that is not

supported by theory. Hence, we only employ the natural logarithm of the cash ratio in alternative regressions (see Table 27 in the appendix).

5.2.2 Non-flow variables

The non-flow explanatory variables presented here are expected to account for effects that influence the cash holding *target* of companies. Some of the measures are standard in the literature on static trade-off theories. Accordingly, we leave variables 1, 3, 4, 8, 9, 12, 22, and 23 unchanged from BKS. All other measures come from other sources, are altered to better fit our research, or are our own contribution.

1. *Firm size* – The transaction-cost models by Baumol (1952) and Miller & Orr (1966) suggest that cash holdings relative to firm size should be decreasing with firm size, i.e. there are economies of scale in managing cash. Larger firms may furthermore have easier access to external finance, reducing the need for precautionary cash holdings (BKS). Hence, we expect firm size to have a negative effect on the cash ratio. We measure the variable as the natural logarithm of total assets in constant dollars, which is obtained by dividing total assets by the consumer price index (CPI) provided by the Bureau of Labour Statistics. We use 2012 as the base year for the CPI.

2. *Tangible assets* – The more tangible assets a company has, the easier it should be to access external finance because tangible assets serve well as collateral. Tangible assets may also lose less of their value in case of bankruptcy compared to intangible assets, which reduces the cost of financial distress (OPSW; BKS). Both factors reduce the need for cash holdings according to the precautionary motive. We follow general praxis and proxy for this effect through the ratio of net property, plant, and equipment to total assets, and we expect the variable to have a negative coefficient.

3. *Net working capital (NWC)* – As discussed under the precautionary motive, NWC can be a source of internal funds and is as such a substitute for cash holdings (OPSW; BKS). We therefore expect a negative relation with cash holdings. We measure net working capital net of cash and scale by total assets.

4. *Market-to-book* – The precautionary motive for holding cash should be increasing with the amount of growth opportunities a firm has because they increase the potential cost of underinvestment and financial distress (OPSW; BKS). We proxy for this by employing the ratio of market value of assets to book value of assets. Since only the market value includes growth opportunities, we should see a higher market-to-book ratio for firms with more growth opportunities. The measure is constructed by adding the book value of liabilities to the market value of common equity and dividing by total assets.

5. *Leverage and Leverage-squared* – Based on Guney et al. (2007), we include both a level and a quadratic form of the leverage variable because the authors have documented that it has a non-linear relation to cash holdings. We expect a negative relation with cash holdings for low to

moderate levels of leverage because these proxy for the ability to access external finance, which substitutes for cash holdings. However, we expect a positive effect on cash holdings to increase in strength for high levels of debt because highly leveraged firms have a higher risk of financial distress and will therefore hold more cash out of precaution (Guney, et al., 2007). Hence, we expect the coefficient of the level variable to be negative and the coefficient of the squared variable to be positive, as this would be evidence of a u-shaped relation between leverage and cash holdings. Whether or not the negative effect of leverage on cash holdings is simply decreasing or turns positive is dependent on the turning point of the function, which will be discussed further in the results section. Leverage is defined as long-term debt plus current liabilities divided by total assets.

6. *Debt rating* – Firms with a sound credit rating should have easier access to external finance as the rating serves to both reduce information asymmetries and indicates creditworthiness (OPSW; Acharya, et al., 2007). This reduces the precautionary demand for cash holdings. Following OPSW, we therefore construct a dummy variable that takes the value 1 if a company in a given year has a credit rating of BBB or higher (investment grade) and 0 if it has a lower or no credit rating.

7. *Debt due within 3 years* – Firms may increase their precautionary cash holdings in response to the roll-over risk of their debt (Harford, et al., 2012). We follow Harford et al. (2012) and proxy for roll-over risk through the amount of long-term debt due within the next three years divided by total long-term debt. Alternatively, the measure can also be understood as medium-term leverage and proxy for the ability to access external capital, which would cause firms to have lower cash holdings according to the precautionary motive. Several companies only report long-term debt due in one year, but not in the second or third year. Where possible, we work around this issue by taking the reported amount of long-term debt due in one year at time t_{i+1} and t_{i+2} respectively. If a company reports zero long-term debt, the variable is set to zero since naturally it can neither be exposed to roll-over risk nor have medium-term leverage.

8. *Dividends* – Dividends can be cut if need be, which makes them a potential source of internal finance. Firms that pay dividends are also more likely to be established and have easier access to external finance (OPSW; BKS). Both factors reduce the need for cash holdings under the precautionary motive. We therefore construct a dummy variable that takes the value 1 if a firm paid a common dividend in a given year and 0 otherwise. We expect it to have a negative coefficient.

9. *T-bill rate* – The T-bill rate is a measure of the risk free interest rate and is supposed to proxy for the opportunity cost of cash holdings (BKS). However, as discussed earlier, it only addresses the cost of cash in a simple sense while failing to account for the liquidity premium of short-term investments. Still, we expect it to have a negative relation to cash holdings. We define the variable as the annual average of the three-month T-bill rate published by the Federal Reserve Bank.

10. *Loan rate spread* – Tight credit markets aggravate the roll-over risk of debt (Harford, et al., 2012) and may make it more difficult to access external capital in general. Both factors should increase cash holdings according to the precautionary motive. Based on this we expect a positive relation with cash holdings. The opportunity cost of cash may, however, be increasing with the loan rate spread, which predicts the opposite relation to cash holdings. We follow Harford et al. (2012) and account for the supply of available credit through the commercial and industrial loan rate spread over the intended federal funds rate for loans greater than USD 1 million, which is provided by the Federal Reserve Bank. The data is retrieved directly from the Federal Reserve Bank's homepage[10] and we use the four-quarter moving average value at year-end.

11. *S&P VIX* – Acharya et al. (2013) show how market risk can influence the cost and availability of credit lines based on the notion that banks offering credit lines are essentially pooling firms' risk of actually needing liquidity. We follow the authors and use the annual average of the S&P VIX as a measure of this market risk. We expect cash holdings to increase with the VIX, since this should increase the cost of credit lines, which in turn reduces their substitution effect on cash holdings.

12. *Operating cash flow (OCF) volatility* – Both the precautionary motive and the transaction cost motive suggest that cash holdings should be increasing with OCF risk (e.g. BKS; Han & Qiu, 2007). We follow BKS and measure OCF risk at the industry level using the average firm-level volatility across all firms in an industry, as defined by the primary 2-digit SIC code. Firm-level volatility itself is measured as the sample standard deviation of a firm's OCF over the ten years prior to *t*. Missing values are ignored but we require at least three observations. Our measure of OCF itself follows BKS as well and is defined as operating income before depreciation less interest expense, income taxes, and dividends. The reasons for choosing this specification is that we want to measure the surplus cash flows that management can actually dispose over in financing investments out of normal operations. Variations in these should therefore directly affect investment unless the company uses cash holdings, sells assets, or finances externally (OPSW). Unfortunately, a significant amount of observations on interest expense are missing. We adjust for this by setting interest expense to zero if it is most likely insignificant. We define this as being the case when 10% of reported total debt is less than 1% of operating income before depreciation.

13. *Financing gap* – A low or even negative correlation between the availability and need for funds increases the risk of a 'financing gap', which in turn increases the need for precautionary cash holdings or other forms of hedging (Froot, et al., 1993; Acharya, et al., 2007; Duchin, 2010). Acharya et al. (2007) operationalize this intuition by proxying for the 'financing gap' with the correlation between firm-level OCF and industry-level investment expenses[11]. The lower or more negative this correlation, the higher cash holdings should be. While we utilize the general idea of

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[10] http://www.federalreserve.gov/releases/e2/e2chart.htm.
[11] The point of using industry-level measures for investment expenses is to gauge external pressures to invest, caused for instance by rapid changes in technology, and thus avoid endogeneity (Acharya, et al., 2007). Endogeneity will be further discussed in the robustness section.

Acharya et al. (2007), we adapt their 'financing gap' variable in several ways to better meet our research agenda. First, we use a more comprehensive measure of investment expenses by adding capex and acquisition expenditure to R&D expenditure before dividing by total assets for each firm-year. Any missing expenditure variables are set to zero following BKS' approach to R&D expenses. Second, we use 2-digit rather than 3-digit primary SIC codes to group industries because our sample is not restricted to manufacturing firms and because it increase comparability to OCF volatility. The industry-level investment ratio is then defined as the average firm-level investment ratio in that industry for a given year. Third, we follow Duchin (2010) and explicitly test for change in correlations over time by measuring the correlation between investment expense and OCFs over the ten years prior to *t*, rather than for the entire sample period. We require at least five observations of firm-level OCFs and industry-level investments during an estimation period.

14. *Diversification factor* – Another factor in assessing a company's riskiness is the diversification arising from having multiple business segments. Duchin (2010) goes to great lengths in investigating this relationship by producing new and very detailed measures on segment-weighted OCF volatility, investment volatility, and the correlation between OCFs and investments. Unfortunately, Compustat's data on business segments is very patchy with respect to our measures of OCF and investment, which precludes us from applying the approach of Duchin (2010) directly. Still, we want to adjust for the diversification effect through a more nuanced measure than simply counting business segments as OPSW do. Our solution is to develop a new measure of diversification, which we will refer to as the 'diversification factor' throughout this paper. It is constructed as follows. First, we compute pair-wise correlations of investments between each industry in our sample by using the investment ratio discussed in variable 13. We then use the Compustat Segments file to collect information on 2-digit SIC codes and sales for each business segment in which a company reports to be active in a given year. The diversification factor is then defined as:

$$Diversification\ factor_{it} = \sum_{k=1}^{N} w_{kt}(1 - \rho_{kt})^2$$

Where *N* is the number of business segments *k* in which company *i* is active at time *t* other than its primary business segment, and w_{kt} is the weight of segment *k* for the firm, calculated as the ratio between the segment's sales and the total sales of the firm at time *t*. ρ_{kt} is the correlation of investment ratios between company *i*'s primary industry and the industry of segment *k* during the ten years prior to time *t*. The expression $1 - \rho_{kt}$ is also known as Pearson's distance and translates correlations into an absolute distance from 1. Admittedly, the construction of the diversification factor is somewhat arbitrary and it fails to capture correlations between secondary business segments. It does, however, have some very desirable properties with respect to measuring risk diversification. First, it takes into account both the correlation and size of secondary business segments relative to the primary segment which is a clear improvement over simply counting

business segments. Second, squaring Pearson's distance increases the weight given to industries where investment ratios move distinctly different compared to those of the primary industry. Third, it assigns the uniform value of zero to the majority of Compustat firms who do not report additional business segments. Since the diversification factor increases the more diversified a firm, is we expect it to have a negative correlation with cash holdings. The reason that we compute the diversification factor based on investment expense rather than OCFs is that Duchin (2010) finds investment levels to be the relevant factor for measuring diversification.

15. *Herfindahl–Hirschman Index (HHI)* – Competitive pressures may aggravate the costs of being short of funds, which increases cash holdings under the precautionary motive. Haushalter et al. (2007) and Fresard (2010) use the HHI to measure industry concentration and test the impact of competition on cash holdings. They find a positive correlation with cash holdings which they attribute to the notion that strategic competition may be more likely in oligopolistic industries. However, competition is often thought to be more intense in fragmented industries (Lynne, et al., 2008), which would predict a negative relation. We include the measure but use Compustat instead of U.S. Economic Census data to compute the HHI. The reason is that U.S. Census data was last published for the five-year period until 2007 and that the data for the five-year period until 2012 will not be available before March 2014. Furthermore, the U.S. Census HHI is only available for manufacturing firms. Hence, while a Compustat HHI is a rough proxy, because not all firms in an industry are included in the data, it still offers superior data availability by having an annual observation frequency across all industries. We assign firms to industries based on their 3-digit primary SIC codes and use annual sales as the basis for calculating market share. We use 3-digit instead of 2-digit SIC-codes because assessing direct competition requires a higher level of granularity vis-à-vis measuring investment levels or OCFs. The HHI is then computed according to the following formula:

$$HHI_{jt} = \sum_{i=1}^{N} s_{ijt}^2$$

Where s_{ijt} is the market share of firm i in industry j at time t, and N is the number of firms in the industry. The approach to estimating the HHI presented here has been used in other financial research areas (see for instance Giroud & Mueller (2010)).

16. *Repatriation tax* – The tax costs of repatriating foreign earnings may increase the cash holdings of multinational companies. Foley et al. (2007) develop a Compustat-based measure for these costs, which is computed by multiplying pre-tax foreign income by the marginal U.S. tax rate and deducting the foreign taxes already paid. The larger value of zero and this difference is then divided by total assets. We expect the variable to have a positive coefficient. However, it is important to keep in mind that this proxy is only valid to the extent that accumulated foreign earnings are proportional to current foreign earnings (Foley, et al., 2007). We further follow the authors and set foreign pre-tax income to zero if it is not reported since companies without

significant foreign activities are not required to do so (Foley, et al., 2007). Extending this logic, we set foreign taxes paid to zero as well if the data is missing. The U.S. marginal tax rate is estimated as suggested by Graham (1996), where it is set to the statutory rate of 35% if the company does neither have a tax loss carry forward nor negative taxable income; half of the statutory rate if it has either a tax loss carry forward or negative taxable income but not both; or zero if the company has a tax loss carry forward and negative taxable income.

5.2.3 Flow variables

We will now turn to flow variables which may be associated with both shocks leading to *deviations* from targeted cash holdings and the height of *targets* themselves. Dissecting flow variables in order to investigate each of these effects separately is a main contribution of our paper and central to our hypotheses. However, doing so requires insight into the difference in interpreting regression coefficients following temporary versus permanent increases in flows. Hence, we will discuss this aspect in general before turning to the specific variables.

Consider a regression on cash holdings with only OCF and its lagged values as explanatory variables (the error term and other explanatory variables are omitted for notational simplicity)[12]:

$$y_t = a_0 + \beta_1 OCF_t + \beta_2 OCF_{t-1} + \beta_3 OCF_{t-2}$$

Now, if at time *t* there is a one-time shock, *S*, to otherwise constant cash flows the result will be as follows:

$$y_t = a_0 + \beta_1(S + OCF) + \beta_2 OCF + \beta_3 OCF$$

$$y_{t+1} = a_0 + \beta_1 OCF + \beta_2(S + OCF) + \beta_3 OCF$$

$$y_{t+2} = a_0 + \beta_1 OCF + \beta_2 OCF + \beta_3(S + OCF)$$

$$y_{t+3} = a_0 + \beta_1 OCF + \beta_2 OCF + \beta_3 OCF$$

That is, over the course of three time periods the shock disappears and cash holdings have reverted to their normal level ($y_{t-1} = y_{t+3}$). Moreover, the effect on cash holdings of a shock in the past is estimated by its respective coefficient. In this way, the coefficients here are inversely related to the speed of adjustment estimated by Dittmar & Duchin (2010) and Venkiteshwaran (2011). The reason is that the lower the coefficients are, the less of the shock is traceable at their respective lag, so the faster cash holdings have reverted to their normal level. If for instance β_1 is 0.5, then only half of the shock has been adjusted for within the first year. This impact of shocks is exactly what we want to estimate in order to investigate our deviation hypotheses.

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[12] The examples presented here are adapted from Wooldridge (2009), pp. 343-344.

The reason why we need to be careful in constructing variables becomes evident when looking at changes that are not temporary. Consider a permanent change, P, in OCF at time t. The model from above would then be:

$$y_t = a_0 + \beta_1(P + OCF) + \beta_2 OCF + \beta_3 OCF$$

$$y_{t+1} = a_0 + \beta_1(P + OCF) + \beta_2(P + OCF) + \beta_3 OCF$$

$$y_{t+2} = a_0 + \beta_1(P + OCF) + \beta_2(P + OCF) + \beta_3(P + OCF)$$

The coefficients now no longer estimate how fast cash holdings return to their old level, but by how much cash holdings are changed in the long-run due to a permanent change in OCFs. The trouble is that the only difference between the two examples provided here is the nature of the change in OCF, while the model remains identical. Thus, if we are interested in assessing the impact of disturbances we must construct our variables accordingly. That is, shock proxy variables must follow shocks as closely as possible while ideally being unchanged by permanent increases. This, in turn, leads us to the principle for the construction of our variables for OCF, R&D expense, and capex. For all of these we split the flow into a shock component and an equally weighted moving average (MA) component measured over the five years prior to time t:

$$Flow_t = Shock_t + \frac{1}{N} \sum_{i=1}^{N} Flow_{t-i}, \qquad i = 1, \dots, 5$$

or

$$Shock_t = Flow_t - \frac{1}{N} \sum_{i=1}^{N} Flow_{t-i}, \qquad i = 1, \dots, 5$$

The result is that we should be able to account for deviations from normal flows, and consequently deviations from cash targets, with the shock component. Meanwhile, the MA component controls for effects on cash targets related to the level of a flow variable. All flows are measured as the respective flow divided by total assets. Missing values for R&D or capex are set to zero. However, we require a least three firm-year observations over a five-year period to construct meaningful MA variables.

17. *OCF shock* – A shock to the inflow of cash from operations should have an impact on the stock of cash in a given company if it adjusts to changes imperfectly (Dittmar & Duchin, 2010; Venkiteshwaran, 2011). Naturally, cash holdings should move in the direction of the shock of an inflow, so we expect as positive coefficient for the variable. '

18. *OCF MA* – From a static trade-off perspective, a higher level of OCFs should reduce cash holdings due to the precautionary motive since they make it easier to obtain credit-lines or finance project

internally. The pecking order theory, on the other hand, posits that high OCFs should increase cash holdings due to companies' preference for saving internally generated funds.

19. *R&D shock and capex shock* – A drop (increase) in the outflow of cash due to R&D expenses or capex may temporarily increase (decrease) cash holdings. This should be particularly so if the shock was driven by external factors and thus unlikely to be adjusted for by the company's management in advance.

20. *R&D MA and R&D MA-squared* – We include both a level and a quadratic form of the R&D MA because we suspect that it has a non-linear impact on cash holdings. We expect a strictly positive relation with cash holdings for low to moderate levels because this proxies for the presence of growth opportunities, which should lead companies to hold more cash out of precaution (OPSW; BKS). For high levels of R&D activities, however, we expect a negative effect on cash holdings to increase in strength. One reason is that the marginal effect of growth opportunities may simply be diminishing at some point. Another is that companies with an abundance of growth opportunities may spend every available dollar on investments because the benefit of investing immediately outweighs the benefit of cash holdings. That is, the opportunity costs of cash are no longer just forgone interest but forgone positive NPV projects. We therefore predict the coefficient of the level variable to be positive and that of the squared variable to be negative. This results in concave relation with cash holdings.

21. *Capex MA and capex MA-squared* – Similar to R&D, we include both a level and a quadratic form of the capex MA. The reasoning and predictions are generally the same as for R&D. The impact on cash holdings may however be less pronounced for at least two reasons. First, capex investments can be financed externally easier because they can be collateralized (OPSW; BKS). Second, capex can usually be postponed more easily than R&D projects. Both factors weaken the need for precautionary cash holdings.

22. *Acquisitions* – Ideally, we would like to separate acquisition expenses into a moving average and a shock component as well. This is unfortunately not meaningful because acquisitions are a rare event for most companies, which means that there is no 'normal' level of acquisitions. Hence, we expect the flow variable of acquisitions to have the same effect as an investment shock and thus have a negative coefficient (BKS). The variable is defined as acquisition expense divided by total assets. Missing values for acquisitions expense are set to zero. Further, note that the variable only measures payments in relation to acquisitions and does not include share deals.

23. *Net debt issuance and net equity issuance* – Firms tend to raise capital in chunks and then spend it over a period of time. This may temporarily push their cash holdings away from their target (BKS; Dittmar & Duchin, 2010; Venkiteshwaran, 2011). The repurchase of equity is furthermore an instrument frequently used to re-adjust cash holdings if these are too high. Hence, we expect both variables to be positively related to cash holdings and we follow BKS in constructing them. Net

debt issuance is defined as long-term debt issuance minus long-term debt retirement, divided by total assets. Net equity issuance is defined as the sale of common and preferred stock minus the purchase of common and preferred stock, divided by total assets. A problem with this variable is that the value of stock repurchases is not reported for a large amount of firm-year observations in our sample. We interpret this as lack of a repurchase programme and set its value to zero because not disclosing a stock repurchase programme would make a company potential liable for insider trading.

In sum, we have presented a sizeable amount of variables that may explain variation in corporate cash holdings. To do so, we have surveyed the extant literature but also contributed with our own variables and adjustments where relevant. Importantly, we have separated shock and moving averages in order to test the predictions of our hypothesis. The goal here has been comprehensiveness while the econometric results will clarify which variables may be more or less important. Already, however, we want to briefly address two issues arising from our variables section. The first is missing data points, which are a problem because a firm-year observation must be entirely discarded if just one variable for that year is missing. If reasonable, we have therefore tried to work around this issue. This has helped us to retain our sample size and avoid a further skew towards larger companies, which are less likely to have missing observations. Some variables have, however, not been appropriate to adjust. This includes stock prices, where observations are missing for over 5,000 firm-years. In total, missing data-points reduce our sample to 44,481 firm-year observations. A second problem arises when entire variables are missing. For instance derivative use, agency problems, and credit-lines are notably absent from our list of variables. This is because firms do not report them and/or because there are no good proxies available to otherwise assess them. While we will discuss remedies for the econometric issues this causes later, it is a clear loss that we cannot assess these parameters' impact on cash holdings directly.

5.3 Econometric method

A variety of considerations are necessary in order ensure the validity and reliability of our econometric analyses. This section therefore describes our methodology for estimating our main regressions. The first step is dealing with outliers. Second, we discuss the three general econometric specifications we apply, putting particular emphasis on the unique methods available with panel data. Third, we discuss two common issues with time-series data. Following this, we address the problem of correctly estimating standard errors in panel data. We finish by briefly addressing multicollinearity, linearity, and sample attrition.

5.3.1 Outliers

Initial inspection of our variables reveals that we have severe problems with outliers that are likely to be spurious. This is because many of our variables are ratios, which make them very sensitive to low values of the denominator. Spurious outliers are a problem because they materially distort our regression analyses.

We deal with this issue by first winsorizing variables where necessary and then dropping remaining observations with extreme values of Cook's D.

Winsorizing adjusts outliers by setting all variables above a percentile to the value of that percentile. The benefit of this approach is that we decrease the magnitude of an outlier while retaining the observation and its direction (Barnett & Lewis, 1994). We always use the 1st and 99th percentile for winsorization but decide for each variable whether none, one, or both tails have to be adjusted. The decision rule has been to winsorize if the most outlying values of a variable are magnitudes larger than the value for the 1st or 99th percentile. Details on the winsorization of individual variables can be found in Table 24 (appendix). Cook's D measures to what extent a single observation influences a regression by assessing the difference in fitted values with and without the observation. The literature suggests that variables with a Cook's D higher than 4/n, where n is the total number of observations, warrant further inspection as to their validity (Chen, et al., 2003). We set the cut-off value ten times higher since we are concerned about excluding valid, as opposed to spurious, outliers. The result is that, after winsorizing, we exclude the remaining 206 most extremely outlying observations from our sample.

5.3.2 Model specification

Given the multitude of potential issues that may arise in econometric analyses, it is common practice to estimate regressions using several relevant estimation methods to assess the validity and reliability of results. All of our regression will therefore be estimated using pooled OLS, pooled OLS with industry dummies, and fixed effects regression. However, before turning to these, we will provide some necessary background on panel data and its benefits.

5.3.2.1 Panel data

Our sample consists of panel data because it extends over time and across firms. A simple multiple regression function can therefore be expressed as:

$$y_{it} = \alpha + \beta_1 x_{1it} + \beta_2 x_{2it} + \cdots + \beta_k x_{kit} + u_{it} ,$$

$$i = 1, \ldots, N; \ t = 1, \ldots, T; \ k = 1, \ldots, K$$

Where *i* denotes firm, *t* denotes time, *y* is the dependent variable, α is the intercept, x_k are the independent variables, and β_k their respective coefficients. Using panel data has several advantages over pure cross-sectional or time-series data. One of these is that panel data provides more variability and is better suited to assess dynamics of change since we can study phenomena across time and firms. Another advantage is that panel data allows us to control for unobserved effects if these are constant over time. This is important because omitting relevant variables biases the coefficients of explanatory variables if the omitted and the included variables are correlated. The reason is that a change in the dependent variable caused by the omitted variable will then be partially attributed to the correlated explanatory variable. Leading candidates to cause such a bias in our research are the use of credit lines and derivatives or the extent of agency problems. All of these have been found to be related to both cash holdings and other explanatory variables in previous research, but unfortunately we cannot control for them directly. However, to the extent that

these omitted variables are constant over time for a given firm, we can control for them through regressions methods unique to panel data.

5.3.2.2 Fixed effects estimation

Fixed effects regression is one out of three commonly used methods to remove time invariant unobserved effects in panel data. We will start by introducing it before explaining why we have chosen it over other methods. The intuition of fixed effects estimation can be understood in terms of the dummy variable method, which adds a time-invariant variable α_i for each firm to our regression model described earlier. Hence, by adding a firm-specific constant, we control for all effects that are constant for that firm over time, regardless of whether or not we can directly observe them. However, adding several thousand dummy variables to our regression is impractical. We therefore use a fixed effects transformation. The method works by time-demeaning variables for a given firm, which removes any time-invariant variables. Consider the following simplified model:

$$y_{it} = \beta_1 x_{1it} + \beta_2 x_{2it} + \alpha_i + u_{it}$$

If we average over time, the result will be:

$$\bar{y}_i = \beta_1 \bar{x}_{1i} + \beta_2 \bar{x}_{2i} + \alpha_i + \bar{u}_i$$

Subtracting the second from the first equation yields:

$$y_{it} - \bar{y}_i = \beta_1 (x_{1it} - \bar{x}_{1i}) + \beta_2 (x_{2it} - \bar{x}_{2i}) + (\alpha_i - \alpha_i) + (u_{it} - \bar{u}_i)$$

or

$$\ddot{y}_{it} = \beta_1 \ddot{x}_{1it} + \beta_2 \ddot{x}_{2it} + \ddot{u}_{it}$$

Note how the firm-specific time invariant effect, α_i, has been removed from the demeaned equation, which can now be estimated using OLS. This produces the exact same results as the dummy variable method except for R-squared, which is now based on the within transformation and will appear lower. The resulting estimators are called fixed effects estimators and are not biased due to omission of α_i.

An alternative to the fixed effects estimator is the random effects estimator. The method assumes that α_i is uncorrelated with all explanatory variables in all time periods and that it can therefore be treated as an idiosyncratic error term. This assumption is, however, highly unlikely to hold given the evidence in the extant literature on the correlation between our explanatory variables and variables that we know we have omitted. The eligibility for credit lines, for one, is highly dependent on leverage and OCFs (Sufi, 2009; Demiroglu & James, 2011). We substantiate this point empirically by using the Hausman test, which tests the null hypothesis that random effects and fixed effects estimates do not differ significantly. We strongly reject the null hypothesis due to a p-value $\ll 0.01$ and conclude that random effects are not appropriate due to the correlation between α_i and our explanatory variables. Furthermore, even if the randomness assumption would hold, both pooled OLS and fixed effects estimations would provide unbiased, although inefficient, results.

A second alternative to using fixed effects is using first-difference estimators, since this will also remove any observed or unobserved time-invariant variables. Consider our previous model in first differences which yields:

$$y_{it} - y_{it-1} = \beta_1(x_{1it} - x_{1it-1}) + \beta_2(x_{2it} - x_{2it-1}) + (\alpha_i - a_i) + (u_{it} - u_{it-1})$$

or

$$\Delta y_{it} = \beta_1 \Delta x_{1it} + \beta_2 \Delta x_{1it} + \Delta u_{it}$$

Again a_i has been removed. The problem with this approach is that it produces the wrong dependent variable so that we cannot use it to test our hypothesis. It does, however, have some other desirable properties, which is why we return to it in the robustness section.

5.3.2.3 Pooled OLS estimation

The downside of using fixed effects is that they are non-discriminatory and absorb all variables that are constant over time. The estimation method is also likely to render variables insignificant that do not vary much relative to their time-mean. This, among other things, makes it beneficial to also include a pooled OLS regression. The pooled OLS regression ignores the panel structure of our data and simply estimates one grand regression for all firms in our sample, which allows us to preserve all variation in the data. This is important because several of the variables we are interested in, particularly those that measure risk, may be absorbed by removing time invariant effects for each firm. As discussed, this comes at the cost of potentially biased coefficients. We therefore also include a pooled OLS regression with industry dummies by including indicator variables based on firms' 2-digit SIC code. This controls for unobserved effects to the extent that they are common to an industry. Hence, the pooled OLS regression with industry dummies strikes a balance between pooled OLS without industry dummies and fixed effects regression.

5.3.3 Trends and structural changes

Generally speaking, valid inference with time series regression is subject to more difficulties than simple cross-sectional regression. Two potential problems in our regressions are time trends and structural changes. Both issues are closely related to the problem of non-stationarity. A time series is said to be stationary if its probability distribution remains constant over time. On a practical level this is relevant for our inferences because, if we want to understand the impact of a variable over time, we need to rely on some sort of stability. Importantly, however, non-stationary time series can be included in a regression provided that appropriate adjustments have been made.

Many time series contain a time trend, for instance because they grow over time. Such a time trend would cause non-stationarity, since at the very least the mean of that variable would not be constant. By itself, this does not necessarily violate any of the assumptions underlying OLS regressions. However, a time trend common to two or more variables may cause a spurious regression problem. This is the phenomenon of finding a significant relationship between two or more variables simply because they are trending in the same direction. Hence, it is equivalent to omitting a common trend variable. Fortunately, adding appropriate time variables will eliminate this problem. We therefore include a linear time trend in all of our regressions

by adding the year as an explanatory variable. Moreover, we have controlled for a typical common trend in firms, namely growth of the firm, by scaling most variables by total assets.

Structural changes refer to changes in the relationship between the dependent and one or more of the independent variables over time. This is in fact what Hypothesis 3 predicts, but from an econometric perspective it is a problem to be dealt with. The reason is that a structural change clearly violates the assumption of constant coefficients. It also means that at least the dependent variable is non-stationary. We control for this issue (and test Hypothesis 3) by interacting all explanatory variables in our base regression with a financial crisis dummy variable indicating all observations after 2007.

5.3.4 Standard error estimation

A further issue in econometrics is the correct estimation of standard errors. OLS standard errors are only unbiased when the residuals are independent and identically distributed. This condition may be violated if the variance of the error term is not constant (heteroscedasticity) or if error terms are correlated across observations. While these problems in their pure form leave coefficient estimates unbiased and consistent, they result in invalid estimations of standard errors and other statistics. It is therefore important that we test and, if necessary, adjust for them.

We expect heteroscedasticity to be a problem because it is common to observe unequal variances if the subjects in a sample exhibit vastly different size, as the firms do in our sample. We test for heteroscedasticity by using the modified Wald statistic for groupwise heteroskedasticity in fixed effects models suggested by Baum (2001). It tests the null hypothesis that error variances are equal across firms. We strongly reject the null hypothesis because the p-value $<< 0.01$ and conclude that there is heteroscedasticity. We remedy the problem by using heteroscedasticity robust standard errors.

In panel data, correlation between error terms is common in two general forms. First, error terms may be correlated across time for a single firm due to some unobserved firm effect (serial correlation). Second, they may be correlated across firms for a single year due to some unobserved effect affecting all firms in that year (cross-sectional correlation) (Petersen, 2009). There have been recent advances in dealing with both issues and Petersen (2009) shows that many previous finance papers using panel data have produced severely biased estimates of standard errors by employing inappropriate estimation techniques. We therefore test for serial correlation by using a test suggested by Wooldridge (2010). It tests for serial correlation by regressing firm-specific residuals from a regression in first difference on their lagged value. We strongly reject the null hypothesis of no autocorrelation due to a p-value $<< 0.01$. We test for cross-sectional correlation by using a test specifically developed for unbalanced panel data with short T and large N by Pesaran (2004). It tests pair-wise correlation coefficients of OLS residuals from individual regressions in the panel data against the null hypothesis of independence. We reject the null hypothesis due to a p-value < 0.01[13]. Having concluded that there is both serial and cross-sectional correlation in our error terms, we correct for both by following suggestions in Petersen (2009). For our OLS regressions we do so by using the two-way clustered standard errors developed by Cameron et al. (2009). These produce robust estimates

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[13] The test was run on a significantly reduced sample due to computational restrictions in our version of STATA.

by clustering the standard errors by firm and by year, thereby allowing them to be correlated across both dimensions. Unfortunately, only one-way clustering is available for the fixed effects regressions. We therefore cluster standard errors by firm in fixed effects regression in order to account for any remaining serial correlation not eliminated by the fixed effects. While we could control for the cross-sectional correlation parametrically by including year dummies (Petersen, 2009), we refrain from doing so because it would bar us from estimating variables that are constant for all firms at a given time, like the T-bill rate, S&P VIX, and the loan rate spread. Note that all correlation robust standard errors are also heteroscedasticity robust since the former are an advancement of the latter (Cameron, et al., 2009).

5.3.5 Multicollinearity, linearity, and sample attrition

Multicollinearity refers to high correlations between explanatory variables. It is not a significant problem in econometric estimation in the sense that it does not violate any assumptions[14]. However, it can cause standard errors to be very large so we need to investigate whether some explanatory variables may be insignificant due to the presence of high multicolinearity. We do so by using the variance inflation factor (VIF), which assesses the component of an explanatory variable's standard error caused by its correlation with other explanatory variables. The VIF only exceeds 10, the usual threshold, for capex MA so we conclude that generally there is no problem with multicollinearity.

Next, linearity in parameters is a key assumption of multiple regression analyses, and failing to include the correct functional form of a variable is equivalent to omitting a variable. We therefore test for linearity by visually inspecting scatter plots with standardized residuals on the one axis and each of the explanatory variables on the other. Indeed, applying this method to early regressions formed part of the idea to include a squared term of the moving average of R&D and capex. Our final models do, however, not show any clear patterns that would lead us to suspect further non-linarites.

Another aspect of our data set is that we allow for companies to leave the sample which is called attrition. This may cause a sample selection bias if the reason firms leave the sample is systematically related to the error term. However, we do not expect this to be a significant problem since we include variables that are related to bankruptcy (e.g. leverage, market-to-book, and NWC) and even control for unobserved effects that may cause firms to leave in fixed effects estimations.

5.4 Results

Having addressed our sample, variables and, econometrics specification we now turn to the results their application has produced. We start by briefly presenting summary statistics. We then structure the main discussion of results around our four hypotheses, which will be treated in numerical order. Naturally, Hypothesis 1 receives most attention due to its centrality in our theoretical framework. Overall, we find evidence consistent with all of our hypotheses with the possible exception of parts of Hypothesis 4. We round off by elaborating on the general applicability of our model for research beyond to the financial

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[14] This excludes the case of perfect correlation between variables which, however, renders the econometric model insoluble and therefore would not go undetected.

crisis. Given the vast amount of data our statistical analyses have produced, we will focus on the most relevant results.

5.4.1 Summary statistics

Figure 18 shows how cash holdings relative to assets develop during our sample period. A dip in the cash ratio can be identified across all measures in 2008, although it is more pronounced for the mean and median of the entire sample. Measures of the cash ratio are, however, likely to underestimate the dip in cash holdings because it is partially offset by a simultaneous dip in assets (see Table 25 in the appendix). The post-crisis surge in cash holdings is clearly visible as well and, importantly, exceeds the prior drop in size. However, in this case the lower asset base may amplify the effect. In 2011 and 2012, the cash ratio falls but generally remains above pre-crisis levels. This is consistent with the development predicted by our hypotheses. It also means that the development of cash holdings, which PSW and Kahle & Stulz (2013) described as a u-shape, is in fact more of a tilted s-shape. The secular increase in cash holdings documented by BKS is furthermore evident in the first half our sample period. It can be seen from the difference between values for the whole sample and for the balanced sample that this increase is at least partially driven by young firms entering the sample, who presumably have more growth opportunities. This observation has quite general implications, since it illustrates that the economy-wide cash ratio can be influenced by several factors, as we have discussed at length earlier. Taken together, the above emphasizes the need for further investigation into the determinants of cash holdings.

Development of the Cash Ratio from 1998 to 2012
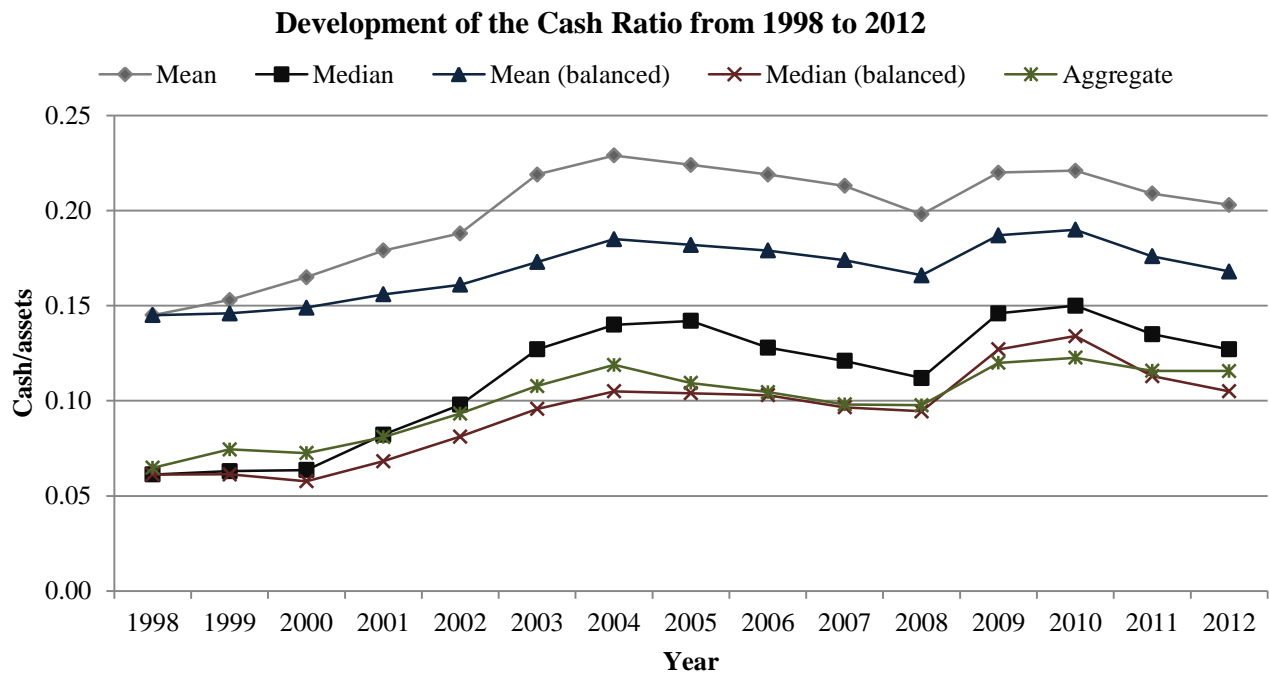
Figure 18 – Development of the Cash Ratio from 1998 to 2012. The figure summarizes the development of different measures of cash relative to assets for our Compustat sample of U.S.-based publicly traded firms from 1998 to 2012. Mean and median are computed for the entire sample as well as for the sub-sample of firms that are already in the sample in 1998 (balanced). The aggregate cash ratio is computed by dividing aggregate cash holdings by aggregate total assets for the entire sample. Tabulated results can be found in Table 26 (appendix).

Table 14 summarizes descriptive statistics on key variables. There is considerable variation in the ratio of cash-to-assets in our sample. It has an interquartile range of 27 percentage points and a standard deviation roughly the size of its mean. Furthermore, cash-to-assets and many other variables are skewed as can be seen from the differences between mean and median. The median firm in our sample has 11.3% of its assets in cash. This translates into median cash holdings of $26.2 million since the median of total assets is $232 million in 2012 dollars. Correlations of explanatory variables with the cash ratio are also presented and are not always as expected. This emphasizes the need for joint estimation with regression analysis. A full correlation table can be found in Table 39 (appendix), and we note that the correlation between shocks and there moving average is low, as intended.

Table 14 – Summary Statistics
Descriptive statistics on key variables for our Compustat sample of U.S.-based publicly traded firms from 1998 to 2012. Variables are discussed in section 5.2 and summarized in Table 24 (appendix). The total number of observations is 44,275 for all variables.

Variable	Mean	5th Percentile	25th Percentile	Median	75th Percentile	95th Percentile	St. Dev.	Correlation with Cash-to-assets
Cash-to-assets	0.201	0.004	0.032	0.113	0.299	0.690	0.221	1.00
Firm size	5.355	1.351	3.688	5.447	7.043	9.265	2.437	-0.23
Tangible assets	0.249	0.017	0.072	0.174	0.361	0.751	0.227	-0.41
NWC	-0.055	-0.501	-0.063	0.044	0.174	0.384	0.759	-0.05
Market-to-book	2.541	0.762	1.103	1.512	2.377	6.549	4.209	0.16
Leverage	0.285	0.000	0.010	0.178	0.363	0.818	0.495	-0.20
Leverage-squared	0.326	0.000	0.000	0.032	0.131	0.669	1.734	-0.05
Debt rating	0.100	0.000	0.000	0.000	0.000	1.000	0.300	-0.17
Debt due within 3 years	0.373	0.000	0.000	0.203	0.810	1.000	0.401	-0.15
Dividends	0.258	0.000	0.000	0.000	1.000	1.000	0.438	-0.20
T-Bill rate	2.711	0.099	1.160	2.045	4.835	6.152	2.094	-0.07
Loan rate spread	2.102	1.430	1.690	1.920	2.290	3.100	0.493	0.05
S&P VIX	22.134	12.807	17.536	23.315	25.750	32.693	5.981	-0.05
OCF volatility	0.471	0.051	0.129	0.284	0.605	1.640	0.563	0.17
Financing gap	0.015	-0.709	-0.310	0.030	0.348	0.695	0.430	-0.12
Diversification factor	0.030	0.000	0.000	0.000	0.000	0.188	0.116	-0.09
HHI	0.203	0.061	0.086	0.150	0.260	0.543	0.169	-0.23
Repatriation tax	0.001	0.000	0.000	0.000	0.000	0.005	0.003	0.06
OCF shock	-0.001	-0.319	-0.041	-0.000	0.044	0.354	0.391	0.05
OCF MA	-0.086	-0.764	-0.039	0.058	0.101	0.170	0.527	-0.18
Capex shock	-0.008	-0.079	-0.023	-0.006	0.006	0.058	0.045	-0.03
Capex MA	0.058	0.008	0.022	0.041	0.072	0.171	0.056	-0.18
Capex MA-squared	0.006	0.000	0.000	0.002	0.005	0.029	0.015	-0.14
R&D shock	-0.003	-0.098	-0.002	0.000	0.000	0.078	0.087	-0.09
R&D MA	0.073	0.000	0.000	0.006	0.084	0.348	0.148	0.47
R&D MA-squared	0.027	0.000	0.000	0.000	0.007	0.121	0.108	0.31
Acquisitions	0.021	0.000	0.000	0.000	0.006	0.139	0.059	-0.13
Net debt issuance	0.013	-0.111	-0.017	0.000	0.010	0.197	0.114	-0.02
Net equity issuance	0.046	-0.083	-0.002	0.001	0.012	0.374	0.201	0.27

5.4.2 Hypothesis 1

This section presents our main results in relation to Hypothesis 1, which states that differences in corporate cash holdings can be attributed to two mechanisms; changes in targeted cash holdings and deviations from targeted cash holdings. As discussed earlier, this understanding of cash holdings is the foundation we use to develop our other hypotheses. Investigating Hypothesis 1 therefore deserves special attention and we start by extensively discussing the results of our base model. Second, we investigate the impact of past shocks by extending the base model with lagged variables and find that several of these are significant. Results from both models are consistent with the existence of both target-based and shock-based determinants of cash holdings. Taken together, we interpret this as strong evidence in support of Hypothesis 1.

5.4.2.1 Base model

Regression results for our base model are reported in Table 15, Panel A. Overall the results are in line with our expectations discussed in the variable section. However, it is evident that the fixed effects estimation absorbs many variables of interest. In addition to the regression results, we also report estimates of economic significance in Panel B. For most variables, these are calculated as the predicted change in the cash ratio following a one standard deviation increase in the respective variable. Variables with a squared term, variables with a shock interpretation, and dummy variables are, however, special cases. The interpretation of variables with a squared term requires attention because the estimated impact on the cash ratio depends on the level coefficient, the squared coefficient, and the initial value of the variable. This becomes clear when recalling that the derivative of the function:

$$y = \beta_1 x + \beta_2 x^2$$

is

$$y' = \beta_1 + 2\beta_2 x$$

Therefore, in order to capture the non-linear interpretation of these variables, estimates of the change in the cash ratio due to a one standard deviation increase in x are based on different initial values of x. The 5th percentile of the variable is used for the level coefficient, whereas the 95th percentile is used for the squared coefficient. We will also discuss the turning point of quadratic variables which is given by:

$$x^* = -\frac{\beta_1}{2\beta_2}$$

For shock variables calculated as the difference from their moving average, we use the 95th percentile instead of the standard deviation in order provide a more adequate measure of shocks. We do this because most variation around the moving average is noise rather than a real shock. The same reasoning applies to net debt and net equity issuance. For acquisitions we use the 95th percentile as well because they are rare events and equal to zero for the majority of firm-years. The most meaningful interpretation of dummy variables is already given by their coefficient, which is why we do not provide a separate measure. We furthermore refrain from interpreting the economic significance of variables that are not statistically significant. As with statistical significance, fixed effects estimation also tends to absorb economic

significance. We will therefore focus on the size of coefficients from OLS regressions since we are interested in ceteris paribus effects across time and firms, rather than mainly across time within firms. Next, we will progress with a detailed discussion of flow variables and then treat non-flow variables afterwards.

As discussed earlier, the separation of flows into shocks and moving averages is central to investigating the hypothesized difference between targeted and actual cash holdings. Finding that shock proxies and moving averages have independent effects, and that shocks have the predicted sign, is therefore evidence in favour of Hypothesis 1. Starting with the coefficient on OCF shocks, we see that it is significant and the sign is as expected across all estimations. It is moderately economically significant since a shock to OCFs will change the cash ratio with about 1.5 percentage points. We interpret this as evidence that shocks are a relevant determinant of cash holdings. The results for the OCF MA, on the other hand, are surprising. The coefficient is consistently positive and both statistically and economically significant. All else equal, a one standard deviation increase in the level of OCF MA will increase the cash ratio with approximately 3.4 percentage points. Our results therefore indicate that the pecking order perspective cannot be disregarded as a determinant of cash holdings. This is interesting since it does not receive much attention by the bulk of theoretical discussions on cash holdings. The coefficient of the capex shock variable is statistically significant and the sign is as predicted. Its economic significance is comparable to that of the OCF shock variable. Again, this is evidence in favour of the shock hypothesis. The coefficient of the capex MA is insignificant for both functional forms in our base regression. However, if we run the base regression with the natural logarithm of cash-to-assets as the dependent variable (see Table 27 in the appendix), the level and the squared term become significant, their sign as predicted, and the coefficient extremely high. This may be due to a less skewed distribution of the natural logarithm of cash-to-assets compared to its normal specification. The turning point beyond which an increase in capex MA would reduce cash holdings is estimated to be about 1.2 by the logarithmic model. This value is much higher than the highest value in our regression sample, which means that it does not turn negative in practice. We therefore conclude that there is some evidence that firms increase cash holdings in response to high levels of capex, and that the effect is decreasing with the value of the variable but remains positive.

Continuing with R&D, we see that the shock variable's coefficient is statistically significant in the fixed effects estimation where it has the right sign but is economically insignificant. Strangely, it changes sign in OLS regression when using the natural logarithm of cash holdings as the dependent variable. We interpret these inconsistencies as evidence that there are time-constant unobserved effects related to R&D shocks, which influence its coefficient if they are not controlled for. This regression therefore only finds contingent evidence of the relevance of R&D shocks in relation to the mechanisms discussed earlier. The R&D MA, on the contrary, is highly significant both statistically and economically speaking, except for the fixed effects regression. The latter may be due to a relatively low time-variance of the R&D MA, which could also partially explain the insignificance of the shock variable (see Figure 23). The signs of coefficients are as expected and the turning point is about 0.6, which is lower than the 99th percentile of the R&D MA in our sample. Hence, the effect of R&D on cash holdings is not only diminishing but does actually turn negative for the most R&D intensive firms. This points to an aspect of the relationship between cash holdings and investment opportunities not previously investigated in the literature. Due to these non-

linarites, a one standard deviation change in R&D MA increases the cash ratio with about 15 percentage points for low initial values but only with about 7 percentage point for high initial values. Both constitute a large impact since the median cash ratio is only 11.3%. Finally, the coefficients of shocks due to acquisitions, net debt issuance, and net equity issuance all have the predicted sign and are statistically and economically significant. Especially acquisitions have a strong effect on cash holdings since, all else equal, cash holdings are reduced by just below half of the cash used in the acquisition. Taken together, we find that the regression results for flow variables provide evidence in favour of Hypothesis 1 and that the application of new functional forms and variable constructions is relevant.

Turning to non-flow variables, we see that results are largely in line with our theory as well and that many of the measures we add are significant. Starting with firm size, however, we actually see that it has become less significant compared to previous papers. It is merely significant for the fixed effects regression where it takes a ~240% increase in firm size to reduce the cash ratio by 1.9 percentage points. The reduction in significance is probably driven by the inclusion of the tangible asset ratio. Its coefficient is negative, as expected, and highly significant both statistically and economically speaking. Interestingly, firm size and tangible assets are the only variables where the coefficients become larger in the fixed effects regression. This points to the existence of time invariant effects related to both variables which obfuscate their 'pure' effect. The coefficient of NWC is as predicted and statistically and economically significant which is consistent with the results of previous papers. The coefficient of the market-to-book ratio is significant and the sign as expected as well, but its impact on the cash ratio is very small. Leverage and leverage-squared are very significant and the signs are as predicted. The turning point for the aggregate impact of leverage is about 3.4. This is higher than the 99th percentile but below the maximum value. Thus, the negative effect of leverage on cash holdings is decreasing and it actually turns positive for extremely leveraged firms. For most firms, however, the effect remains negative and a one standard deviation difference in leverage is estimated to result in a cash ratio that is between 12 and 9 percentage points lower for low and high base values of leverage, respectively. The coefficient of the debt rating dummy is negative and statistically and economically significant as well. Having an investment grade debt rating reduces cash holdings by approximately 5 percentage points. Interestingly, our regressions consistently produce negative coefficients for debt due within 3 years, which is contrary to the results in the paper where the measure was introduced (Harford, et al., 2012). Investigating the discrepancy, we find that it is driven by sample composition. Harford et al. (2012) only include firms with long-term debt in their sample. If we restrict our sample in the same way, we get comparable results. We thus interpret the variable as a proxy for the ability to finance externally with medium-term debt instead of as a proxy for roll-over risk. Hence, since we already control for total leverage, there seems to be a separate effect on cash holdings originating from the ability to use medium term debt compared to debt in general.

Continuing with dividends, the coefficient for dividends is negative in OLS regressions but positive in the fixed effects regression, which is similar to what BKS find. A possible explanation is that in pooled OLS regressions, dividends proxy for constant firm characteristics that ease access to external capital. These are absorbed in the fixed effects regression. Dividends are only not absorbed by time de-meaning if they are non-constant. That is, if a firm changes its dividend paying status. Hence, in fixed effects estimation, the

positive coefficient may proxy for firms that start (stop) paying dividends because they have too much (too little) cash on hand. In all cases, dividends are only moderately economically significant. The T-Bill rate is statistically significant and the sign as expected, but it is only weakly economically significant. This may be because its negative impact on the cost of cash holdings is not straightforward, as previously discussed. The loan rate spread is statistically and economically significant and has a negative coefficient. This is consistent with its role as a measure of the opportunity cost of cash holdings, for which it appears to be a better proxy than the T-bill rate. Its sign is, however, inconsistent with the roll-over risk interpretation suggested by Harford et al. (2012) as well. The S&P VIX is either statistically or economically insignificant. This may be because it is simply a too distant measure of the cost of credit lines. Recall that the variables proxies for banks' cost of offering credit lines, which in turn affects their price, which only then affects their substitution effect on cash holdings.

Regarding the variety of risk measures we have included (OCF volatility, financing gap, and diversification factor) three commonalities stand out. First, all measures are statistically significant and have the predicted sign in pooled OLS regressions. Second, they all turn insignificant in the fixed effects regression, which indicates a lack of time-variance. Third, they are only weakly economically significant. We interpret this mainly as evidence that the factors for which the variables proxy are relevant. However, it also indicates that the measures may still be too rough to capture the true riskiness, and thus variation in cash holding targets, of a business. Adding to this is that riskiness is also partially controlled for by other variables, like the debt rating. Furthermore, the diversification factor is zero for over 75% of firms, which may reduce its significance. The coefficient of the HHI is statistically significant in pooled OLS regressions and also moderately economically significant. However, the sign of the coefficient is contrary to the predictions by Haushalter et al. (2007) and Fresard (2010), but in line with more standard interpretations of the HHI's relation to competition. As with roll-over risk, this divergence in results is driven by sample composition. Haushalter et al. (2007) and Fresard (2010) confine their research to manufacturing firms (2-digit SIC codes 31-33) and we get similar results if we do the same. Hence, it appears that for firms in general, lower industry concentration leads to higher cash holdings. Finally, the coefficient of the repatriation tax variables is statistically significant and as predicted. Economically speaking, however, it is not an important determinant of cash holdings. In sum, our results for non-flow variables are in line with the extant literature in that they provide evidence of cash holding targets based on a cost-benefit trade-off. Moreover, the results also show that the inclusion of novel non-flow measures of the determinants of said targets was relevant.

Additionally, we also want to briefly comment on the time-trend and constant. The reason is that the very high coefficient of the constant has to be interpreted in the light of the high values for years, which range from 1998 to 2012. If we calculate the net effect of the constant and the time trend, we see that the average intercept is 0.334, and that it increases from 0.319 to 0.350 over the period. Hence, there is a positive trend in cash holdings.

Table 15 – Base Regression and Economic Significance

The table reports regression results for our base regression (Panel A) and estimates of the economic significance of coefficients (Panel B). We use our Compustat sample of U.S.-based publicly traded firms from 1998 to 2012. Variables are discussed in section 5.2 and summarized in Table 24 (appendix). Models 1 and 2 in Panel A are pooled OLS regressions respectively without and with an industry dummy based on the primary 2-digit SIC code. Statistics and p-values for both models are based on standard errors robust to clustering by firm and year. Model 3 is estimated using a fixed effects transformation and we report within R-squared. Standard errors for this model are robust to clustering by firm, and the constant is the average of firm fixed effects. A linear time trend is included in all regressions (Year). Z-statistics are in parenthesis while *, **, and *** indicate significance at the 90%, 95%, and 99% level, respectively. Panel B estimates economic significance of coefficients for all the models by reporting the impact of a change in cash/assets following a one standard deviation increase in the explanatory variable, unless otherwise indicated. When calculating the coefficient for variables with a quadratic term (†), the 5th percentile of the variable is used as the base for the level variable whereas the 95th percentile is used for the squared variable. The effect of shocks, net debt issuance, net equity issuance, and acquisitions (‡) is estimated using the 95th percentile of the variable. Estimates for dummies and statistically insignificant variables are omitted in Panel B.

	PANEL A – Regression			PANEL B – Economic significance		
	1	2	(3)	1	2	3
Model	OLS	OLS Ind.	Fixed Effects	OLS	OLS Ind.	Fixed Effects
Dependent variable	Cash/assets	Cash/assets	Cash/assets			
Firms size	0.000	-0.001	-0.008***	-	-	-0.019
	(0.12)	(-0.67)	(-2.96)			
Tangible assets	-0.196***	-0.284***	-0.394***	-0.044	-0.064	-0.089
	(-17.65)	(-21.11)	(-25.24)			
NWC	-0.053***	-0.047***	-0.032***	-0.040	-0.036	-0.024
	(-10.90)	(-9.74)	(-8.80)			
Market-to-book	0.002***	0.002***	0.002***	0.008	0.008	0.008
	(3.71)	(3.68)	(3.23)			
Leverage	-0.243***	-0.246***	-0.146***	-0.120†	-0.122†	-0.072†
	(-27.08)	(-28.79)	(-17.13)			
Leverage-squared	0.035***	0.037***	0.021***	-0.092†	-0.092†	-0.055†
	(13.01)	(14.57)	(9.22)			
Debt rating	-0.051***	-0.053***	-0.010**	-	-	-
	(-9.29)	(-9.26)	(-2.05)			
Debt due within 3 years	-0.064***	-0.060***	-0.021***	-0.026	-0.024	-0.008
	(-17.73)	(-18.16)	(-9.42)			
Dividends	-0.017***	-0.014***	0.009***	-	-	-
	(-3.60)	(-2.84)	(2.78)			
T-Bill rate	-0.004***	-0.004***	-0.004***	-0.008	-0.008	-0.008
	(-5.00)	(-4.47)	(-6.90)			
Loan rate spread	-0.012***	-0.012***	-0.010***	-0.025	-0.025	-0.021
	(-3.31)	(-3.10)	(-3.38)			
S&P VIX	-0.000	-0.000	-0.000**	-	-	-0.001
	(-1.32)	(-1.34)	(-2.20)			
OCF volatility	0.009**	0.003**	0.001	0.005	0.002	-
	(2.38)	(2.24)	(0.73)			
Financing gap	-0.017***	-0.018***	-0.004	-0.007	-0.008	-
	(-4.86)	(-5.21)	(-1.43)			
Diversification factor	-0.032***	-0.036***	0.004	-0.004	-0.004	-
	(-2.90)	(-3.35)	(0.44)			
HHI	-0.068***	-0.071***	-0.010	-0.011	-0.012	-
	(-7.57)	(-6.52)	(-0.69)			

	PANEL A – Regression			PANEL B – Economic significance		
	1	2	(3)	1	2	3
Model	OLS	OLS Ind.	Fixed Effects	OLS	OLS Ind.	Fixed Effects
Repatriation tax	1.555***	1.525***	0.670**	0.005	0.005	0.002
	(3.59)	(3.23)	(2.43)			
OCF shock	0.043***	0.040***	0.028***	$0.015^{\ddagger}$	$0.014^{\ddagger}$	$0.010^{\ddagger}$
	(9.72)	(9.15)	(6.95)			
OCF MA	0.064***	0.060***	0.028***	0.034	0.032	0.015
	(8.74)	(8.82)	(4.16)			
Capex shock	-0.236***	-0.216***	-0.117***	$-0.014^{\ddagger}$	$-0.013^{\ddagger}$	$-0.007^{\ddagger}$
	(-7.47)	(-6.24)	(-6.44)			
Capex MA	-0.034	0.138	0.020	-	-	-
	(-0.36)	(1.45)	(0.24)			
Capex MA square	0.403	-0.258	-0.024	-	-	-
	(1.47)	(-0.90)	(-0.10)			
R&D shock	0.031	0.031	-0.075***	-	-	$-0.006^{\ddagger}$
	(0.95)	(1.03)	(-4.44)			
R&D MA	1.022***	0.978***	0.093	$0.151^{\dagger}$	$0.145^{\dagger}$	-
	(20.11)	(19.99)	(1.54)			
R&D MA-squared	-0.790***	-0.787***	-0.144**	$0.070^{\dagger}$	$0.064^{\dagger}$	$-0.001^{\dagger}$
	(-13.38)	(-14.35)	(-2.28)			
Acquisition	-0.484***	-0.462***	-0.342***	$-0.067^{\ddagger}$	$-0.064^{\ddagger}$	$-0.048^{\ddagger}$
	(-17.16)	(-16.55)	(-30.01)			
Net debt issuance	0.155***	0.148***	0.122***	$0.031^{\ddagger}$	$0.029^{\ddagger}$	$0.024^{\ddagger}$
	(11.25)	(10.74)	(14.42)			
Net equity issuance	0.149***	0.135***	0.137***	$0.056^{\ddagger}$	$0.050^{\ddagger}$	$0.051^{\ddagger}$
	(12.16)	(11.44)	(19.20)			
Year	0.002***	0.002***	0.000			
	(4.02)	(4.37)	(0.16)			
Constant	-4.144***	-3.945***	0.284			
	(-3.74)	(-3.96)	(0.37)			
Observations	44,275	44,275	44,275			
Number of Firms	5,502	5,502	5,502			
Adjusted R-squared	0.487	0.513	0.208			

5.4.2.2 Base model extended with lagged variables

Previous research has shown that deviations from targeted cash holdings may persist for longer than a year (Duchin, 2010; Venkiteshwaran, 2011). We are interested in such lasting effects because finding that shocks impact cash holdings for several years would add further evidence in favour of Hypothesis 1.

Results for our regressions with lagged shock variables are presented in Table 16. Panel A reports our initial regression with two time lags for all variables with a shock interpretation. We add further lags where relevant in Panel B. Starting with OCF shocks, we see that its lags are insignificant for all but one case where the second lag is weakly significant in the fixed effects estimation. We thus conclude that there is little evidence of OCF shocks having a long-lasting impact on cash holdings. Capex shocks and

acquisitions, on the contrary, appear to impact cash holdings for quite some time. We find that four lags for both variables are significant and that their coefficients are negative and generally decreasing with the distance of the lag, as expected. In unreported regressions, we even find that their effect lasts beyond four lags. However, we prefer the reported regression because adding more lags does not improve R-squared, because the coefficients become very low, and because each lag significantly reduces the number of observations. Turning to R&D shocks, the results confirm our earlier notion that contemporaneous shocks may also proxy for some unobserved effect, while the general impact of R&D shocks is as predicted. The reason for this is twofold. First, the coefficients of R&D shocks are negative and significant for contemporaneous and lagged values in fixed effects estimation. Second, the coefficients are negative and significant for lagged values in OLS regressions. Hence, the results are only confounding for contemporaneous values in OLS estimation, where there is only weak statistical significance. Last we find that the coefficients of past net debt issuance and net equity issuance behave as expected and are significant for up to three lags. This confirms the notion that external capital is raised in chunks, which increases cash holdings for a prolonged period. Taken together, the regressions with lagged variables provide further evidence that actual cash holdings may deviate from their target due to shocks, and thus support Hypothesis 1.

Table 16 – Regression with lagged variables
The table reports regression results for our base regression extended with lags of variables associated with shocks. We start with two lags in Panel A and add additional lags where relevant in Panel B. We use our Compustat sample of U.S.-based publicly traded firms from 1998 to 2012. Variables are discussed in section 5.2 and summarized in Table 24 (appendix). Models 1, 2, 4, and 5 are pooled OLS regressions respectively without and with an industry dummy based on the primary 2-digit SIC code. Statistics and *p*-values for both models are based on standard errors robust to clustering by firm and year. Model 3 and 6 are estimated using a fixed effects transformation and we report within R-squared. Standard errors for these models are robust to clustering by firm, and the constant is the average of firm fixed effects. A linear time trend is included in all regressions (Year). *Z*-statistics are in parentheses while *, **, and *** indicate significance at the 90%, 95%, and 99% level, respectively.

	PANEL A – Two lags			PANEL B – Added lags		
	1	2	3	4	5	6
Model	OLS	OLS Ind.	Fixed effects	OLS	OLS Ind.	Fixed effects
Dependent variable	Cash/assets	Cash/assets	Cash/assets	Cash/assets	Cash/assets	Cash/assets
Firms size	0.001	0.000	-0.005*	0.001	0.000	-0.003
	(1.09)	(0.30)	(-1.92)	(0.74)	(0.02)	(-0.90)
Tangible assets	-0.207***	-0.295***	-0.398***	-0.209***	-0.296***	-0.409***
	(-17.60)	(-20.83)	(-23.65)	(-17.01)	(-19.27)	(-22.01)
NWC	-0.058***	-0.051***	-0.037***	-0.062***	-0.055***	-0.042***
	(-11.14)	(-9.89)	(-9.24)	(-9.50)	(-8.41)	(-8.43)
Market-to-book	0.002***	0.002***	0.002***	0.002**	0.002**	0.001*
	(3.40)	(3.34)	(2.69)	(2.18)	(2.11)	(1.91)
Leverage	-0.244***	-0.247***	-0.144***	-0.235***	-0.238***	-0.142***
	(-25.17)	(-26.59)	(-15.21)	(-22.78)	(-23.77)	(-12.60)
Leverage-squared	0.035***	0.038***	0.020***	0.033***	0.036***	0.019***
	(12.39)	(13.91)	(8.39)	(11.22)	(12.55)	(6.69)
Debt rating	-0.054***	-0.056***	-0.008	-0.053***	-0.054***	-0.006
	(-9.35)	(-9.18)	(-1.39)	(-8.92)	(-8.70)	(-0.93)
Debt due within 3 years	-0.064***	-0.061***	-0.020***	-0.064***	-0.060***	-0.018***

	PANEL A – Two lags			PANEL B – Added lags		
	1	2	3	4	5	6
Model	OLS	OLS Ind.	Fixed effects	OLS	OLS Ind.	Fixed effects
	(-16.12)	(-15.82)	(-8.70)	(-13.86)	(-13.46)	(-7.32)
Dividends	-0.015***	-0.012**	0.010***	-0.012**	-0.008*	0.011***
	(-3.17)	(-2.41)	(3.02)	(-2.45)	(-1.66)	(2.99)
T-Bill rate	-0.003***	-0.003***	-0.003***	-0.002*	-0.002*	-0.003***
	(-2.78)	(-3.06)	(-5.41)	(-1.72)	(-1.93)	(-4.45)
Loan rate spread	-0.010*	-0.011**	-0.008***	0.000	-0.002	-0.005
	(-1.83)	(-2.08)	(-2.64)	(0.05)	(-0.37)	(-1.46)
S&P VIX	-0.000	-0.000	-0.000	-0.000	0.000	0.000
	(-0.29)	(-0.17)	(-0.64)	(-0.12)	(0.01)	(0.09)
OCF volatility	0.010**	0.004*	0.002	0.009**	0.005**	0.002
	(2.41)	(1.77)	(1.39)	(2.51)	(2.02)	(1.29)
Financing gap	-0.015***	-0.017***	-0.004	-0.011***	-0.013***	-0.004
	(-3.94)	(-4.45)	(-1.22)	(-2.61)	(-3.15)	(-1.15)
Diversification factor	-0.027**	-0.031***	0.003	-0.025**	-0.031***	-0.001
	(-2.46)	(-2.83)	(0.29)	(-2.23)	(-2.63)	(-0.08)
HHI	-0.072***	-0.073***	-0.014	-0.072***	-0.074***	-0.022
	(-7.71)	(-6.65)	(-0.89)	(-7.20)	(-6.38)	(-1.37)
Repatriation tax	1.510***	1.397***	0.651**	1.761***	1.604***	0.489
	(3.55)	(3.00)	(2.28)	(4.08)	(3.44)	(1.59)
OCF shock	0.048***	0.045***	0.031***	0.049***	0.046***	0.032***
	(10.03)	(10.21)	(7.12)	(8.00)	(7.60)	(5.88)
OCF shock$_{t-1}$	-0.002	-0.002	0.002	-0.002	-0.001	0.000
	(-0.47)	(-0.37)	(0.40)	(-0.25)	(-0.16)	(0.03)
OCF shock$_{t-2}$	0.005	0.004	0.010**	-0.003	-0.002	0.012**
	(1.11)	(0.98)	(2.46)	(-0.52)	(-0.43)	(2.51)
OCF MA	0.090***	0.084***	0.042***	0.105***	0.099***	0.056***
	(10.24)	(10.34)	(6.05)	(9.70)	(9.48)	(5.87)
Capex shock	-0.190***	-0.182***	-0.132***	-0.198***	-0.195***	-0.135***
	(-7.85)	(-6.08)	(-7.28)	(-7.50)	(-6.12)	(-6.72)
Capex shock$_{t-1}$	-0.117***	-0.107***	-0.059***	-0.102***	-0.090***	-0.052***
	(-5.00)	(-5.31)	(-4.33)	(-3.66)	(-3.87)	(-3.58)
Capex shock$_{t-2}$	-0.120***	-0.104***	-0.041***	-0.068**	-0.058**	-0.034**
	(-4.73)	(-4.48)	(-3.01)	(-2.39)	(-2.48)	(-2.36)
Capex shock$_{t-3}$				-0.079***	-0.071***	-0.046***
				(-3.69)	(-3.50)	(-3.26)
Capex shock$_{t-4}$				-0.130***	-0.115***	-0.039***
				(-6.84)	(-6.01)	(-2.67)
Capex MA	-0.127	0.052	-0.080	-0.202*	-0.048	-0.072
	(-1.26)	(0.50)	(-0.92)	(-1.89)	(-0.45)	(-0.73)
Capex MA-squared	0.489*	-0.222	0.024	0.742**	0.058	-0.004
	(1.72)	(-0.75)	(0.10)	(2.48)	(0.19)	(-0.01)
R&D shock	0.054*	0.051*	-0.068***	0.052*	0.050*	-0.074***
	(1.88)	(1.89)	(-3.86)	(1.68)	(1.73)	(-3.48)
R&D shock$_{t-1}$	-0.037**	-0.033**	-0.035***	-0.032	-0.028	-0.036**
	(-2.17)	(-2.19)	(-2.62)	(-1.36)	(-1.33)	(-2.20)
R&D shock$_{t-2}$	-0.078***	-0.066***	-0.002	-0.075***	-0.061***	0.016
	(-2.84)	(-2.70)	(-0.14)	(-3.41)	(-3.09)	(0.93)
R&D MA	0.941***	0.907***	0.038	0.887***	0.856***	-0.116

	PANEL A – Two lags			PANEL B – Added lags		
	1	2	3	4	5	6
Model	OLS	OLS Ind.	Fixed effects	OLS	OLS Ind.	Fixed effects
	(17.58)	(17.07)	(0.59)	(15.61)	(14.87)	(-1.50)
R&D MA-squared	-0.713***	-0.714***	-0.102	-0.657***	-0.653***	0.022
	(-11.74)	(-12.54)	(-1.54)	(-10.46)	(-10.73)	(0.28)
Acquisitions	-0.422***	-0.409***	-0.376***	-0.396***	-0.386***	-0.390***
	(-14.94)	(-14.60)	(-29.07)	(-13.56)	(-13.12)	(-26.66)
Acquisitions$_{t-1}$	-0.314***	-0.303***	-0.243***	-0.294***	-0.286***	-0.274***
	(-14.38)	(-14.96)	(-20.86)	(-13.08)	(-13.22)	(-20.15)
Acquisitions$_{t-2}$	-0.251***	-0.239***	-0.175***	-0.228***	-0.220***	-0.200***
	(-15.29)	(-14.82)	(-15.85)	(-14.41)	(-13.74)	(-15.31)
Acquisitions$_{t-3}$				-0.184***	-0.175***	-0.132***
				(-11.55)	(-11.40)	(-10.97)
Acquisitions$_{t-4}$				-0.136***	-0.130***	-0.087***
				(-11.17)	(-10.69)	(-8.74)
Net debt issuance	0.138***	0.133***	0.128***	0.133***	0.128***	0.132***
	(9.37)	(9.16)	(13.23)	(7.72)	(7.33)	(12.31)
Net debt issuance$_{t-1}$	0.076***	0.071***	0.057***	0.066***	0.062***	0.062***
	(4.86)	(4.72)	(6.95)	(4.06)	(3.93)	(6.57)
Net debt issuance$_{t-2}$	0.069***	0.062***	0.048***	0.064***	0.060***	0.055***
	(4.89)	(4.75)	(6.42)	(4.01)	(4.11)	(6.61)
Net debt issuance$_{t-3}$				0.057***	0.051***	0.040***
				(4.30)	(4.14)	(4.92)
Net equity issuance	0.138***	0.126***	0.143***	0.144***	0.133***	0.148***
	(9.68)	(9.27)	(18.80)	(10.01)	(9.29)	(15.67)
Net equity issuance$_{t-1}$	0.046***	0.039***	0.050***	0.050***	0.043***	0.060***
	(3.79)	(3.41)	(7.70)	(3.76)	(3.47)	(7.61)
Net equity issuance$_{t-2}$	0.025*	0.020	0.024***	0.022	0.018	0.027***
	(1.89)	(1.62)	(3.99)	(1.52)	(1.44)	(3.80)
Net equity issuance$_{t-3}$				0.026*	0.021	0.019**
				(1.76)	(1.51)	(2.56)
Year	0.002***	0.002***	-0.000	0.002***	0.002***	-0.000
	(4.08)	(4.32)	(-0.14)	(4.22)	(4.26)	(-0.32)
Constant	-4.199***	-3.994***	0.518	-3.525***	-3.321***	0.675
	(-3.80)	(-3.92)	(0.64)	(-3.89)	(-3.80)	(0.78)
Observations	40,076	40,076	40,076	33,827	33,827	33,827
Number of Firms	5,336	5,336	5,336	4,648	4,648	4,648
Adjusted R-squared	0.503	0.528	0.234	0.494	0.519	0.243

5.4.3 Hypothesis 2

Hypothesis 2 states that the immediate impact of the financial crisis was a drop in cash holdings due to a drop in OCF as well as a dearth of external finance. Our regressions results in the previous section have already shown that shocks to OCFs as well as shocks to external financing are determinants of cash holdings. In order to investigate Hypothesis 2, we will therefore look at the development of these variables

during the financial crisis. We find that the variables' development is consistent with their hypothesized impact on cash holdings.

Figure 19 shows the yearly mean and median OCFs shock for all firms in our sample. Starting with the mean we see that a negative OCF shock is clearly identifiable across firms during the crisis years 2008 and 2009. Interestingly, the median shock is only strongly negative in 2009 but stays relatively constant in 2008. This delayed impact is a phenomenon present in many measures of the financial crisis. Generally speaking, this is due to two factors. First, as previously mentioned, a simultaneous decrease in assets and the variable of interest may leave the ratio of the two relatively unchanged. We have documented a drop in assets during 2008 in Table 25 (appendix) and it has also been reported by the media. Second, the fiscal year 2008 may contain non-crisis quarters which, too, may dilute the effect of the crisis. With this caveat in mind, we turn to average net debt issuance and net equity issuance in Figure 20. Net debt issuance already decreases in 2008 and even becomes negative in 2009. Average net equity issuance shows the strongest dip in 2008 but rebounds relatively fast. Still, it remains below pre-crisis levels for the remainder of the sample period.

Figure 21 adds a further perspective to the development of OCF, net debt issuance and net equity issuance by graphing their aggregate ratios over the sample period. Recall that aggregate ratios are calculated by dividing the cumulative value of a variable by cumulative assets for all firms in a given year. Mathematically, this is equivalent to calculating an asset weighted average. Given the wide dispersion in firm size, this causes aggregate measures to be dominated by large firms. What we can see from Figure 21, then, is that aggregate OCF does not dip before the 2009 fiscal period. Furthermore, the ratio even increases during 2008. The difference between aggregate OCFs and the mean of OCF shocks therefore points to that smaller firms were more heavily affected by the financial crisis. Second, we see that the aggregate net debt issuance ratio decreases slightly in 2008 but is strongly reduced in 2009 and 2010. Interestingly, such a delayed impact is also evident after the dotcom bubble. Finally, we see that the aggregate net equity issuance ratio actually increases during the crisis, although it remains negative. This may appear contrary to the development of the average ratio and we therefore decompose the aggregate measure to investigate the divergence. This reveals two things. First, the aggregate equity sales ratio only falls slightly during the crisis. This further indicates that small firms were hit harder by the crisis since the average net equity issuance ratio fell markedly in 2008. Second, share buy backs decrease sharply over the crisis. Buy backs are largely voluntary compared to dividend payments and, especially, interest payments or debt repayments. Hence, it appears that companies cancelled them during the crisis to stop further bleeding of cash.

In sum, we find evidence that OCFs and net debt issuance were severely affected by the crisis and that equity sales were reduced. This is in line with previous research (Kahle & Stulz, 2013). In combination with the results of our regressions analyses, we treat this as evidence in favour of Hypothesis 2. Differences between aggregate and simple averages furthermore indicate that smaller firms were more heavily influenced by the crisis than larger companies. Finally, it appears that equity purchases were strongly reduced during the crisis, which we interpret as firms trying to mitigate the impact of the other negative effects on cash holdings.

Mean and Median OCF Shocks from 1998 to 2012
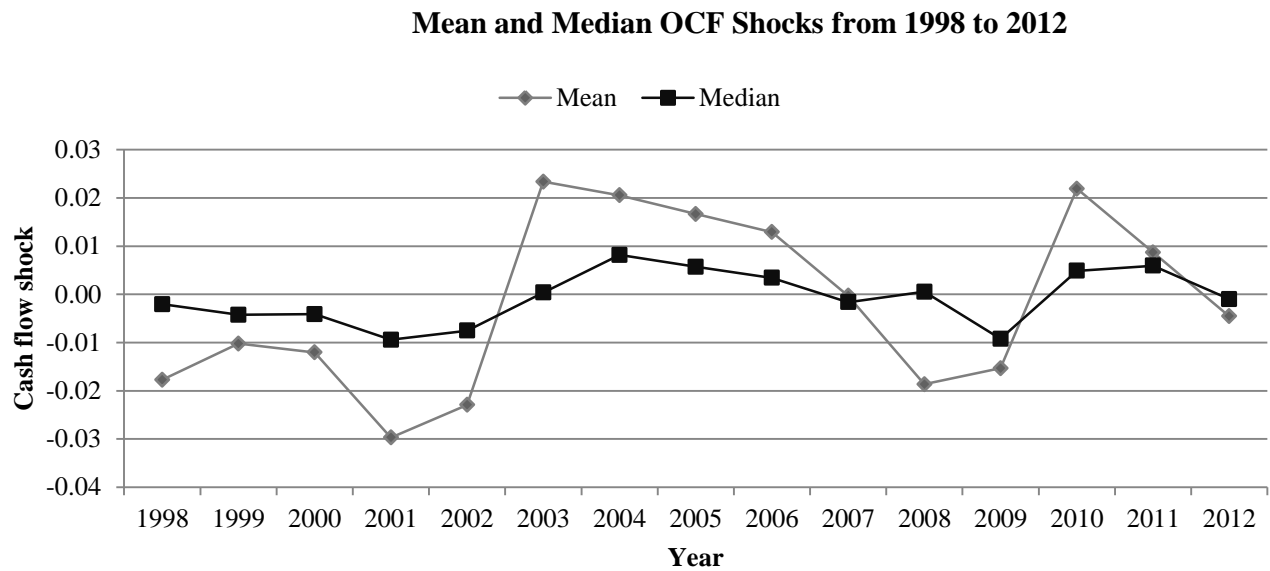
Figure 19 – Mean and Median OCF Shocks from 1998 to 2012. The figure shows the mean and median OCF shock for our Compustat sample of U.S.-based publicly traded firms from 1998 to 2012. Tabulated results can be found in Table 28 (appendix).

Mean Net Debt Issuance and Net Equity Issuance from 1998 to 2012
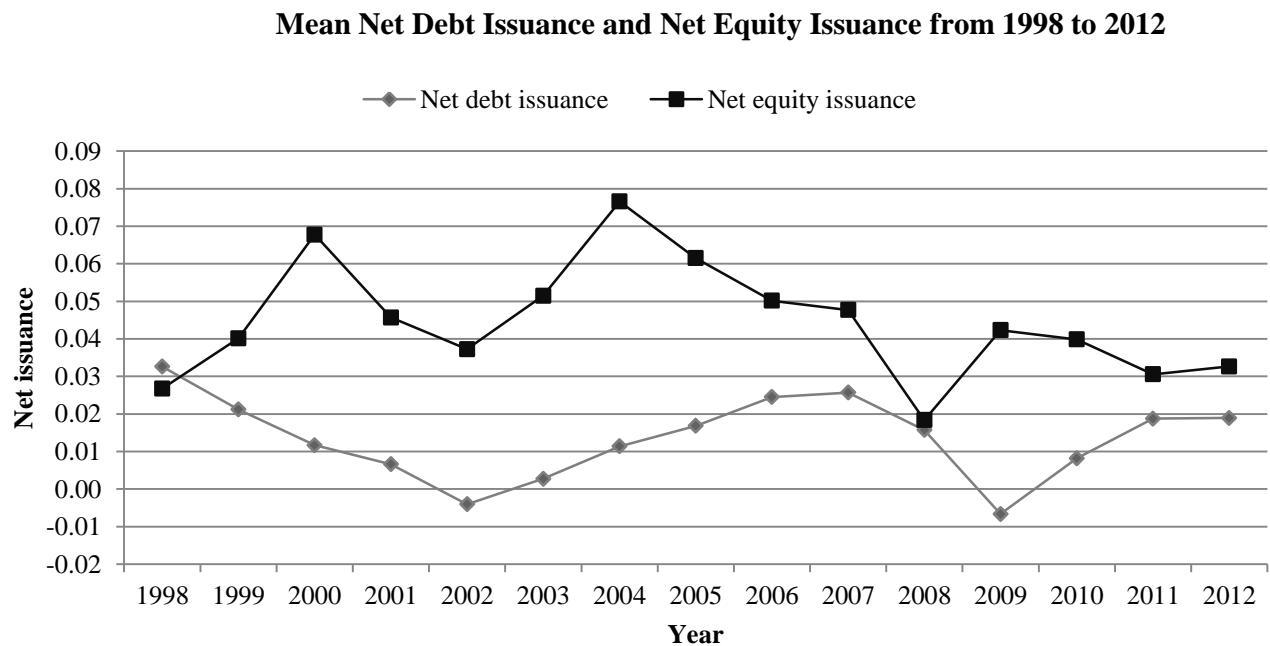
Figure 20 – Mean Net Debt Issuance and Net Equity Issuance from 1998 to 2012. The figure shows the mean of net debt issuance to assets and net equity issuance to assets for our Compustat sample of U.S.-based publicly traded firms from 1998 to 2012. Tabulated results can be found in Table 28 (appendix).

Aggregate OCF, Net Debt Issuance, and Net Equity Issuance and its Components from 1998 to 2012
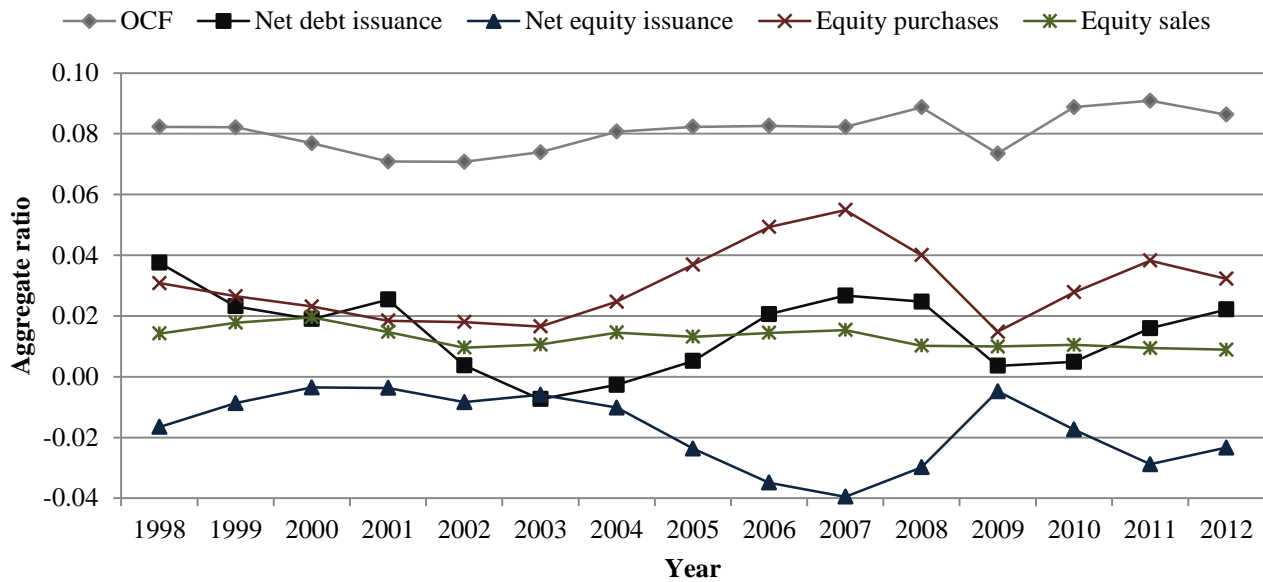
Figure 21 – Aggregate OCF, Net Debt Issuance, and Net Equity Issuance and its Components from 1998 to 2012. The figure shows aggregate ratios for OCF, net debt issuance, net equity issuance, and the components of net equity issuance for our Compustat sample of U.S.-based publicly traded firms from 1998 to 2012. The ratios are calculated by taking the cumulative value of the variable and dividing by cumulative total assets for each year. Tabulated results can be found in Table 29 (appendix).

5.4.4 Hypothesis 3

We argue in Hypothesis 3 that the financial crisis has made precautionary motives for holding cash more important, thereby leading to higher targeted cash holdings. Such a policy change would cause regression coefficients associated with cash holdings targets to change as a result of the crisis. We therefore investigate Hypothesis 3 by interacting all explanatory variables from our base regression with a crisis-indicator variable that takes the value 1 for the years 2008 to 2012 and 0 for the years 1998 to 2007. Significant interacted coefficients would then indicate that firms have in fact changed their policies after 2008. This is what we find and the direction of the changes leads us to interpret them as evidence in support of Hypothesis 3.

The results for our regression with time period interaction are presented in Table 17. We see that the interacted coefficients for several variables that proxy for firms' ability to access external finance, and typically lower business risk, are significant and positive. These variables are the debt rating dummy, debt due in 3 years, and dividends. After 2008, firms therefore hold more cash in response to a given level of these variables than before 2008, although their net effect generally remains negative. We interpret this as evidence that firms have a reduced confidence in their ability to access external capital or otherwise have sufficient funds. This, in turn, has led them to increase their cash holdings target in order to guard against adverse shocks. The positive and both statistically and economically significant interaction coefficient on

the S&P VIX further supports the notion that increased risk has put an upwards pressure on targeted cash holdings. This may be due to the credit-line-cost mechanism discussed by Acharya et al. (2013), as well as a response to the economy-wide increase in uncertainty. It is, however, puzzling that the pre-crisis coefficient is negative, albeit smaller and less significant than the post-crisis one. This further indicates that there is a difference in the response to risk parameters between normal times and times of crisis. The loan rate spread may also provide evidence in support of the effect of reduced access to external finance. While its coefficient is negative before the crisis, its net effect turns positive for the period after 2008. This could indicate that the effect of reduced access to external capital, caused by tighter credit markets, has come to dominate the increased opportunity cost of cash holdings in those markets, which seems most important pre-crisis. Such a development is consistent with what we find in our media analysis. However, we are cautious about giving too much weight to the S&P VIX and loan rate spread, since they are macroeconomic time series, which are prone to create spurious results in times of economy-wide shocks.

As with the access to external finance, the effect of internal financing opportunities also seems to have been reduced due to the crisis. This can be seen from the positive interaction coefficient of NWC and, again, dividends, which can both be cut to finance investments if need be. Turning to R&D MA we see that its level coefficient has become even larger following the crisis in OLS regressions. This further supports Hypothesis 3, because it indicates that firms have chosen to increase their targeted cash holdings for a given level of growth opportunities. The interaction coefficient in fixed effects estimation may in principle contradict this, since it is negative and weakly significant. However, we attribute this to an effect different from growth opportunities, since these have been captured by the fixed effects in previous regression where the coefficient was insignificant. The coefficient of the repatriation tax has increased as well, which can be explained by firms' unwillingness to incur unnecessary taxation when they are already struggling with reduced profits. Yet, economically speaking it remains insignificant and thus cannot explain the hike in cash holdings, which is consistent with PSW's findings.

In addition to the interacted explanatory variables, we also add the crisis dummy itself as an independent variable. Its coefficient is negative and significant both statistically and economically speaking. If we calculate the combined effect of the constant, the time-trend, and the crisis dummy, we see that predicted cash holdings are on average 8.2 percentage points lower after 2007. This provides further evidence of the negative shock discussed in Hypothesis 2, but also shows that our shock variables have not captured the full drop in cash holdings.

Two variables do, however, not show a development that is consistent with our expectations. These are firm size and the diversification factor. If anything, we expected the interaction coefficient to be positive for both variables. It is therefore puzzling that the interaction coefficients are statistically significant, albeit weakly so, and negative in most estimations. We must admit that our theoretical framework does not offer a compelling answer for the observed relation. Additionally, OCF volatility turns insignificant which we, however, attribute to the larger number of explanatory variables.

Finally, it is also worth noticing some of the coefficients that do not turn insignificant although we include interaction terms. Specifically, we see that all coefficients associated with shocks remain significant. This

means that the importance of shocks cannot be regarded as a phenomenon unique to the financial crisis. Taken together we therefore interpret the results in Table 17 not only as evidence in support of Hypothesis 3, but also as further confirmation of the general applicability of Hypothesis 1.

Table 17 – Regression with Time Period Interaction

The table reports regression results for our base regression fully interacted with an indicator variables for the crisis period. The indicator has the value 0 for the years 1998-2007 and 1 for the years 2008-2012. Non-interacted coefficients are reported under 'Base'. Interacted coefficients are reported under 'Crisis'. We use our Compustat sample of U.S.-based publicly traded firms from 1998 to 2012. Variables are discussed in section 5.2 and summarized in Table 24 (appendix). Models 1 and 2 in Panel A are pooled OLS regressions respectively without and with an industry dummy based on the primary 2-digit SIC code. Statistics and *p*-values for both models are based on standard errors robust to clustering by firm and year. Model 3 is estimated using a fixed effects transformation and we report within R-squared. Standard errors for this model are robust to clustering by firm, and the constant is the average of firm fixed effects. A linear time trend is included in all regressions (Year). Z-statistics are in parentheses while *, **, and *** indicate significance at the 90%, 95%, and 99% level, respectively.

Model	1 OLS		2 OLS Ind.		3 Fixed effects	
Dependent variable	Cash/assets		Cash/assets		Cash/assets	
Coefficients	Base	Crisis	Base	Crisis	Base	Crisis
Firms size	0.001	-0.004**	0.000	-0.004**	-0.006**	-0.003**
	(0.87)	(-2.45)	(0.22)	(-2.24)	(-2.32)	(-2.29)
Tangible assets	-0.196***	0.004	-0.286***	0.010	-0.395***	0.013
	(-14.80)	(0.22)	(-17.54)	(0.50)	(-24.35)	(1.08)
NWC	-0.058***	0.015**	-0.053***	0.016**	-0.039***	0.018***
	(-10.10)	(2.10)	(-9.32)	(2.35)	(-8.22)	(2.91)
Market-to-book	0.003***	-0.001	0.002***	-0.001	0.002***	-0.001
	(3.62)	(-0.99)	(3.76)	(-1.32)	(3.24)	(-1.09)
Leverage	-0.250***	0.023*	-0.252***	0.019	-0.144***	0.003
	(-24.35)	(1.85)	(-23.97)	(1.46)	(-15.42)	(0.27)
Leverage-squared	0.035***	-0.002	0.038***	-0.001	0.018***	0.008**
	(9.99)	(-0.37)	(9.63)	(-0.13)	(6.38)	(2.16)
Debt rating	-0.056***	0.015**	-0.059***	0.020***	-0.018***	0.029***
	(-9.83)	(2.41)	(-9.90)	(3.16)	(-3.50)	(5.11)
Debt due within 3 years	-0.068***	0.013**	-0.064***	0.010*	-0.024***	0.007
	(-18.72)	(2.29)	(-18.01)	(1.88)	(-8.78)	(1.61)
Dividends	-0.021***	0.016***	-0.018***	0.015**	0.010***	-0.001
	(-4.15)	(3.02)	(-3.04)	(2.38)	(2.89)	(-0.24)
T-Bill rate	-0.004***	0.003*	-0.005***	0.004*	-0.005***	0.003
	(-10.64)	(1.65)	(-8.98)	(1.92)	(-7.31)	(1.18)
Loan rate spread	-0.015***	0.024***	-0.020***	0.030***	-0.017***	0.029***
	(-5.03)	(4.44)	(-7.55)	(6.55)	(-2.80)	(3.56)
S&P VIX	-0.001**	0.002***	-0.001***	0.002***	-0.000*	0.001***
	(-2.15)	(4.00)	(-2.63)	(4.66)	(-1.88)	(5.06)
OCF volatility	0.011	-0.005	0.001	0.002	-0.000	0.001
	(1.29)	(-0.59)	(0.32)	(0.71)	(-0.10)	(0.23)
Financing gap	-0.018***	0.005	-0.019***	0.004	-0.004	0.002
	(-4.39)	(0.97)	(-4.69)	(0.79)	(-1.35)	(0.36)
Diversification factor	-0.024*	-0.024*	-0.028**	-0.028**	-0.006	0.022*
	(-1.75)	(-1.73)	(-2.13)	(-2.05)	(-0.55)	(1.69)
HHI	-0.066***	-0.005	-0.073***	0.004	-0.014	0.001

Model	1 OLS		2 OLS Ind.		3 Fixed effects	
	(-6.74)	(-0.47)	(-6.29)	(0.29)	(-0.95)	(0.12)
Repatriation tax	1.116**	1.027**	0.955**	1.376***	0.474	0.497
	(2.44)	(2.00)	(1.99)	(2.66)	(1.47)	(0.99)
OCF shock	0.045***	-0.009	0.043***	-0.010	0.027***	0.002
	(9.26)	(-0.99)	(8.36)	(-1.11)	(5.26)	(0.24)
OCF MA	0.062***	0.005	0.059***	0.001	0.019***	0.018**
	(8.08)	(0.31)	(7.65)	(0.08)	(2.61)	(2.03)
Capex shock	-0.230***	-0.013	-0.213***	0.008	-0.107***	-0.003
	(-6.08)	(-0.20)	(-4.69)	(0.12)	(-5.07)	(-0.09)
Capex MA	-0.010	-0.060	0.194*	-0.179	0.024	-0.094
	(-0.10)	(-0.43)	(1.83)	(-1.34)	(0.27)	(-0.82)
Capex MA square	0.376	0.055	-0.367	0.411	0.010	0.177
	(1.29)	(0.12)	(-1.19)	(1.00)	(0.04)	(0.54)
R&D shock	0.019	0.029	0.015	0.038	-0.085***	0.033
	(0.47)	(0.41)	(0.42)	(0.62)	(-4.02)	(1.00)
R&D MA	0.977***	0.148**	0.929***	0.157**	0.098	-0.091*
	(16.90)	(2.02)	(17.48)	(2.31)	(1.62)	(-1.75)
R&D MA-squared	-0.756***	-0.118	-0.755***	-0.113	-0.154**	0.104
	(-10.85)	(-1.30)	(-11.96)	(-1.33)	(-2.44)	(1.45)
Acquisition	-0.465***	-0.067	-0.441***	-0.077	-0.303***	-0.129***
	(-14.39)	(-1.21)	(-13.63)	(-1.44)	(-23.84)	(-5.46)
Net debt issuance	0.151***	0.014	0.142***	0.021	0.111***	0.032*
	(12.58)	(0.35)	(10.21)	(0.52)	(11.46)	(1.82)
Net equity issuance	0.150***	-0.005	0.138***	-0.015	0.134***	-0.005
	(12.58)	(-0.16)	(8.63)	(-0.47)	(16.48)	(-0.33)
Crisis	-0.097***		-0.114***		-0.098***	
	(-5.00)		(-3.42)		(-4.06)	
Year	0.002***		0.002***		0.000	
	(5.14)		(12.32)		(0.77)	
Constant	-3.543***		-3.800***		-0.295	
	(-4.76)		(-10.98)		(-0.32)	
Observations	44,275		44,275		44,275	
Number of Firms	5,502		5,502		5,502	
Adjusted R-squared	0.488		0.515		0.214	

5.4.5 Hypothesis 4

Hypothesis 4 states that firms' cash holdings have exceeded their targets in the aftermath of the crisis due to a lack of growth opportunities, increased OCF and, possibly, opportunistic borrowing. The difficulty is of course to separate this positive shock to cash holdings from the simultaneous increase in targeted cash holdings discussed in Hypothesis 3 and the negative shock discussed in Hypothesis 2. We mainly do so by investigating the development of variables associated with shocks. However, we will also briefly discuss the coefficients of these variables from the interaction regressions. We find that the evidence supports our hypothesis with respect to a negative shock to investment and, as shown earlier, increased OCF. The

assertion that this effect is amplified by opportunistic borrowing seems, however, only to be valid for firms with an investment grade debt rating.

Starting with the lack of growth opportunities, we investigate the development of investments which is shown in Figure 22 (average ratios), Figure 23 (aggregate ratios), and Figure 24 (average shocks). Overall, we see that investments drop later and remain low for longer than the shocks to OCFs discussed earlier. This behaviour is consistent with the hypothesized causal link with the development of cash holdings. Acquisitions actually start decreasing in 2008, but are at their low-point in 2009 and 2010. Capex even increases in 2008 but is significantly below its average in 2009 and 2010. It does not recover before 2012. While R&D does not drop as rapidly as the other measures, it decreases in 2009 and 2010 and, importantly, reverts neither in 2011 nor 2012. The development of shocks follows the development of their respective variables closely. Hence, the average shock is negative for both R&D and Capex in the three last year of our sample, but positive in 2008. Interestingly, the capex shock is particularly pronounced in 2009, which probably reflects the combined effects of a lack of growth opportunities and deliberate reductions in investment due to low OCF. Briefly returning to the interaction regression in Table 17, we also note that the interacted coefficient on OCF MA is significant and positive in the fixed effects estimation. Hence, after controlling for all constant factors, firms hoard more cash out of OCFs post-crisis. All of the above is consistent with the notion that post-crisis firms experience a shortfall in investment opportunities on which they can spend incoming cash.

The increase in OCFs has already been documented in Figure 19, which shows a positive shock to mean and median OCF in 2010 and 2011. Figure 21 furthermore shows that the aggregate OCF ratio is also above pre-crisis levels in 2010 and 2011. Yet, we are also interested in investigating the impact of the cost-cutting programmes emphasized by the media analysis. Figure 25 shows the median operating profit margin of firms in our sample and confirms that firms have indeed increased their profitability post-crisis. Collectively, this testifies to increased OCFs in the aftermath of the crisis.

Turning to the impact of opportunistic borrowing, we see that neither Figure 20 nor Figure 21 indicate a post-crisis surge in net debt issuance relative to assets. Alternatively, some commentators have pointed to the low T-Bill rate to support the argument of opportunistic borrowing. However, even to the extent that the T-Bill rate captures the opportunity cost of cash, it constitutes a determinant of cash holdings targets rather than a shock. We must therefore, yet again, seek to identify disturbances to the normal balance of in- and out-going cash flows in order to document a positive shock to cash holdings. We do so by investigating the ratio of net debt issuance to total investments. If firms are indeed pushing cash holdings above targets due to opportunistic borrowing, this ratio should be increasing in the post-crisis period. We construct the ratio by dividing net debt issuance with the sum of acquisition expense, capex, and R&D expense. The scaling creates extreme outliers, so we winsorize both tails at the 1% level. The development of the ratio is graphed in Figure 26, and we split the sample into firms with and without an investment grade debt rating. Only about 10% of the firms in our sample have an investment grade debt rating. The data therefore shows that for the majority of firms there was no excess borrowing after the crisis. In fact, it seems that the recovery in investments in 2012 has been financed by relatively less debt than usually. This is also consistent with the negative and significant interacted coefficient of the acquisition variable in Table 17, which points to an

increased use of cash holdings in financing these. For firms with an investment grade debt rating, however, the development in the ratio is consistent with the pre-borrowing motive since they appear to be borrowing more than they usually would, given their investment level. This is consistent with our findings in the media analysis.

In sum, we interpret our results as being consistent with the hypothesized positive post-crisis shock to cash holdings caused by a lack of growth opportunities and increased OCFs. The opportunistic borrowing effect seems, however, only to be present for firms with easy access to capital markets.

R&D, Capex, and Acquisitions from 1998 to 2012
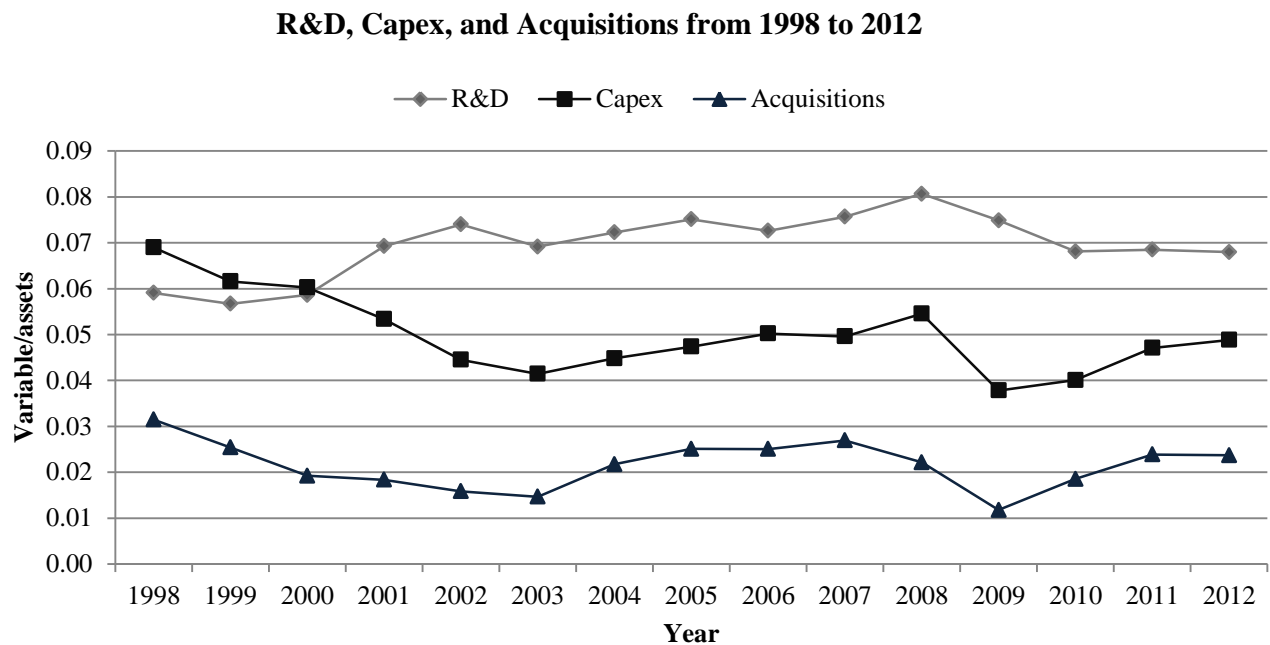
Figure 22 – R&D, Capex, and Acquisitions from 1998 to 2012. The figure shows the average ratio of R&D, capex, and, acquisitions to assets for our Compustat sample of U.S.-based publicly traded firms from 1998 to 2012. Tabulated results can be found in Table 30 (appendix).

Aggregate R&D, Capex, and Acquisitions from 1998 to 2012
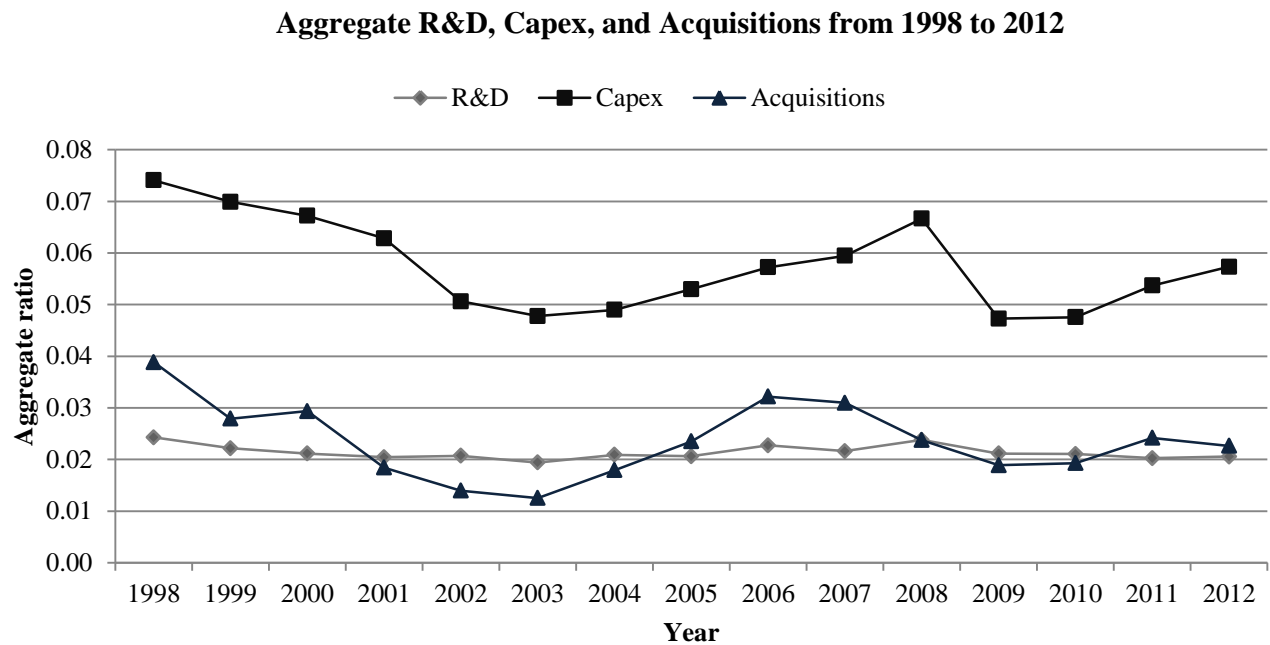
Figure 23 – Aggregate R&D, Capex, and Acquisitions from 1998 to 2012. The figure shows the aggregate ratio of R&D, capex, and, acquisitions to assets for our Compustat sample of U.S.-based publicly traded firms from 1998 to 2012. Aggregate ratios are calculated by taking the cumulative value of the variable and dividing by cumulative total assets for each year Tabulated results can be found in Table 30 (appendix).

Average R&D and Capex Shock from 1998 to 2012
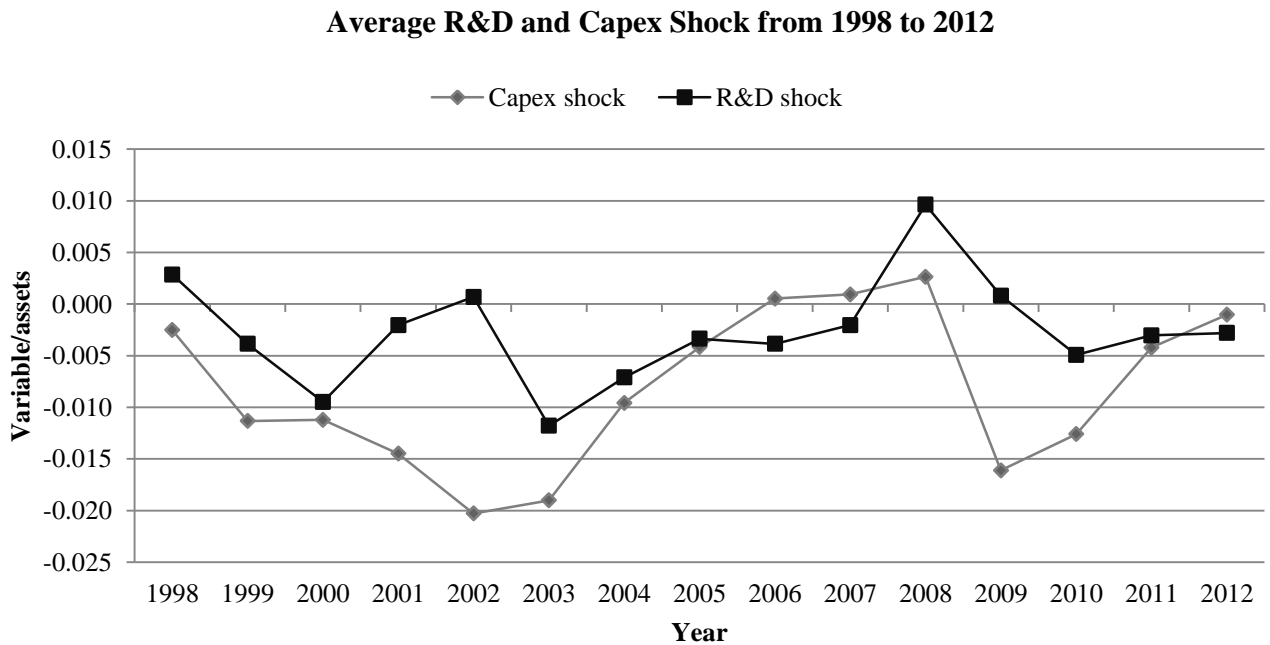
Figure 24 – Average R&D and Capex Shock. The figure shows the average shock to R&D and capex for our Compustat sample of U.S.-based publicly traded firms from 1998 to 2012. Tabulated results can be found in Table 31 (appendix).

Median Operating Profit Margin from 1998 to 2012
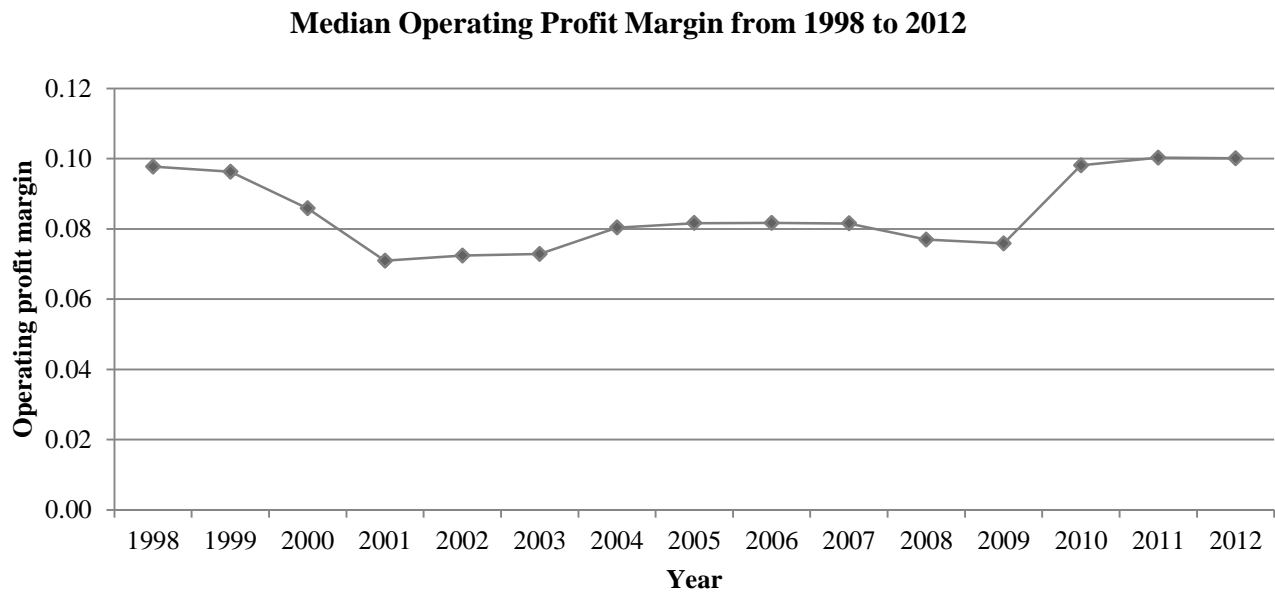
Figure 25 – Median Operating Profit Margin from 1998 to 2012. The figure shows the median operating profit margin for our Compustat sample of U.S.-based publicly traded firms from 1998 to 2012. The margin is calculated as operating income before depreciation divided by total sales. Tabulated results can be found in Table 32 (appendix)

Net debt issuance to investment ratio from 1998 to 2012
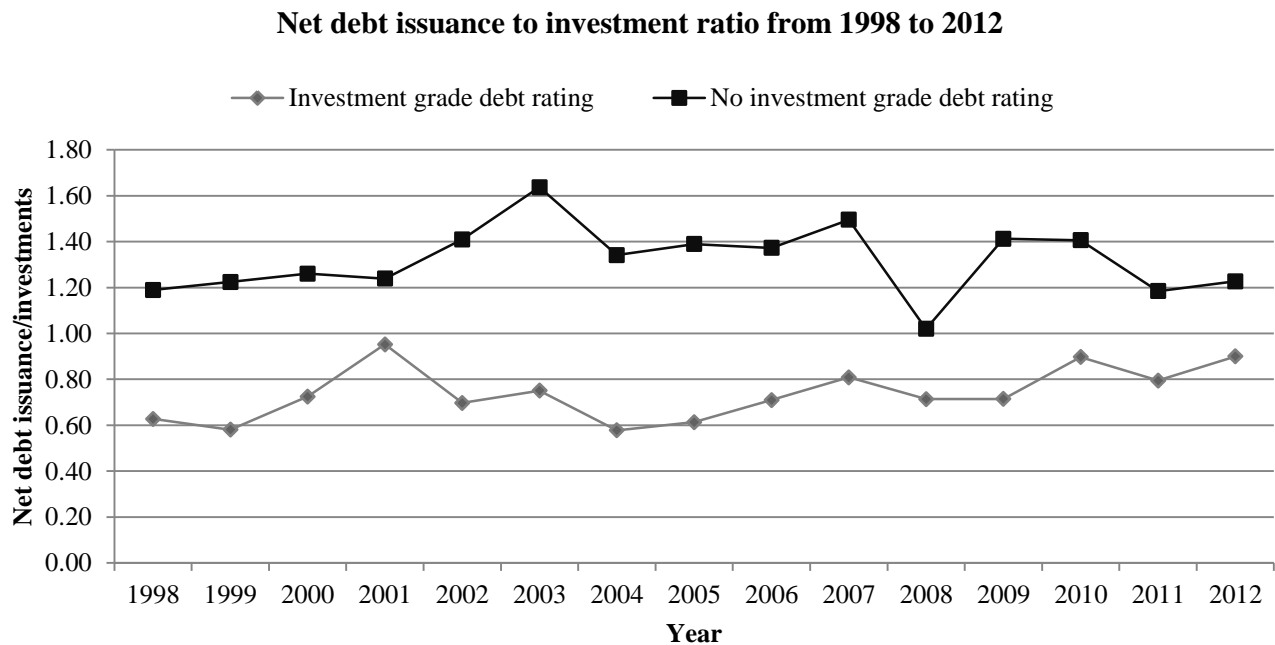
Figure 26 – Net debt issuance to investment ratio from 1998 to 2012. The figure shows the average ratio of net debt issuance to the sum of capex, acquisitions, and R&D for our Compustat sample of U.S.-based publicly traded firms from 1998 to 2012. The sample is split into firms with and without and investment grade debt rating (BBB or higher). Tabulated results can be found in Table 33 (appendix).

5.4.6 General applicability of our model

Throughout the results section, we have utilized our regression models in order to research the impact of the financial crisis on cash holdings. However, it is also interesting to investigate the relevance of our contributions as a model of cash holdings in general. We will therefore compare our empirical model to BKS' empirical model, which currently is the one most widely used in the financial literature.

As a first step, we replicate BKS' regression using our data sample[15]. The results are reported in Table 34 and all coefficients, their sign, and their significance are entirely consistent with BKS' earlier results. Before comparing the predictive power of the models, it is, however, important to understand that in terms of included raw data the models do not differ all that much. In fact, BKS use every flow variable we use in our regression as well, and also many of the non-flow variables. Our main econometric contribution, therefore, is twofold. First, we decompose flows into shocks and moving averages for reasons previously discussed. Second, we collect non-flow variables that have proven relevant in recent research and apply them jointly. With these qualifications in mind, it is all the more interesting that the adjusted R-squared for the replication of BKS' regression is 0.359 while it is 0.478 for our base regression. The consequences of this difference are graphed in Figure 27, where we plot the actual mean cash ratio and the predicted mean cash ratio from BKS' regression and our regressions. All results are for OLS regressions since we want to capture the effect of explanatory variables rather than firm or industry dummies. The graph indicates that BKS' model systematically misses swings in the cash ratio. This can be seen from the underestimation of the cash ratio during the profitable years from 2003 to 2006 as well the overestimation of the cash ratio during the financial crisis. Comparatively, our base regression appears to capture such swings better. We interpret this as further evidence in support of our framework for understanding cash holdings laid out in Hypothesis 1. Furthermore, we see that the best fit with the data is achieved by our base model with time period interaction, which has an adjusted R-squared of 0.488. This lends further support to Hypothesis 3. Overall, the results suggest that our research is relevant beyond an investigation of the financial crisis.

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[15] The regression we replicate is the one commonly used by researchers following BKS. BKS themselves report their base regression without net debt issuance and net equity issuance.

Actual versus Predicted Mean Cash Ratio from 1998 to 2012
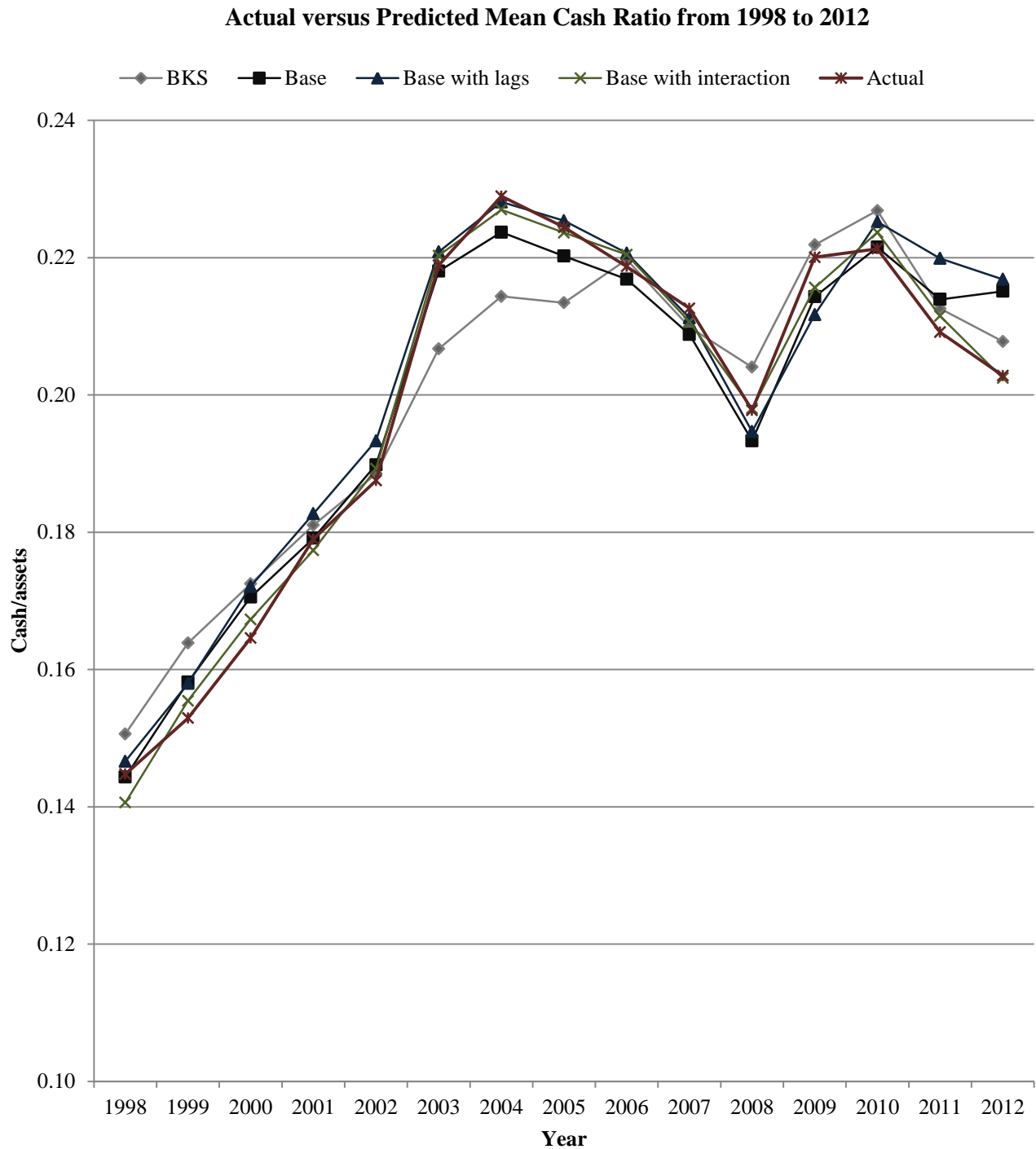
Figure 27 – Actual versus Predicted Mean Cash Ratio from 1998 to 2012. The figure compares the actual mean cash ratio with the mean cash ratio predicted by BKS' regression, our base regression, our regression wit lags, and our regression with time period interaction. Results for BKS' regression are presented in Table 34 (appendix). All estimates are from OLS regressions without industry dummies and based on our Compustat sample of U.S.-based publicly traded firms from 1998 to 2012.

5.5 Robustness

There are some issues concerning the validity and reliability of our results that we have postponed discussing until now. The main reason for doing so is that there is little we can do about the issues other than acknowledge them and gauge their impact on our results. Hence we will now elaborate on problems with endogeneity and highly persistent time series.

5.5.1 Endogeneity

Generally speaking, endogeneity in econometric models refers to a situation where the error term is correlated with any of the explanatory variables. This is a very serious problem because it causes the zero conditional mean assumption, which is central to the very concept of regressions analyses, to fail. The consequences are biased and inconsistent estimates of coefficients and standard errors. Hence, endogeneity receives considerable attention by econometricians and we have already discussed one of its more obvious causes, the omitted variable bias. Time series regression adds a dimension to the endogeneity issue by requiring that explanatory variables are strictly exogenous. This means that they must be uncorrelated with all past, current, and future values of the error term. We already control for one way in which this condition may be violated by including lagged values of the explanatory variables. Another case is if the dependent variable affects current or future values of the explanatory variables. This is referred to as reverse causation or a simultaneity bias. We are concerned about this case for instance because very low levels of cash holdings can cause reductions in investments. We use two approaches to gauge the impact of endogeneity on our results. First, we re-estimate our regression using first difference estimators, which is suggested in order to compare results. The regression results are presented in Table 37 (appendix) and they do not contradict our previous results in a material way, although many coefficients turn insignificant, probably due to the low time-variance of their respective variables. On the contrary, the results seem to emphasize the importance of shocks since they are all significant and have the predicted sign. This includes the coefficient of the R&D shock which is negative and highly significant. Second, we follow OPSW and re-estimate our regressions excluding variables that are most likely to cause endogeneity, i.e. leverage and investment variables (see Table 38 Panel A in the appendix). This does not contradict our results in any material way either, although naturally the significance of some variables changes. Overall, this indicates that, at least from a practical perspective, our results are somewhat robust with respect to violations of the strict exogeneity assumption.

5.5.2 Weak dependence

A further requirement for statistically valid estimations of time series regressions is that all variables are weakly dependent. This means that a variable z_t and its lagged value z_{t+h} must become independent as h increases. Weak dependence is very important for two reasons. First, it is necessary in order to apply the law of large numbers and the central limit theorem to time series estimates. Without these, much stricter requirements than usual apply to the independence and normality of error terms as well as the normality of the dependent variable. Second, and even more concerning, using time series that are not weakly dependent may cause us to find spurious relations between variables. We test each variable for each firm for weak dependence by using the Augmented Dickey Fuller test with and without a trend and one lag of the dependent variable. It tests the null hypothesis that the coefficients of lags in an autoregressive model are

equal to one, which indicates that the time series is not weakly dependent[16]. Unfortunately, the test produces implausible results which we attribute to the very short time series (see Table 35 and Table 36 in the appendix). For instance, the null hypothesis is rejected for the T-bill rate in tests including a trend, although it is commonly known not to be weakly dependent. At the same time, we fail to reject the null hypothesis for all firm-specific variables for the majority of firms. Due to the potential presence of unit roots, we therefore use two approaches to investigate the impact of non-weakly dependent time series on our results. First, we compare our findings to regression in first differences, because taking first differences turns most time series into weakly dependent ones. This is the same regression we used above (Table 37 in the appendix) and, as noted, it does not contradict our results. Second, we re-estimate our regressions without macroeconomic time series that are commonly expected not to be weakly dependent, i.e. S&P VIX, loan rate spread, and the T-bill rate (see Table 38, Panel B in the appendix). This does not contradict our results either. Again, this leads us to be optimistic about the practical validity of our results.

5.6 Chapter summary

In sum, this chapter shows how we arrive at practically robust statistical analyses of corporate cash holdings, and that the results provide evidence in support of our hypothesis. We start by constructing our sample which eventually consists of 44,275 firm-year observations of U.S.-based public companies between 1998 and 2012. We then carefully derive our explanatory variables in a way that enables us to test our hypotheses. Importantly, we separate flows into shocks and moving averages in order to investigate their distinct hypothesized effects. We also add new non-flow determinants of cash holdings targets. Next, we elaborate on our choice of econometric specifications. Apart from using different econometric models, we took a variety of further measures to ensure the validity of our results, including the use of recent advances in standard error clustering. Generally, our results provided evidence in favour of our hypotheses. A possible exception, however, is the applicability of the pre-borrowing argument for firms without an investment grade credit rating. We thus find evidence consistent with a change in cash holding targets caused by the crisis, and that actual cash holdings are first below and then above that target. We also find that our contributions are relevant for general models of cash holdings. We ended the chapter with additional robustness test and found support for the practical validity of our results and further support for our main hypothesis.

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[16] The Augmented Dickey Fuller test can also be used to detect non-stationarity. However, it is important to realize that stationarity and weak dependence are two very different concepts, although they are often confused. A non-stationary time series can be weakly dependent and hence included without violating any assumption, provided that appropriate adjustment have been made.

6. Discussion

The previous chapters have detailed our research and its results. In this chapter, we seek to expand on those contributions by discussing the implications of our findings for different audiences, some apparent limitations of our study, and suggestions for future research.

6.1 Implications

Ultimately, the relevance of our research is determined by its implications for external audiences. Accordingly, we want to elaborate on the value our conclusions have to researchers, practitioners, and society at large.

The first and main implication of our study for future research on cash holdings is that shocks to flow variables cannot be ignored. Importantly, our results show that this is not only the case for the financial crisis, but also for non-crisis periods. Less intuitively, this includes periods of systemic positive shocks to OCF, like the one observed in the years prior to the financial crisis (see Figure 27). Even if one is interested solely in targeted cash holdings, the mechanic relation between stocks and flows must be addressed. Capex, for instance, cannot be viewed as an isolated proxy for a capital intensive business, since a shock to it will directly affect cash holdings. It is in relation to this problem that we furthermore contribute with variables that allow researchers to disentangle target and shock effects. Future papers may thus want to estimate targeted cash holdings after controlling for the effect of shocks. Second, we also show that the joint application of recent advances in assessing cash holding targets is worthwhile. Moreover, we contribute with a novel assessment of the risk reduction arising out of corporate diversification. However, it is also evident that previous results regarding the effects of industry concentration and roll-over risk are sensitive to sample composition. Similarly, our results add further evidence to the problem of estimating adjustment speeds. While our results are not directly comparable to partial adjustment models, the coefficient of shocks to OCF is lower than the ones for financing activities, which is opposite to the findings of Duchin (2010) and Venkiteshwaran (2011). Third, it appears that the pecking order perspective deserves renewed attention. It receives little consideration in contemporary papers on corporate cash holdings, which are dominated by the precautionary motive and its relation to risk management. Our research provides unique evidence in support of the pecking order perspective because we separate OCF into a shock and a moving average. The dynamic trade-off perspective can only explain the positive shock component, which is why we interpret the positive and significant coefficients on the moving average component as evidence in favour of the pecking order perspective. We largely dismiss the argument that the effect may be caused by agency problems because Harford et al. (2008) find that, in the U.S., companies with weak corporate governance actually tend to spend their cash faster (i.e. the spending hypothesis).

Turning to the more practical relevance of our research, we argue that our findings have implications for banks supplying liquidity as well as the CFOs managing liquidity. Our media analysis finds evidence that firms have reduced faith in the dependability of banks. This is hardly news. However, our empirical analysis concludes that this development has had a tangible impact on firms' cash holdings target. This is

relevant for banks to the extent that increased cash holdings substitute liquidity previously provided by credit lines or debt capacity. The banks that are best at regaining the trust of companies may therefore stand to win market shares in corporate lending post-crisis. This may be particularly important since corporations' collectively increased preference for cash, and reluctance to rely on the availability of external finance, reduces the overall market for bank lending. CFOs of financially strong companies may, however, take note of the results relating to Hypothesis 4 and draw counterintuitive conclusions for future crisis. Specifically, we find evidence that those companies have easy access to external finance post-crisis and overshoot their targeted cash holdings. Anticipating this, it may be rational for financially strong companies to accept temporarily reduced cash holdings and invest or acquire at bargain prices during a crisis[17]. This argument relates to the theoretical model developed by Acharya et al. (2007)[18] in the sense that the crisis caused a reduced correlation between investment opportunities and cash flows in its aftermath. This makes it beneficial for companies to invest in current states of the world although abundant cash flows will only materialize in future states of the world. In essence, such behaviour would be a reverse application of the pre-borrowing motive.

Society at large may also benefit from a better understanding of economic crises, which our study has contributed to. This benefit is derived from the general observation that interdependent systems, like an economy, generate fewer fluctuations as the degree of information actors have about the system increases (Sterman, 2000). An example is the countercyclical investment strategy just discussed, as it describes how knowledge about the temporary nature of a crisis would work against the paradox of thrift. More directly, however, our research has implications for the actions of governments and central banks. Our results suggest that intervention was too little or too late to prevent a drop in cash holdings, which worsened the drop in investment and thus the recession. Recall that for instance research by Minton & Schrand (1999) indicates that firms do not fully cover shortfalls in cash holdings with external capital or wait until cash becomes available again, but permanently forgo investments. Likewise, our media analysis has shown that managers became anxious and clung to their cash holdings. For instance Edward Liebert, the then-president of the National Association of Corporate Treasurers, emphasized after the crisis:

> *"You can miss your earnings target and survive, but you can only run out of cash once"* (CFO Magazine, 2010b, p. 1)

It therefore appears that the U.S. government needs to act faster and secure corporations' liquidity needs during a crisis. However, previous research has also shown that the traditional economic policy mechanism of supplying banks with cheap funds did not work, because banks were in the process of deleveraging their balance sheets (Kahle & Stulz, 2013). Furthermore, our results indicate that, by the time lending had restarted, low interest rates were exploited mostly by firms with easy access to external finance, which arguably needed them the least. An alternative may therefore be for the government to intervene and provide credit lines to corporations directly. This would have a positive effect on all of the three main

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[17] Berkshire Hathaway, Warren Buffet's investment company, for instance seized the opportunity and bought Burlington Northern and Santa Fe Railway company in 2009.
[18] See section 2.1.4.3 for a review.

developments of cash holdings we have documented as a result of the crisis. First, access to credit lines may mitigate the reduction in investment caused by the initial drop in cash holdings. Research suggesting that access to credit lines reduces the impact of the crisis on corporate spending is for instance provided by Campello et al. (2011). Second, the availability of a lender of last resort for non-financial corporations may also reduce the increase in targeted cash holdings out of precautionary reasons. This would limit the amount of capital idling in corporate treasuries. Third, the dampening of the initial impact of the financial crisis may reduce the following overshoot.

Last, Duchin et al. (2010) note that, in their assessments of the value of cash holdings, researchers and investors must take the effects of a financial crisis into account, since they may justify seemingly excess cash holdings. Our results clearly second that argument since we add to the documentation of the adverse effects the crisis has had on companies' liquidity.

6.2 Limitations

Generally speaking, and as discussed earlier, we conclude that our results are consistent with our hypotheses and provide sound answers to our research questions. Still, we want to discuss some of the more apparent limitations of our research.

Starting with the results pertaining to Hypothesis 1, there may be issues both with the assessment of shocks and cash holdings targets. One concern with shocks is that the effect of a shock on reported cash holdings is dependent on its proximity to the fiscal year end. Hence, if the timing of shocks is correlated with any of the explanatory variables this may cause an omitted variable bias. Another concern with shocks is that we measure the normal level of the respective variable as a moving average. If the variable in question is growing over time, and the growth is not adjusted for by scaling with total assets, this may lead to the generation of a constant 'shock'. If a company can predict the growth in the variable, it can adjust to the change in advance, and it would therefore not cause a deviation in the balance of cash flows and thus cash holdings. However, in the absence of perfect predictability, deviations from targets caused by growth are likely and well within what we want to capture with the shock variable. Given the elusiveness of reliable predictions, the concern may therefore be largely theoretical and the variable meaningful from a practical perspective. More pressing concerns apply to the effects of other financial policies closely related to cash holdings targets. We have already discussed the problems originating from our inability to directly observe access to credit lines, derivative use, and agency problems. Moreover, we have addressed the robustness of our results with respect to estimation problems arising from the simultaneous determination of financial policies. What we have not done is confronting the resulting endogeneity directly, at least for observable variables, by using 2SLS or even simultaneous equation techniques (Wooldridge, 2009). The reason is twofold. First, when using panel data, it is very difficult to find relevant and exogenous time-varying instruments, which makes it challenging to apply 2SLS in practice (Wooldridge, 2009). Second, there is no accepted theoretical model of the interplay of various corporate financial policies such as leverage, investments, and cash holdings. This makes it problematic to derive a sound structural equation to be used

in simultaneous equation estimation (Wooldridge, 2009). Perhaps, this is also why neither BKS nor OPSW use any of these methods in their regressions analysis of the cash ratio.

Continuing with our conclusions in Hypotheses 2 and 4, our measurement of variable changes may create problems in two ways. First, we use economy-wide measures of central tendency to describe effects that are firm-specific in their causal relation with cash holdings. The rationale for doing so is, of course, that the effects of the crisis were systemic and affected all companies. However, it is not impossible to derive firm-specific changes in the dependent and independent variables and doing so may have refined our results, since our sample is quite heterogeneous. This also leads us to the second problem, which is that economy-wide measures obfuscate firm-level idiosyncrasies. Several previous studies have focused on specific types of firms, for instance small versus large ones, and doing so my have provided a more granular view of the effect of the financial crisis. Yet, we maintain that our conclusions are valid for most firms since we generally use a variety of measure of central tendency to substantiate the hypothesized developments, which allows us to give different weights to different types of firms.

Some very different issues arise out of the interaction regressions in Hypothesis 3. First, we are actually concerned about our ability to capture the full magnitude of the hypothesized policy change with respect to cash holding targets. This is because the time period after 2007 is relatively short and much of the variation in cash holdings is not due to target changes. A further reason is that risk and risk aversion are notoriously hard to measure using accounting data. The concern is substantiated by the finding that changes in corporate attitudes to cash are pervasive in our media analysis, but not evident in risk measures such as OCF volatility or the financing gap. Hence, we may actually underestimate the effect of the 'new normal'. Second, we cannot exclude the possibility that the increased uncertainty in the economy is not solely due to the financial crisis. U.S. politics have been highly partisan over the past years and may have contributed to the increase in uncertainty. However, political risk has always been an element of business risk and we maintain our conclusion that the financial crisis was the driving force behind the increase in uncertainty, and thus targeted cash holdings, after 2008.

A final issue that could potentially affect the validity of our conclusion is that the measures we use to control for a variety of causal links are proxy variables. This is a common concern in the financial literature but deserves mentioning because we have previously noted that some coefficients change their sign, and possibly interpretation, when we control for fixed effects. Therefore, an important caveat for several variables is that we cannot exclude the possibility that they capture effects other than those our theory suggests. The problem may further be aggravated by managers' incentive to misrepresent their company's true condition in fiscal reports. These issues in combination are also the reason why we do not discuss measurement errors in greater detail. The problem is simply so pervasive that we can only acknowledge it.

6.3 Suggestions for future research

Based on the results and limitations of our study, we would suggest several directions for future research. Among the more obvious ones is the expansion of our work in geography and time. Research on cash holdings may for instance be interesting in bank-dependent Europe, which has suffered through a longer crisis than the U.S. Furthermore, a review of cash holdings during crises over a longer time-horizon may allow researchers to draw more general inferences about the nature of cash holdings during and following systemic shocks. For instance, we do not know how long the effect of elevated post-crisis uncertainty will last.

More fundamentally, however, we would argue that new quantitative and qualitative research methods are called for in the investigation of cash holdings and financial policies in general. The reason is the interdependence of those decisions. The majority of the variables of our regression would also be included in empirical models that have leverage or investments as the dependent variable. Treating their effect on cash holdings as unidirectional may therefore seem almost absurd. Even to the extent that our results remain practically valid, it is a clear loss that we have no holistic understanding of the joint determination of corporate financial policies, particularly doing times of crisis.

Quantitatively, we therefore believe that the understanding of cash holdings may benefit from the application of system dynamics. System dynamics models the interplay of stocks and flows and has already been useful in a variety of contexts to create a holistic understanding of the behaviour of complex systems (Sterman, 2000). We believe that the method is applicable since, as we emphasize throughout this paper, cash and other financial policy variables can be understood in terms of stocks and flows. Indeed, our inspiration for applying this intuition is derived from introductions to system dynamics. The relevance of the approach originates from the fact that simultaneity and reverse causation are serious problems in econometrics (Wooldridge, 2009). In system dynamics, on the other hand, they are a feature. The very purpose of the method is to model the effect of feedback loops that can cause complexity even in seemingly simple systems. Furthermore, the numerical, as opposed to analytical, derivation of solutions in system dynamics allows for the modelling of non-linarites (Sterman, 2000). This is relevant because for instance credit line covenants may cause sudden drops in total liquidity once a threshold is reached (Demiroglu & James, 2011). While the application of system dynamic modelling is more challenging than econometric estimation, we believe it may be worthwhile in order to overcome the shortcomings of the relatively narrow quantitative studies that dominate the finance literature.

Turning to qualitative research methods, we believe that they offer yet another approach to a better understanding of the interdependencies of corporate financial policies. The reason is that, at the end of the day, statistical analysis can only establish correlation of some sort. Financial papers therefore largely rely on theory to provide causality. Causality in social science is, however, eventually provided by human actions and intentions. Studying these directly should therefore receive more attention. The opinions and decision of managers may reveal which theoretical motives for holding cash are truly relevant and which concerns trump others. Our media analysis attempts to create a short-cut at this by analysing the reports of journalists, which are avid users of qualitative methods, particularly interviews. Other researchers have

gone further and directly immersed themselves in companies and reached important conclusions. Brown (2001) for instance conducts a detailed study of foreign exchange risk management at a single multinational company by using discussions with managers, internal firm documents, and data on derivative transactions. He concludes that many of the reasons why the firm hedges are not consistent with commonly accepted financial theories. Instead, among the main drivers of derivative use is the need to facilitate internal contracting via a hedge rate. It is not unlikely that similar surprises await researchers of cash holdings willing to break the mould of regression analysis.

6.4 Chapter summary

In sum, this chapter has expanded on our contributions by discussing the implications of our conclusions for different audiences, some apparent limitations of our study, and suggestions for future research. The main implication of our study is that researchers of cash holdings cannot ignore the effect of shocks to cash holdings, that new proxies for cash holdings targets are relevant, and that the pecking order theory of cash holdings is not irrelevant. From a practical perspective, our research may furthermore be valuable because it enhances the understanding of cash holdings during a crisis. Some apparent limitations of our study are problems with endogeneity, economy-wide measures of key variables, and the difficulties in assessing shifts in risk and risk aversion. Our suggestions for future research are mainly concerned with the creation of a more holistic understanding of corporate financial policies. We argue that different quantitative and qualitative methods may contribute towards this end.

7. Conclusion

This thesis investigates U.S. corporate cash holdings in the light of the financial crisis of 2008. Towards this end, we first review the determinants of corporate cash holdings and then study their development before, during, and after the financial crisis. Overall, we conclude that the financial crisis has had a profound impact on corporate cash holdings. Regarding the determinants of cash holdings, we find that observed cash holdings must be understood as a combination of targeted cash holdings and shocks to these, and that targeted cash holdings are primarily determined by precautionary motives. Regarding the development of the determinants of cash holdings, we conclude that three major effects influenced cash holdings over the course of the financial crisis. We find that the immediate effect of the crisis was a negative shock to cash holdings caused by the recession and credit crunch. Thus, actual cash holdings fell below targeted cash holdings in 2008. At the same time, however, firms were actually increasing their targeted cash holdings due to elevated risk and risk aversion also caused by the crisis. In the aftermath of the crisis, the situation changed and firms' actual cash holdings surpassed their targeted. This was due to recovered OCFs, a lack of investment opportunities, and, for firms with an investment grade debt rating, easy access to external finance. Hence, we show that the development of corporate cash holdings observed between 2008 and 2012 is caused by the interplay of different, and at times opposing, mechanisms.

We begin our thesis with a literature review in order to investigate how previous studies can add to our research agenda. This has yielded new explanatory variables that can explain facets of targeted cash holdings not included in the influential empirical cash holding models of BKS and OPSW. To the best of our knowledge, we are the first to apply these findings collectively in an empirical model on cash holdings. More fundamentally, however, recent work on the dynamics of cash holdings following deviations from their target inspired us to understand observed cash holdings as a combination of targets and shocks. The literature on the financial crisis has furthermore provided some evidence on the development of the determinants of cash holdings.

Next, we enhance our literature review with a media analysis of publications such as The Economist, The Wall Street Journal, and CFO Magazine. In total we analyze 113 articles from 44 newspapers published between 2004 and 2013. The results of our media analyses contribute important insights, particularly in areas that have received little attention by academia. First, it reveals a shift in attitudes following the crisis, where companies perceive elevated uncertainty. This phenomenon has been so pervasive as to been labelled the 'new normal' of doing business and causes firms to increase precautionary cash holdings. Second, the media analysis has also highlighted that a further reason of high post-crisis cash holdings is a lack of growth opportunities. Third, it appears that not only is the public concerned with corporate cash holdings, but also that the legitimacy of holding cash has increased due to the crisis.

The findings of the literature review and media analysis are synthesized in a separate hypothesis section. The first hypothesis articulates our understanding of the determinants of corporate cash holdings. We argue that changes in cash holdings during the crisis can be explained by a combination of deliberate changes in targeted cash holdings and shocks that cause deviations from said targeted cash holdings. This dichotomy is

a main contribution of our paper because neither OPSW nor BKS fully incorporate it into their models[19]. The theoretical framework laid out in Hypothesis 1 is furthermore central to answering our research question because it allows us to disentangle the opposing effects of the financial crisis. Hypotheses 2 through 4 then employ this framework in order to explain cash holdings during the crisis. Hypothesis 2 states that the immediate effect of the crisis was a negative shock to cash holdings due to the recession and credit crunch. At the same time, we argue in Hypothesis 3, firms were actually increasing their targeted cash holdings due to the 'new normal'. Hypothesis 4 then asserts that firms' actual cash holdings surpassed their targeted in the aftermath of the crisis due to abundant OCFs and a lack of investment opportunities.

We test our hypotheses empirically, mainly by the use of panel data regressions. We employ a Compustat sample of 44,275 firm-year observations of U.S.-based public companies between 1998 and 2012. Hence, we include two more years of data than the most recent paper next to ours (PSW) and, importantly, employ a different statistical method. We furthermore put considerable efforts into constructing variables that allow us to investigate the two distinct mechanisms discussed in Hypothesis 1. The results of our quantitative analyses generally support our hypotheses. Most importantly, we find that our results provide evidence consistent with Hypothesis 1. This means that we can use the framework to investigate our remaining hypotheses. The results from doing so show that cash holdings developed as predicted, and that the development of the determinants of cash holdings is generally consistent with the causal links discussed in our hypotheses. An exception, however, is that the opportunistic borrowing effect due to low interest rates is only evident in firms with an investment grade debt rating. Finally, we also conclude that our empirical model explains cash holdings better than the empirical model of BKS. Hence, we contribute with research that is relevant beyond the recent financial crisis. Interestingly, our research also provides unique evidence in support of the pecking order perspective on cash holdings, which suggests that it deserves more attention than it currently receives in the financial literature.

We round off with a discussion of our research. We conclude that, given the implications and limitations of our study, the application of different quantitative and qualitative research methods may constitute the most relevant direction for future research on cash holdings.

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[19] OPSW do, for instance, acknowledge the relevance of transitory cash holdings, but defer them to the robustness section. They use the following year's change in cash holdings as an independent variable to control for differences between observed and targeted contemporary cash holdings.

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9. Appendix

9.1 Appendix for media analysis

Table 18 - Media Analysis Sample
The table summarizes our final sample of media publications for our media analysis according to source, date, title, and author. The sample has been constructed by use of relevance sampling. In total we have 44 different sources. Most articles have been located through Factiva.

Source	Date	Title	Author
Associated Press	30.1.04	Exxon Mobil sits on pile of cash	David Koening
Barron's	11.2.13	Cashing in on capex	Jack Hough
Barron's	12.12.11	Where is all that corporate cash, anyway?	Jacqueline Doherty
Barron's	27.6.11	Show Ralph the Money	Randall W. Forsyth
Bloomberg	23.5.13	Cash piles up as U.S. CEOs play safe with slow-growth economy	Chris Burritt
Bloomberg	8.5.13	Offshore cash hoard expands by $183 billion at companies	Richard Rubin
C.D. Hower Institute	16.1.13	Money never sleeps: The real reasons for the cash build-up on corporate balance sheets	Unknown
Canadian Business	12.2.13	Dead money: There are good reasons for hoarding cash	John Lorinc
CFO Insight	13.2.13	Cash pile unlikely to trigger capex boom, S&P says	Anne-Kathrin Meves
CFO Insight	31.10.12	On cash floods and droughts	Steven Arons
CFO Insight	21.5.12	CFOs spend down reserves and invest	Desiree Backhaus
CFO Magazine	29.09.13	Better than nothing	Vincent Ryan
CFO Magazine	5.6.13	Too much cash?	Edward Teach
CFO Magazine	8.5.13	Corporate cash: Hold and release	Vincent Ryan
CFO Magazine	17.12.12	Three resolutions CFOs must make for 2013	John Calia
CFO Magazine	01.11.11	Sitting comfortably on a cash cushion	Kate O'Sullivan
CFO Magazine	15.7.10	Time to get off your cash?	Vincent Ryan
CFO Magazine	17.2.10	A license to hold cash	Vincent Ryan
CFO Magazine	1.10.09	Hard lessons	Alix Stuart
CFO Magazine	1.3.09	The standoff continues	Russ Banham
CFO Magazine	1.6.08	Keeping cash safe	Vincent Ryan
CFO Magazine	1.12.07	Mastering the flow	Edward Teach

Source	Date	Title	Author
CFO Magazine	13.8.07	Stockpiles of cash in an uncertain market	Alan Rappeport
CFO Magazine	17.10.06	Cash scorecard: Unleash the hoards	David Katz
CFO Magazine	18.7.06	Fed guvernor: Sarbox spurs cash jitters	Stephen Taub
CFO Magazine	6.1.05	Capital ideas: Unsightly cash buildup	Marie Leone
CFO Magazine	5.4.04	Companies are awash in cash: When will they finally start spending it?	Ronald Fink
CFO Magazine	1.12.01	It must be peanuts	Gary Kelly
Chicago Tribune	26.9.11	Many U.S. companies sitting tight on plump cash cushion	Becky Yerak
City Am	3.4.13	Corporate cash piles won't be spent in Britain any time soon	Allister Heath
CNBC	6.6.11	Solving the mystery of corporate cash hoarding	Unknown
CNN Money	6.6.12	New study says $2 trillion corporate cash hoard not Obama's fault	Stephen Gandel
Dow Jones Newswires	30.9.13	Number of the week: Companies holding lots more cash	Ben Casselman
Dow Jones Newswires	13.2.13	Companies awash in cash and debt	Unknown
Dow Jones Newswires	6.8.04	WSJ on the other hand: pros and cons on corporate cash hoards	Unknown
Financial Times	18.1.13	Reality not politics dictates corporate cash hoarding	Gillian Tett
Financial Times	23.11.12	US cash piles built on more than anxiety	Sarah Gordon
Financial Times	13.7.12	US companies' dash for cash heralds a painful freeze	Gillian Tett
Financial Times	11.3.12	Cash-hoarding companies seem unable to splash out	Tony Jackson
Financial Times	9.8.10	Corporate Earnings: Revival of the fittest	Richard Milne
Financial Times	20.1.09	Tactics that deliver in a 'war for cash'	Richard Milne
Financial Times	30.11.05	A surplus of cash invariably leads to a shortage of sense	Simon London
Forbes	6.7.13	Stocks could take-off due to the $14 trillion cash being hoarded	Robert Lenzner
Forbes	4.3.13	Big companies are throwing off cash faster than they spend it	Steve Schaefer
Forbes	19.3.13	U.S. companies stashing more cash abroad as stockpiles hit record $1.45T	Agustino Fontevecchia

Source	Date	Title	Author
Forbes	29.9.11	Focus on cash-holding sectors: Technology: health care and industrials	Richard Peterson
Forbes	8.8.11	Too much becomes a really serious business problem	Robert Picard
Fund Strategy	5.12.11	Skewed View of Cash raises questions	Andrew Smithers
Harvard Business Review	16.4.12	Should companies retain strategic cash?	Bruce Nolop
Indianapolis Business Journal	24.1.11	Cash reservoir	Francesca Jarosz
International Herald Tribune	2.5.11	Despite riches, apple seeks a loan	Peter Lattman
Investment Weekly News	25.10.10	University of Illinois at Urbana campaign: cash hoarding nothing new for businesses, scholar says	Unknown
Investor's Business Daily	9.3.09	Firms slash dividends, saving cash	Reinhardt Krause
Investor's Business Daily	15.10.08	Companies cut investment in tough times	Reinhardt Krause
Los Angeles Times	20.3.13	Companies hoarding more cash than ever before	Alana Semuels
Market Watch	18.8.11	5 money moves: Dr. Doom is making now: Marc Faber readies for hyperinflation, dollar's demise and civil unrest	Jonathan Burton
Market Watch	8.10.10	A funny thing happened on the way to the bank	Mark Hulbert
Marketplace Money	16.7.05	Newsweek's Allan Sloan discusses why companies hang on to extra cash	Kai Ryssdal
MSN Money	27.7.11	Companies, funds hoard cash ahead of debt crisis	Kim Peterson
Network World Fusion	3.9.13	Tech's cash kings are sitting on billions: Compared to other industries" tech companies are the keepers of the cash	Ann Bednarz
New York Post	5.6.06	Big fat cash cache: $640B on sidelines	Tom Bawden
Newsweek	8.11.10	Holding dollars hostage: Big companies stash cash abroad	Daniel Gross
NPR Post	20.9.11	Companies have been holding more cash for decades	Jacob Goldstein
Phys	4.7.13	Corporate hoarding of cash has roots in CEO	Unknown
Quartz	28.6.13	A brand new reason US companies are spending their cash hoard	Simone Foxman
Regional Economist	1.4.13	Uncertainty and the economy	Kevin Kleisen

Source	Date	Title	Author
Reuters	21.10.09	As crisis eases, companies still hoard	John Parry
Ritholtz	18.7.13	Corporate cash balance and economic activity	Guvernor Kevin Warsh
Smart Money	1.5.06	Stockscreen: Rollin in money: Cash rich companies have lots of options and the market rewards their shares	Jack Hough
The Atlanta Journal Constitution	8.6.11	Guest Column: Uncertainty is suffocating U.S. economy	E. Thomas McClanhan
The Australian	3.11.09	Companies hoard cash in reaction to crisis	Tom Ginty and Cari Tuna
The Australian	14.6.05	Corporate cash piles up	Stephen Ellis
The Economist	15.6.13	Quality street	Unknown
The Economist	6.4.13	A world of cheap money: Six years of low interest rates in search of some growth	Unknown
The Economist	16.2.13	Corporate cash piles	Unknown
The Economist	3.11.12	Corporate savings: Dead money	Unknown
The Economist	21.7.12	Buttonwood: Capital gains	Unknown
The Economist	17.3.12	Corporate saving and the budget: stashing the cash	Unknown
The Economist	10.3.12	Apple's cash pile - How to spend it	Unknown
The Economist	6.7.10	Why are firms saving so much?	Viral Acharya
The Economist	1.7.10	Companies' cash piles: show us the money	Unknown
The Economist	20.11.08	Managing in the downturn: desperately seeking a cash cure	Unknown
The Economist	22.7.04	Microsoft' cash bonanza: An end to growth?	Unknown
The Globe and Mail	3.4.13	Cash-rich companies still biding their time	Barrier McKenna
The New York Times	23.3.13	How to unlock that stashed foreign cash?	Jeff Sommer
The New York Times	12.2.13	The growing Corporate Cash hoard	Bruce Bartlett
The New York Times	5.12.04	Long on cash, short on ideas	Anna Bernasek
The New Yorker	9.8.04	Cash kills: The financial page series	James Suroweicki
The Wall Street Journal	30.7.13	CFO Journal: Banks open arms to corporate cash	Vipal Monga
The Wall Street Journal	30.7.13	Companies hold on to their cash	Katy Burne
The Wall Street Journal	22.7.13	Leadership in corporate finance - companies have lots of cash - and with good reason	Chana Schoenberger
The Wall Street Journal	7.12.12	U.S. news: cautious companies stockpile cash	Ben Casselman

Source	Date	Title	Author
The Wall Street Journal	7.8.12	Google googles for yield, finds auto bonds	Katy Burne
The Wall Street Journal	12.7.12	Video: CFOs cling to cash amid risks	Vipal Monga
The Wall Street Journal	1.7.12	Blame not, not greed, as firms hoard cash	John Bussey
The Wall Street Journal	9.6.12	Number of the week: corporation not hoarding cash	Ben Casselman
The Wall Street Journal	7.6.12	Big customers are taking longer to pay	Angus Loten
The Wall Street Journal	7.12.11	CFO Journal: Holding course for safety: CFO:s will keep steering cash to low-yield investments while tensions persist	Maxwell Murphy
The Wall Street Journal	17.10.11	Companies shun investment, hoard cash	Ben Casselman
The Wall Street Journal	11.6.10	U.S. firms build up record cash piles	Justin Lahart
The Wall Street Journal	16.02.10	Job defends Apple's cash hoard	Ben Chamy
The Wall Street Journal	25.9.08	U.S. firms gird for hits and draw on credit now	Jeffrey McCracken
The Wall Street Journal	5.4.06	Long and short: The tech sector is hogging the green blanket	Jesse Eisinger
The Wall Street Journal	27.10.05	The follies of regulation	Henry G. Manne
The Wall Street Journal Asia	2.10.08	U.S. firms press for bailout	Amol Sharma
The Wall Street Journal Europe	5.3.10	Firms reach for wallets - record capital piles spur moves toward merging and acquiring	Tom McGinty
The Washington Post	10.12.10	Tax U.S. companies into spending	Mihir A. Desai
The Washington Post	7.10.10	Companies spend their stash of cash to buy back stock	Jia Lynn Yang
The Washington Post	15.7.10	Companies have cash, but not the will to hire	Jia Lynn Yang
USA Today	12.2.13	Too much cash is a problem? Companies can't seem to put enough of it back to work	Matt Krantz
USA Today	28.7.10	Companies are sitting on a pile of cash: enough to pay 2.4M workers $70.000 salaries for 5 years - yet they're not hiring	Matt Krantz
USA Today	1.3.09	Economic prospects dimmed by firms' actions	Unknown

Source	Date	Title	Author
W.P. Carey school of business	15.3.10	Evidence from recession: the real reason companies hold cash	Unknown

Table 19 – General Coding Instructions

The table summarizes our general coding instructions. They describe how to apply the coding frame for our media analysis. These include pieces of advice and other best practices to be relied upon when conduction the coding of an article. The general coding instructions are all at a very generic level and are meant to lay the foundation for the specific instructions for categories, subcategories, and sub-subcategories described in our coding manual.

Category	Instruction/convention
Unless otherwise indicated	Use 1 when an argument is present
	Use 0 when an argument is not present
When range	Numbers symbolize sub-sub categories. Use a given number for the presence of an argument related to a specific category
	Use 0 when an argument is not present
Indicating relationship or direction	Use + to indicate a positive relationship
	Use - to indicate a negative relationship
	Use 0 when no relationship or direction is mentioned
Time periods (time frame studied, not publication date of article)	Pre-crisis: Includes the time period from 2004 to mid-2007
	During crisis: Includes the time period from mid-2007 to mid-2009
	Post-crisis: Includes the time period from mid-2009 up until September 2013.
If in doubt	Refer back to the coding manual for precise instructions
	Include comment and/or discuss with partner
Chains of causation	Write down chain of causation following the number (e.g. 1) when coding an argument, if relevant. If in doubt of whether writing a chain of causation or not, write it. Rather one too many than one too few
	Pay special attention to new variables or new relationships
	Remember not to confine the code entry to a limited amount of text in the comments. Include all factors, explanations and arguments that may be relevant
	Make the code entry cell orange if the finding is of particular relevance: Orange box = attention

Table 20 – Overview of Categories
The table shows an overview of all the categories used in our coding frame. Categories to the left are the main categories, while categories in the middle are subcategories attached to each respective main category. The same logic applies to sub-subcategories, which are shown to the right. Please note that all subcategories and sub-subcategories for the category 'Reason for holding cash' have been further divided into three different categories according to each time period. This means that reasons for holding cash have been coded in relation to a pre-crisis period, a crisis period, and a post-crisis period. The total amount of all categories is 210.

Main category	Subcategories	Sub-subcategories
Mention of the recent financial crisis?	-	-
Which overall effect has the crisis had?	Limited access to financing	-
	A drop in demand	-
	Increase in uncertainty	-
	General/Other	-
	Comments	-
Current level of cash holdings	Cash holdings very low	-
	Cash holdings low	-
	Cash holdings high	-
	Cash holdings very high	-
	Other	-
	More for the firms with	-
	Comments	-
Overall trend in the development of cash holdings	Down during the crisis, up post-crisis	-
	Only up the after crisis	-
	Increasing over decades	-
	Future direction	-
	Other	-
	Comments	-
Reason for holding cash? (For each of the following periods: Pre-crisis category, During crisis, and Post-crisis).	Opportunity cost	-
	Transaction cost	-
	Precautionary motive	-
	Ability to access external finance	Overall inability
		Availability of financing
		High cost of borrowing
		Information asymmetry
		Asset tangibility
		Other

Main category	Subcategories	Sub-subcategories
	Ability to access internal finance	Overall expenditures
		Cut investment and/or spending
		Cut dividends and/or share repurchasing
		Cut jobs
		Sell assets
		Cut receivables and inventory
		Other
	Likelihood of being short of funds	Overall uncertainty
		Past and current overall uncertainty
		Past and current demand and growth uncertainty
		Past political, legal and regulatory uncertainty
		Future overall uncertainty
		Future demand and growth uncertainty
		Future political, legal and regulatory uncertainty
		Industry-specific uncertainty
		Hedging or diversification
		Debt, refinancing risk and fear of future financing
		Other
	Cost of being short of funds	1) Near future growth opportunities
		2) Competitive pressures
		3) Other
	Agency problems	-
	Dynamic/Pecking Order	Higher profitability
		Dynamic
		Pecking order
		Other
	Other	CFOs are risk averse
		Lack of growth opportunities
		New arguments
		Comments

Main category	Subcategories	Sub-subcategories
Non-crisis explanation for cash holdings level?	-	-
Cash holdings are said to bring along/co vary with:	Cash holdings bring along (Investor pressure)	-
	Cash holdings co vary with	-
Cash holdings are depicted as being a problem?	Yes	Overall (Economy)
		Spending down
		Employment down
		Low return on cash (investors)
		Other
	No	-
	No opinion	-
The high cash holdings are spent on?	Not spent	-
	Dividends	-
	Capital investments (operational assets)	-
	Jobs	-
	Repatriated	-
	Financial investment	-
	Kept abroad	-
	Buy backs	-
	Acquisitions	-
	Other (e.g. pay down debt)	-
How cash holdings should be spent?	Not spent	-
	Dividends	-
	Capital investments (operational assets)	-
	Jobs	-
	Repatriated	-
	Financial investment	-
	Kept abroad	-
	Buy backs	-
	Acquisitions	-
	Other (e.g. pay down debt)	-
Geography	The U.S.	-

Main category	Subcategories	Sub-subcategories
	Worldwide	-
	Other	-
	Comments	-
Time-period examined	Pre-crisis	-
	Crisis	-
	Post-crisis	-
The subject of the articles is	General firms	-
	Specific firm	-
	Specific industry	-
	Other	-
Articles cites	CFO	-
	Academic	-
	Other	-
	Comments	-
Main idea/Take away	-	-
Relevant notes/quotes	-	-

Table 21 – Coding Manual

The table includes the coding manual for all of the 210 categories, subcategories and sub-subcategories of our coding frame. The description and definition of each category is inspired by Krippendorff (2013) and Schreier (2013). The table illustrates the name, a brief description and when to apply, indicators, examples, and potentially a decision rule for each of the respective categories. The categories descriptions appear in the same order as in the category overview in Table 20. Note that in the original coding manual, the subcategories below from 'opportunity costs' to 'other' are all separated into three different categories according to time periods. However, as the descriptions of these are similar, expect for the time period, we have only included one description of each category below.

Coding manual: Description and application of categories
Name: Mention of the recent financial crisis

Brief description and when to apply:	Used when the article mentions the recent financial crisis in its content. The actual effect of it is not important here, just that the article acknowledges its presence. 0=No 1=Yes
Indicators/special attention:	Recent, 2007, 2008, 2009, credit crunch, subprime, financial crisis, overall, mortgage crisis, recession, severe, U.S., recession, uncertainty
Example:	'Companies across the board were affected by the recent financial crisis'
Decision rule:	Articles before 2007 cannot have a '1' in this category

Name: Which overall effect has the crisis had?

Brief description and when to apply:	Describes the generic effects of the recent financial crisis on corporations and/or the economy. Focus is on the actual crisis period, i.e. around mid-2007-mid-2009. Often these influences will fit into the three main effects of our literature review but remember to focus on new influences and chains of causation. 1) Limited access to financing: This includes a constrained access to financing for companies in particular. Often this will happen around the Lehman period. A limited access to financing includes a mention of overall constrained credit, closure of the credit lines market, limited bond lending, bank lending or a mention of the multiplier effect. 2) A drop in demand: This includes an overall decrease in consumer spending and demand contraction that has made it harder for firms to sell their products. This could potentially come from either higher saving or less income or other factors. 3) Increased uncertainty: This category covers an increase in the uncertainty of firms' environment and the general economy, which could e.g. be because of either a drop in demand, limited access to financing or others. 4) Other/General: Sentences or units of coding that do not fit into the three preceding categories. If the crisis is mentioned as an unspecific overall effect that is not broken down into its specific parts or effects. That is, there is no mention of any of the three preceding categories but only the word crisis is mentioned Also, if new categories/effects of the crisis. Write text and chain of causation. Note which one it is exactly 5) Comments: Notes explaining chains of causation that cannot be fitted into the actual box
Indicators/special attention:	Articles from 2007 and forward. Influence, impact, effect, shock, financial crisis, credit crisis, subprime mortgage crisis, spending, demand, Lehman, credit crunch, volatility, VIX, uncertainty, riskiness 1) Dry up, tight credit, bond market collapse, credit line, impossible, drought, dearth

Coding manual: Description and application of categories	
	2) Be aware of macroeconomic indicators: Unemployment rate, disposable income numbers, spending down, demand decrease, margin erosion, weak spending pattern, recession 3) Volatility, economic uncertainty, uncertain environment, future uncertainty, confusion, stock market volatility, unstable climate, insecurity, questionable times, stock market swings or figures, options volatility numbers 4) General, overall, crisis, aggregate, financial crisis altogether, crisis (appears alone in text) 5) New theories, chain of causations, new variables, new dates, new levels
Example:	Read subcategories (3 below) 1) 'After Lehman Brothers collapsed in the autumn of 2008, the bank funding market dried up - a nasty shock for businesses' 2) 'Many companies feel inclined to hoard cash and be reactive as a response to margin erosion and weaker demand' 3) 'One obvious explanation for higher cash holdings by corporations is the uncertainty of the economic environment during the financial crisis' 4) 'While a fortress balance sheet appears appealing during the time of the crisis...' 5)
Decision rule:	This category does only relate to the financial crisis of 2008. If crisis is mentioned, check year of publishing and/or context 1) Only the overall effect is included here *during* the crisis. In the post-crisis era, see 'access to external finance' 2) . 3) May be mentioned along a limited access to financing or a drop in demand 4) Look for indicator words in 'limited access to financing, a drop in demand and, increased uncertainty. If any of these appear, it is likely that the unit of coding does not fit here 5)
Name: Current level of cash holdings	
Brief description and when to apply:	The results of this should be analyzed keeping the publishing year of the article in mind and/or the year of the level of cash holdings mentioned in the text. We want to grasp an idea of the current level of cash defined, i.e. only articles describing the post-crisis period should be included here. Note qualitatively if it is illustrated how cash holdings currently are in relation to their historic level and whether this is due to the crisis. It can both be current direction (if it is increasing or decreasing) and current level. Write qualitative in comments or others if historical levels are mentioned 1) Cash holdings very low: When cash holdings are falling significantly or are at very low levels 2) Cash holdings low: When cash holdings are depicted as below average or below historical levels 3) Cash holding high: Describes a moderate increase or relatively high level. That is no strong adjectives are used to described the cash holdings or their direction 4) Cash holdings very high: An historical all-time high or strong adjectives describing recent developments 5) Other: Relating to other time periods and that development and/or level of cash. This could be relevant to compare to historical levels. Write year. 6) More for firms with: Relates to specific firm characteristics, that is if some firms have increased their cash holdings more than others and why. Important in relation to industry-specific reasons and new hypotheses

Coding manual: Description and application of categories	
	7) Comments: Notes explaining chains of causation that cannot be fitted into the actual box
Indicators/special attention:	High, historic, all-time, decades, low, significant, cash ratio, current level, as of now, compared to, assets, liquidity, abundance 1) Significantly, record, all-time, very low, fallen, decreased, clearly, negative development, level, balance. In general strong adjectives 2) Low, below average, decrease slightly, fall minimally, tap on cash 3) High, large, above average, increase 4) Trillion, significantly, massive, enormous record, all-time, very high, very large, increased, hoard, clearly, very positive development, steep increase, level, balance. In general strong adjectives 5) Years, 1900s, before the crisis, historical, compared 6) 'Especially technology companies hoard cash' 7) New theories, chain of causations, new variables, new dates, new levels
Example:	1) 'Cash holdings are the lowest in 20 years' 2) 'Since the outset of the crisis, companies' cash balances have been depleted' 3) 'Companies are increasing cash holdings awaiting the crisis' 4) 'Companies are hoarding an unprecedented amount of cash' 5) 'After the 2001 crisis, companies increased their cash holdings significantly' 6) 'Especially technology companies hoard cash' 7)
Decision rule:	Look carefully at the publication date of the article and the time period it examines. Only those regarding the post-crisis period are relevant. Remember to note year
Name: Cash holdings very low	
Brief description and when to apply:	When cash holdings are falling significantly or are at very low levels
Indicators/special attention:	Significantly, record, all-time, very low, fallen, decreased, clearly, negative development, level, balance. In general strong adjectives
Example:	'Cash holdings are the lowest in 20 years'
Decision rule:	It is expected that this category should not occur often, so be aware of the reason cited when it appears 1) It is expected that this category should not occur often so be aware of the reason cited when it appears 2) 3) 4) Strong adjectives 5) Texts before 2007 are likely to be included 6) Important category: Look for differences in levels of cash across firms 7)
Name: Overall trend in the development of cash holdings	

Coding manual: Description and application of categories	
Brief description and when to apply:	To see how the articles explain the development of cash holdings over time. This will include a comment on the level of cash holdings at a given time and potential changes, especially around the time of the recent financial crisis. For the most current articles, they might present an educated guess on future levels 1) Down during the crisis, up post-crisis: Describes if U.S. corporations decrease their cash holdings during 2007-2008 and start to rebuild their cash levels afterwards coming out of the crisis through 2009 2) Only up after the crisis: Firms start to increase the cash on their balance sheet as soon as they can. Basically, the cash levels increase from 2008/2009 and forward. 3) Increasing over decades: Will describe a cash holdings timeline ideally. Relatively open category so be open to the option of adding a note. May include a long-term trend 4) Future direction: A statement of a potential future direction is probably substantiated by an interesting argument - be prepared to catch this. Will describe the trend in the coming years 2013-. Focus is only on very recent articles here +: Positive trend: Cash holdings likely to increase -: Negative trend: Cash holdings likely to fall 5) Other: Various specific years or timeline trends not captured by the preceding four overall phenomena. Do only include if relevant. Add note to illustrate exact years for example. 6) Comments: Notes explaining chains of causation that cannot be fitted into the actual box
Indicators/special attention:	Keep an eye on years, trend, fell, rose, highest in years, lowest in years, constant, new normal, stall stay high, decades, since the crisis, future, absolute terms, relative terms, cash-to-asset ratio, cash ratio, compared 1) Attention to most recent articles, companies tap on their holdings during 2007-2008, dip into, rebuilt, increase, decrease, spend cash, higher than, hoard, 2000-years, after, precautionary, deplete, liquidity 2) Increase, stash, hoard, build up, focus on cash, hold onto cash, high level, not spending, increased desire to hold cash 3) Likely to refer to older studies, keep eye on years, return to level of…, highest since, falling since, increase since, stalling during the, cash ratio, compared to 4) Be on the lookout for argument for future increase/decrease, most recent articles, future, change, constant, coming years, imminent change, continuing trend, positive, negative, fall, increase. 5) Years, high, low, compared to, overall, 6) New theories, chain of causations, new variables, new dates, new levels, more for some firms
Example:	1) 'Even firms with cushions were burning through the cash on their balance sheet during the crisis, which made CFOs strive to hoard cash in the years after' 2) ...as companies are spooked by the recent crisis, they have considerably increased their levels of cash' 3) 'According to a study by Rene M. Stulz, cash holdings have actually increased over the last 30 years' 4) 'As companies are still nervous from the crisis, the may not spend cash immediately'.
Decision rule:	The category choice below is likely to be connected with 'current level of cash holdings' in the category before. The important thing here is to look for trends – particularly since the financial crisis. And this category is not specifically for post-crisis articles. 1) If there is a mention of the pattern above but also a mention of pre-crisis level (pre-2007), tick off this box and add a comment

Coding manual: Description and application of categories	
	2)
	3)
	4) If older texts offer a future direction, do only include it. Instead write in notes if it has a relevant/interesting chain of causation. Discuss with partner. E.g. if a 2008 text says cash holdings will fall through the next year, do only include if it offers an interesting explanation on why
	5) Discuss if relevance is dubious. Write argument in full
Name: Reason for holding cash pre-crisis	
Brief description and when to apply:	This category includes explanations or motives that firms have for holding, decreasing or increasing cash coded according to each time period. The reasons relate to the ones laid out by our literature review but new ones and new chain of causations should be added: The pre-crisis period from 2004 to mid-2007 (time frame studied, not publication of article) *Note that in the original coding manual, the categories below from 'opportunity cost' to 'other' are all separated into three different categories according to our three respective time periods. However, as the descriptions of these are similar, expect for the time period, we have only included one description of each category below*. Included in this category is: 1) Opportunity costs 2) Transaction costs 3) Precautionary motive 4) Tax motive 5) Agency costs 6) Dynamic/Pecking order 7) Other 8) Comments See below for each of these subcategories
Indicators/special attention:	2004, 2005, 2006, before, prior, pre, reason, explained by, motive, due to, crisis, credit crisis, subprime, mortgage crisis, uncertainty, future uncertainty, return, low bond lending, credit lines, borrowing costs, higher profitability, demand contraction, growth opportunities, lack of, tax, repatriate, shortage of funds, fear of past uncertainty, cushion, cash blanket, support investment opportunities, questionable future funding, costly external capital, managerial slack, managerial freedom, entrenchment
Example:	See subcategories
Decision rule:	Rather add one too many than one too few chains of causation. If boxes are overlapping write chain of causation/reason also and put it where the majority of the argument belongs. Discuss with partners if overlaps occur and if there is a need to reformulate categories. Write, if necessary, a note in another category where a minority of the argument is placed. If e.g. an article says that CFOs are more risk averse due to the economic environment, put the main argument in that category and a comment in the uncertainty category. Remember that all articles, regardless of publication year, may describe this period.
Name: Opportunity costs	
Brief description and when to apply:	Mentions of the lower rate of return associated with cash because of the benefit of holding liquid funds. Even though we do not distinguish between cash and cash equivalents in our analysis, the media might do this as cash equivalents do earn interest, as opposed to cash that do not. If CFOs attitude towards this is mentioned, be sure to include it. And write if opportunity costs are high or low, important or unimportant in determining how much cash to hold. 0: No mention

Coding manual: Description and application of categories	
	1: Interest rate: Or the cost of carrying cash, as a determining factor of holding cash. After the '1' elaborate, e.g. low interest 2: Other
Indicators/special attention:	Opportunity, forego, compared to, high interest rate, low rate, cost of carry, inflation rate, punishment for holding cash, penalty, cost of safety,
Example:	'Cash is not a productive asset. Particularly if companies are putting that money in the hank, they're getting a low return'
Decision rule:	
Name: Transaction costs	
Brief description and when to apply:	A mention of the fact that there is an optimal level of average cash holdings if firms incur fixed transaction costs as they convert assets or securities to cash. Also, a mention of firms striving to find that optimal balance. Mentions in relation to Baumol' inventory theory analogy or Miller and Orr's non-constant net cash flow model as determining factors of cash flows.
Indicators/special attention:	Transaction cost, optimal balance, balance, converting costs, average cash holdings level, fixed costs, rejuvenate
Example:	
Decision rule:	
Name: Precautionary motives	

Brief description and when to apply:	Arguments supporting the fact that cash is kept to fund daily activities and investment when cash flows are insufficient and other sources of funding are not available are excessively costly. Cash as a buffer against adverse liquidity shocks. In accordance to our literature review, we have divided this motive into four subcategories: Ability to access external finance, ability to raise internal finance, likelihood of being short, and cost of being short.
	
	    1) Low ability to access external finance
	    2) High ability to access external finance
	    3) High ability to raise internal finance
	    4) Low ability to raise internal finance
	    5) High likelihood of being short of funds
	    6) High cost of being short of funds
	See each sub-subcategory below

Indicators/special attention:	Opportunity, forego, compared to, high interest rate, low rate, cost of carry, inflation rate, punishment for holding cash, penalty, cost of safety,
Example:	Precautionary, buffer, shock, tight credit, access to finance, costly, riskiness, demand, unsure, insecurity, pessimistic, uncertainty, future fear, undertake investments, finance activities, fund investments See subcategories
Decision rule:	There are many subcategories for some of these sub-subcategories. Focus on sub-category first and then sub-subcategory (as this is the least important). Note specifically the different sub-subcategories are high or low. The categories are according to our expectation and what would lead to higher cash (e.g. high risk of being short of funds) but note the opposite might be the case (e.g. high ability to access cash internally)

Coding manual: Description and application of categories
Name: Low ability to access external finance

Brief description and when to apply:	This relates to how constrained companies are to accessing external finance. This deals with current to finance and to future. This can be both because of non-availability of external, as if banks stop lending or high prices of financing Expect this to be an issue during the crisis in particular. Keep eyes open in regards to if firms are explained to be constrained depending on various firm characteristics. Also keep an extra eye out for the use or lack of use of credit lines - it pertains to '2'. 1) Overall inability: Companies cannot access capital in general. Overall. No specific explanation given. 2) Availability of financing**:** The difficulty of getting bank or bond funding and fear/uncertainty of future access. If farms draw down on their credit lines due to fear of future financing, this is also mentioned her 3) Cost of borrowing: Rates charged on loans and return firms get on their bonds 4) Information asymmetry: Mentions of companies trying to decrease information asymmetries or can't access capital due to information asymmetries 5) Asset tangibility: Mention of companies with more intangible assets have more difficulties gaining access to capital 6) Other
Indicators/special attention:	Opportunity, forego, compared to, high interest rate, low rate, cost of carry, inflation rate, punishment for holding cash, penalty, cost of safety 1) Overall, general, access, capital, cash, loan 2) Drought, future access, fear, uncertain credit tight, dry up, debt maturities, constrained, large companies, small companies, credit line, draw down, 3) Interest rates, return, rate, interest, cost, cheap, expensive 4) Credit rating, balance sheet, cash, small firms, large firms, rating, junk 5) R&D, intangible, machine, tangible, collateralized, uncertain outcome 6)
Example:	Precautionary, buffer, shock, tight credit, access to finance, costly, riskiness, demand, unsure, insecurity, pessimistic, uncertainty, future fear, undertake investments, finance activities, fund investments See subcategories 1) 'Accessing cash during the crisis was generally impossible for all firms' 2) A report from the European central Bank found considerable worsening in the availability of bank loans to SMEs across the euro zone./ 'The firms drew down on their credit lines as future capital was uncertain' 3) 'Small companies faced sky-high rates on their loans whereas the opposite was true for larger companies' 4) 'Companies fear losing access to capital markets, so they keep their balance sheet pumped with cash thereby increasing the credit rating' 5) 'Old-school industrial companies could use their factories and other hard assets as collateral to borrow lots of the money they needed to grow and invest' 6)
Decision rule:	There are many subcategories for some of these sub-subcategories. Focus on sub-category first and then sub-subcategory (as this is the least important). Note specifically the different sub-subcategories are high or low. The categories are according to our expectation and what would lead to higher cash (e.g. high risk of being short of funds) but note the opposite might be the case

Coding manual: Description and application of categories	
	(e.g. high ability to access cash internally) Remember that refinancing risk is under 'likelihood of being short of funds'. If high ability to access external finance occurs, remember to write text or we might make a new category
Name: High ability to access external finance	
Brief description and when to apply:	If companies are viewed as relatively unconstrained in their access to external capital, as for example bank loans or bond financing. Remember to note the type of companies and pay close attention to this category in the post-crisis period
Indicators/special attention:	Cheap, easy, low, lowest, inexpensive, bond, issue, loan, capital access, external, bank, investor, interest.
Example:	'Obtaining financing has proven historically inexpensive and interest rate are very low'
Decision rule:	
Name: High ability to raise internal finance	
Brief description and when to apply:	Mentions of companies reducing various types of expenditures or investment to raise cash. If the measures below are 'frozen' it should also be added. Also general statistics (see example 2 under investments) for overall firms. That is, a note of business spending has decreased in general for example or no investment is happening. 1) Overall expenditures 2) Cut investment and/or spending 3) Cut dividends and/or share repurchasing 4) Cut jobs 5) Sell assets 6) Cut receivables and inventory 7) Other
Indicators/special attention:	Reduce, decrease, raise, sell cut, to raise cash, to be liquid, ability, internally, internal financing, stop, freeze, general, firms overall, specific firms. 1) No specific mention of words below, overall, general, expenditures 2) Forego spending, expenditures, outsource, investment, general, capex, decrease 3) Payout, investors, dividends, stock, share, repurchasing, buy back, fall decrease, decline 4) Employment, fire, sack, hire, reduce, employees, workforce, outsource 5) Buildings, SBUs, business, assets, non-essential assets, plan 6) Inventory, goods, stock, receivables, bills, outstanding 7)
Example:	'Obtaining financing has proven historically inexpensive and interest rate are very low' 1) 'Firms freeze their budget' 2) 'Cost cutting was initiated during the first period of the crisis'./ 'Business investment fell at an annual rate of 10.8% over past two years despite anemic economic growth' 3) 'Investors are angry that the company cut dividends for the second quarter in a row' 4) 'Lay-offs and outsourcing to Mexico happened for one company' 5) '...Mazda therefore sold non-essential SBUs' 6) '...as a consequence large companies took longer to pay their accounts receivable to smaller companies'

Coding manual: Description and application of categories	
Decision rule:	Take note of reasons why the above mentioned is done. If it is done to offset other uncertainty for example or cash shortage.
Name: Low ability to raise internal finance	
Brief description and when to apply:	Mentions of companies not being able to reduce various types of expenditures, investments or lay off workers to raise cash for whatever reason.
Indicators/special attention:	Cannot reduce, try to decrease, lower, strive to sell, cut, to raise cash, to be liquid, inability, internally, internal financing, stop, freeze, general, firms overall, specific firms.
Example:	'Due to high asset specificity, the firm could not sell its machines'
Decision rule:	Haven't met any mentions of this. Be aware of the reverse category (next that demonstrates the opposite)
Name: High likelihood of being short of funds	
Brief description and when to apply:	Deals with arguments related to the fact that cash holdings have increased due to the risk of being short of funds, i.e. cash flow shortfalls. Any mention of increase in cash flow volatility or firms have a chance of running out of funds should be included. Cash flow volatility can come from a number of sources such as past, present and future uncertainty in the company's environment. This can both relate to demand uncertainty but also to regulative, legislative and political shock or uncertainties. Mentions of industry specific, volatile investment needs, debt, refinancing risk, hedging, and diversification should also be included. Remember chains of causations Indicators/special attention: All words below, hoard, uncertainty, political, euro zone, precaution, cushion, blanket, just-in-case, reduce spending, increase cash, pile, excess 1) Overall uncertainty: No mention of specific cause, just expectations of a fall in cash flow or uncertainty in cash flow make companies hoard cash. Past, current and future 2) Past uncertainty 3) Past demand uncertainty 4) Past political, legal and regulatory uncertainty 5) Current and future overall uncertainty: No mention of specific cause, just only future expectations of a fall in cash flow or uncertainty in cash flow make companies hoard cash 6) Current and future demand uncertainty 7) Current and future political, legal and regulatory uncertainty 8) Industry-specific uncertainty: General uncertainty pertaining to one sector in particular 9) Hedging and diversification: If the article mentions that firms use hedging in derivatives or diversification as substitutes of high cash holdings. Diversification in decreasing dependence on banks and use of corporate diversification to lend across internal businesses 10) Debt, refinancing risk: Mentions of firms being afraid they cannot refinance their loans when they come due. This is relates only to firms that have a large part of debt their coming due within a short period of time. Remember this relates to the article by Harford. 11) Others: Mentions of other reasons than volatility in cash flows and potential new chains of causations. Remember to add notes
Indicators/special attention:	Cannot reduce, try to decrease, lower, strive to sell, cut, to raise cash, to be liquid, inability, internally, internal financing, stop, freeze, general, firms overall, specific firms. 1) General, overall, in general, uncertainty, insecurity 2) Prior, past, before, general uncertainty, demand, political, legal, crisis, credit, regulatory, scared, scarred

Coding manual: Description and application of categories	
	3) Prior, past, before, earlier, lack of demand, no customers, scared, scarred, history 4) Prior, past, before, Obama, Obamacare, lawsuit, regulation, rules, macroeconomic, spending, congress, tax uncertainty, measures, stimulus, quantitative easing 5) Future, current, now, coming, speculation, initiated, next years, overall, general, unease, tension, uncertain, lack of, 6) Future, current, now, coming, speculation, initiated, next year, lack of demand, no demand, uncertain demand, low spending, no spending, high saving, customer, disposable income 7) Future, current, now, coming, speculation, initiated, next year, Obama, lawsuit, regulation, rules, macroeconomic, spending, congress, tax uncertainty, measures, stimulus, quantitative easing 8) Tax, Pharma, Tech, industry, sector, special case 9) Hedging, derivatives, FX, commodities, internal lending, corporate diversification, bank lending arm, internal allocation 10) Refinancing risk, future, constrained, tight, not possible, high debt, short-term, roll over. 11) New, causation, uncertainty, hoard
Example:	See sub-subcategories 1) 'Firms hold cash as they are in an environment marked by much uncertainty' 2) 'Firms were severely hit by the credit crisis' 3) 'Especially smaller firms faced a cash shortage during the financial year of 2008' 4) 'The terrorist attacks and follow entry into Iraq brought along a vast degree of business uncertainty' 5) 'The pessimists see companies afraid of the future, hoarding cash before of the uncertain economic outlook' 6) 'As we are still in a post-crisis era, consumer spending is not prone to pick up soon' 7) 'Many CFOs cited the fiscal cliff as one of many future worries for their company' 8) 'Tech companies, who hold nearly 1/3 of all CH have memories of the dotcom boom-to-bust and have good reason to prefer a comfortable cushion' 9) 'Many large firms are cutting back on credit and self-financing. Even more radically, they are turning into mini-banks themselves: supply chain finance is seeing prosperous, cash rich companies transfer surplus liquidity to their cash constrained suppliers' 10) ' CFO is happy that none of its debt is coming due shortly - there is no chance of rolling it over' 11)
Decision rule:	Haven't met any mentions of this. Be aware of the reverse category (next that demonstrates the opposite)
Name: High cost of being short of funds	
Brief description and when to apply:	For example, the higher the cost of being short of funds is related to the amount of investment opportunities for a company. If a company has good investment opportunities in the near future, it should hold more cash. Include there if there is a mention of funding R&D activities or if cash is hoarding to fund either investments, acquisitions or for competitive pressure in the near future. I.e. funding imminent high growth options 1) Near future growth opportunities: Increase plants, M&As, R&D, purchase assets, hire more, increase spending 2) Competitive pressures: Keep cash to not forego investments and lose market shares to competitors 3) Others
Indicators/special attention:	Shortage, short of funds, future investments, imminent growth options, near future acquisitions, low growth option, competitive reasons, forego investments, rivals, R&D, strategic cash, appealing

Coding manual: Description and application of categories	
	investments, gunpowder, dry 1) Increase, enhance, future, near future, high growth, investment, option, opportunity, acquisitions, expand, acquisitions 2) Rival, forego, lose out, market share, competitors, launch, acquire, winner, loser 3)
Example:	1) 'The cash is seen as insurance to buy raw material and inventory he will need to meet demand as he expect business to pick up soon'. 2) 'A recession can be a fantastic time to launch innovations: firms who want to be winners coming out of the downturn will also need the financial resources to seize any opportunities arising during it.' 3)
Decision rule:	
Name: Tax motive	
Brief description and when to apply:	Revolves around the arguments that repatriation taxes have a significant influence on firms' cash holdings. Since the corporate tax rate in the US is higher compared to other countries, firms choose to hold cash over sees. The tax motive is not per se related to the crisis, so be aware is certain crisis factors amplify or decrease the significance of holding cash abroad
Indicators/special attention:	Foreign, tax, overseas, foreign, domestic, repatriate, transfer,
Example:	'Microsoft is reluctant to repatriate the money because it would get an enormous corporate tax bill'
Decision rule:	
Name: Agency costs	
Brief description and when to apply:	This relates to the agency costs of managerial discretion. Managers increase their own utility at the expense of shareholders for example for holdings higher cash or use cash wastefully. Recall the flexibility, spending, and shareholder power hypothesis.
Indicators/special attention:	Agency costs, agency motive, managers, entrenchment, empire-building, overinvestment, spending, shareholder power, flexibility, hypothesis, control, idle, return, salary, benefits.
Example:	'Investors are worried that managers will spend the cash on unwise acquisitions'
Decision rule:	This category will deal with the motive of holding cash and not the problems, which pertain to another category. Thus, be aware that agency costs should be portrayed as a motive to hold cash and not as negative side effects of high cash holdings
Name: Dynamic/Pecking order	
Brief description and when to apply:	Since the two concepts overlap very much, we focus on the profitability of firms. These include a mention of increased firm profitability. But also be aware of mentions of companies deviating from their average optimal or target cash holdings level. There is a speed of adjustment to the optimal level that can explain inter-temporal dynamic cash holdings. Financing and demand during the financial crisis also play important parts here. Also, note that firm characteristics may influence the speed of adjustment so be sure to capture those. But also arguments that relate to the conventional pecking order theory that the costs of financing increases with information asymmetry. Note if there are arguments supporting the fact that the flow of funds surplus explain cash holdings levels. 1) Higher firm profitability: Better firm performance. Performance can be measured in sales,

Coding manual: Description and application of categories	
	profit, earnings. That is if there is a mention of higher/lower profitability due to increased sales or earnings and/or lower costs. Also general statements (see example 2) 2) Dynamic: Explicit mentions 3) Pecking: Explicit mentions 4) Other
Indicators/special attention:	1) Stock, return, high, low, surprise, all-time, revenue, earnings, overall, general, profitability, profitability 2) Explicit mention 3) Explicit mention
Example:	1) 'Profits have been more than enough to cover corporate spending in many parts of the rich world, leaving an excess of funds for firms to squirrel away'/ 'Corporate profits have soared since the crisis'
Decision rule:	If in doubt of whether to include here or in transaction costs, look for a mention of profitability and/or adjustment. Always write a note to demonstrate the reasoning. Also make clear if there is potential support for either dynamics or the pecking order motive. Make note of any explicit mentions of either motive
Name: Other	
Brief description and when to apply:	Brief description and when to apply: Arguments that do not fit into any of the other categories. New variables and chains of causations - therefore be very sure to write the whole sentence. Can also be used if a category is overlapping too many of the other categories, e.g. if CFOs are risk averse or there is a lack of investment/growth opportunities 1) CFOs are risk averse. Specifically related to CFO behavior 2) Lack of investment opportunities 3) New arguments/Other overlapping arguments
Indicators/special attention:	1) CFO risk averse, no chances, play safe, hectic environment, safe, security, risk, justify, aversion, uncertainty, blanket, buffer, risk, attitude, behavior 2) Lack of investment, no growth, declining investments, bad investment climate, low opportunity, weak options, unfavorable environment, appealing
Example:	1) 'The CFO said that the capital market return do not justify the current risk prevailing' 2) 'Companies have decreased capex as they witness a lack of growth opportunities'
Decision rule:	If overlaps occur, we can discuss them
Name: Comments	
Brief description and when to apply:	Notes explaining chains of causation that cannot be fitted into the actual box
Indicators/special attention:	New theories, chain of causations, new variables, new dates, new levels, more for some firms
Example:	
Decision rule:	
Name: Reasons for holding cash during crisis	

Coding manual: Description and application of categories	
Brief description and when to apply:	This section seeks to explain any motive firms have for holding, decreasing or increasing cash during the crisis period from mid-2007 to mid-2009. Remember this relates to the time frame studied and thus not the publication date of the article. The reasons relate to the ones laid out by our literature review but new ones and new chain of causations should be added
Indicators/special attention:	During, financial, crisis, subprime, under, credit, recession, reason, explained by, motive, due to, crisis, credit crisis, subprime, mortgage crisis, uncertainty, future uncertainty, return, low bond lending, credit lines, borrowing costs, higher profitability, demand contraction, growth opportunities, lack of, tax, repatriate, shortage of funds, fear of past uncertainty, cushion, cash blanket, support investment opportunities, questionable future funding, costly external capital, managerial slack, managerial freedom, entrenchment
Example:	See subsections in pre-crisis
Decision rule:	Rather add one too many than one too little chain of causation. If boxes are overlapping write chain of causation/reason also and put it where the majority of the argument belongs. Write, if necessary, a note in another category where a minority of the argument is placed. If e.g. an article says that CFOs are more risk averse due to the economic environment, put the main argument in that category and a comment in the uncertainty category All the subcategories and sub-subcategories for during the crisis are the same as the ones in the pre-crisis period. Therefore, please confer the instructions given in the pre-crisis categories for the 'opportunity costs' category until the 'other' category for definitions and descriptions of when to apply. The only difference is the time period
Name: Reasons for holding cash post-crisis	
Brief description and when to apply:	This section seeks to explain any motive firms have for holding, decreasing or increasing cash during the post-crisis period from mid-2009 until September 2013. Remember this relates to the time frame studied and thus not the publication date of the article. The reasons relate to the ones laid out by our literature review but new ones and new chain of causations should be added.
Indicators/special attention:	Post, after, aftermath, Reason, explained by, motive, due to, crisis, credit crisis, subprime, mortgage crisis, uncertainty, future uncertainty, return, low bond lending, credit lines, borrowing costs, higher profitability, demand contraction, growth opportunities, lack of, tax, repatriate, shortage of funds, fear of past uncertainty, cushion, cash blanket, support investment opportunities, questionable future funding, costly external capital, managerial slack, managerial freedom, entrenchment
Example:	See subsections in pre-crisis
Decision rule:	Rather add one more than one too little chain of causation. If boxes are overlapping write chain of causation/reason also and put it where the majority of the argument belongs. Write, if necessary, a note in another category where a minority of the arguments is placed. If e.g. an article says that CFOs are more risk averse due to the economic environment, put the main argument in that category and a comment in the uncertainty category Remember than an article published in 2013 for example can also describe prior time periods All the subcategories and sub-subcategories for during the crisis are the same as the ones in the pre-crisis period. Therefore, please confer the instructions given in the pre-crisis categories for the 'opportunity cost' category until the 'other' category for definitions and descriptions of when to apply. The only difference is the time period
Name: Non-crisis explanations for cash holdings level	

Coding manual: Description and application of categories	
Brief description and when to apply:	This is meant for explanations or reasons not directly related to the recent financial crisis. That means that articles claim that factors that have changed over time for example, it should fit here. If articles explain cash holdings patterns and explanations during the last century e.g. this will also be a place to put. Lastly, this is meant for new chains of causations or variables and explanation after the '1' is therefore necessary
Indicators/special attention:	New, reason, motive, positive relationship, reason, keep an open mind, interpret, info for building of hypotheses, non-crisis, not related to the crisis, over time, decades
Example:	'Tech companies occupy larger share of companies, which routinely hold big cash piles to prepare for a sudden shift in technology.'
Decision rule:	Since hypotheses can be developed from here, we will rather include too much. This is the only category where duplicates are allowed
Name: Cash holdings are said to bring along/covary with	
Brief description and when to apply:	When cash attracts the interest of some stakeholders groups in particular or is said to covary with some variables. Remember to write chains of causations here Indicators/special attention: Attention, attraction, covary, concurrence, pressure, target, high cash is known to bring a long 1) Cash holdings bring along: This relates specifically to interest from some stakeholder groups e.g. investors, politicians, suppliers or shareholder. Add chain of causations. E.g. mentions of increase investor pressure as a consequence of high cash holdings. Investors try to force companies to pay out cash as dividends or conduct share buybacks e.g. 2) Cash holdings covary with: If cash is said to move in concurrence or inversely with other variables as described by the literature for example. This could e.g. be credit lines. Add chain of causation. Focus on new ones, if the ones from the literature (e.g. size and cash holdings) are confirmed, do not add. 3) Other: Notes that are not captured by the two other categories above.
Indicators/special attention:	1) Investors, shareholders, buyers, LBO, pressure, attention, force, advocate 2) Debt, credit lines, characteristic, new, novel, prior unknown, 3)
Example:	1) 'Investors eyeing swelling corporate profits but stagnating share prices began pressuring companies to put more money to work' 2) 'As the growth in cash balances has started to reverse, the pace of debt financing has also picked up.'
Decision rule:	
Name: High cash holdings depicted as a problem	
Brief description and when to apply:	Are any arguments presented that portray companies' potentially high cash holding as an issue? This relates both to the economy overall, for investors, for employees and other potential stakeholders. Add chain of causation if relevant 1) Yes 2) No 3) No mention See these subcategories below

Coding manual: Description and application of categories	
Indicators/special attention:	Lack of spending, cash earns low returns, positive, negative, problem, issue, self-fulfilling, agency, advantage, CFO privilege, no mention
Example:	See subcategory
Decision rule:	If the text reports that spending has gone down but no opinion/analysis is followed, do not fill in other categories than 'no mention'

Name: Yes

Brief description and when to apply:	Describes why it is a problem and often related to whom as well. Add chain of causation 1) Overall (Economy) 2) Spending down (Economy, government) 3) Employment down (Employees, government) 4) Low return on cash (Investors) 5) Others (e.g. Agency problems as an effect not a cause, describe)
Indicators/special attention:	1) No mention of specific reason just that cash holdings are bad because it slows down recovery e.g., slows recovery, bad for economy, self-fulfilling, paradox of thrift, slow economic growth, 2) Specifying 'overall', lack of spending, lack of investment, aren't spending, hoard, 3) Specifying 'overall', lack of hire, unemployment up, job shortage 4) Idle cash, low return, dividends, buy backs, invest, investment 5) Entrenchment, managers, waste
Example:	1) 'Companies' cash cushion could prolong the slowdown of the economy'. 2) 'Professor Hartmann argue that the lack of capital spending can intensify a recession 3) 'Workers suffer because of the cuts during the crisis'. 4) 'Shareholders complain that they invest in companies in order to reap a good return, which is not currently happening'.
Decision rule:	

Name: No

Brief description and when to apply:	If arguments are presented in favor of high cash holdings. Or arguments defending firms' right to have high cash holdings and dismissing any problems, e.g. the ones in the left cell. Please state reason and chain of causation after the '1'.
Indicators/special attention:	Positive, not a problem, natural, companies' right, duty, if the cash holdings are lower than expected
Example:	'High cash holdings is perhaps not a bad thing. After all, during the crisis, the velocity of money soared'
Decision rule:	Note that the lack of presence of negative statement about cash holdings should not be put here. This is only for positive views in regards to cash holdings

Name: No mention

Brief description and when to apply:	No arguments are presented for or against the level of cash holdings
Indicators/special attention:	

Coding manual: Description and application of categories	
Example:	
Decision rule:	
Name: The high cash holdings are spend on	
Brief description and when to apply:	If the article tells how companies currently spend or do not spend their cash. Write notes or chains of causation after the number if deemed necessary 1) Not spent 2) Dividends 3) Capital investments 4) Jobs 5) Repatriated 6) Financial investments 7) Kept abroad 8) Buy backs 9) Acquisitions 10) Other (e.g. pay down debt)
Indicators/special attention:	Hoard, aren't spending, , acquired plant, dividends, investment, hire, past, currently, see below 1) Hoard, stashed, idle, not spent, treasuries, deposits 2) Dividends, return to investors, give back to investors, share return 3) Operational assets, plant, assets 4) Hiring, employment, jobs 5) Brought back, brought home, transferred, tax 6) Corporate bonds, commercial paper, safe instruments, yield, risk, stock 7) Local, tax, emerging 8) Share repurchases, repurchases, stock price increase 9) M&A, buy, acquire 10) Refinance, retire
Example:	1) 'Even though the economy has brightened, companies are still holding on to their cash' 2) 'Microsoft issued its first dividend in...' 3) 'Exxon increased its capital spending by $15bn this year' 4) 'This recent growth in profitability has made the company hire 250 new workers for the China plant' 5) 'Texas Instruments brought a large share of their foreign cash home to support domestic operations' 6) 'Recently, the company has turned their attention to corporate bonds due to higher yields'. 7) 'Since most of our business is in emerging countries, we keep our cash abroad to...' 8) 'A majority of firms increased share repurchases possibly because external growth opportunities were weak' 9) 'Even though companies have been acquiring extensively lately...' 10) '...some of this money has been used to restructure the company debt...'
Decision rule:	Only how the money has/is currently been put to use. If future recommendations or predictions are made, see 'how cash holdings should be spent'
Name: How cash holdings should be spent	
Brief description and when to apply:	If the article offers recommendations or future predictions on how the cash holdings will be spent or will not be spent. Write notes or chains of causation after the number if deemed necessary

Coding manual: Description and application of categories	
Indicators/special attention:	Future, imminent, indication, hoard, aren't spending, dividends, acquired plant, dividends, investment, hire, instead, rather, should, ought, waste, good use. For 1-10 see indicators in cell 'the cash holdings are spent on' and remember that this should be combined with words such as: Will be used for, future, could be spent on.
Example:	'These companies could buy back stock to increase their share prices' For 1-10 see examples in cell 'the cash holdings are spent on' and remember that this should be combined with words such as: Will be used for, future, could be spent on.
Decision rule:	
Name: Geography	
Brief description and when to apply:	As the name implies, this relates to the regional or geographical realm of the article in question. Expect a majority of entries in the U.S. coding cell as a reflection of our sample units but remember that we have a few non-US articles too. Also, even though the articles appear in U.S. newspapers, they might report on news from a different country. Regions, e.g. specific U.S. states might be mentioned too. 1) U.S: The United States of America both overall and in the occurrence of a single state. In the latter case, specify in a note which state is it 2) Worldwide: On a global basis. If there is no mention of any countries, read between the lines or look on the source of the article. 3) Other: Relating to single specific countries or regions. If this is the case, evaluate relevance of overall article. 4) Comments: Notes explaining chains of causation that cannot be fitted into the actual box
Indicators/special attention:	Country names, states, continents, in the X country., X corporations, X firms, X non-financial companies, X sample. 1) U.S., American, North American, X state, U.S.A. 2) Worldwide, world, global, across the world, multinationals. 3) Europe, Asia, Canada, China, Japan, Australia. 4)
Example:	1) 'U.S. companies have already slashed $40.7bn in dividends in 2009' 2) When the budget deficits are large worldwide, the private sector must, as a matter of identity, have an equal cash surplus'. 3) 'Two years ago, for example, Canadian manufacturers' holding of cash and inventory...' 4)
Decision rule:	If there is a mention of more than two continents, assume worldwide
Name: Time period examined	
Brief description and when to apply:	Remember to look at which time period or time frame is examined, not the publication date of the articles. However, looking at the date of the article might give a good indication of the period. : Analyze content to which periods it covers most likely by mentioning years or dates. Remember several periods are likely to be covered 1) Pre-crisis: Pre-crisis deals with anything before mid-2007. 2) During crisis: The crisis is from mid-2007 to mid-2009. 3) Post-crisis: Post-crisis is from the crisis ends in mid-2009 until September 2013.

Coding manual: Description and application of categories	
Indicators/special attention:	Before, during, after, crisis, prior to, years, decades, publishing dates, post, pre, Example: See subcategories 1) 2001-2004, last 30 years, a study from 1990, during the end of last century, before the financial crisis 2) 2007, 2008, subprime, credit crunch 3) Aftermath, after, in 2010, ever since, since
Example:	1) 'But the study also found that the biggest increase in corporate cash actually came in the early 2000s. 2) 'When rates were first cut in 2008-2009...' 3) 'Ever since the financial crisis, corporations have hoarded an increasing amount'
Decision rule:	1) Any article before mid-2007 should deal with the pre-crisis period 2) Articles published around the bankruptcy of Lehman Brothers, September 2008, is likely to relate to the crisis-period. 3) The newer the article, the more likely it is that it deals with the post-crisis era. An article published before mid-2009 cannot relate to the post-crisis era
Name: The subject of the article is	
Brief description and when to apply:	What does the article relate in terms of what/who is being examined? This deals specifically with which firms or industries the article in question is talking about. It is important to know to see if some results are industry-specific or firm-specific for example 1) Firms in general: Overall firms, that is non-financials. When firms are only mentioned as a whole or unit and have the same motives for hoarding cash for example 2) A specific company: In the case the article or an argument relates to a certain firms and firm specifics are at play. Add a note with which firms is present after the '1'. If there is a mention of more firms, write them all 3) A specific industry: In the case the articles or an argument relates to a certain industry and industry specifics are at play. Add a note with which industry is present after the '1'. If there is a mention of more industries, write them all
Indicators/special attention:	1) Nonfinancials, no mention of industries or firms, S&P 500 firms, U.S. corporations 2) Microsoft, this firm, Apple, Exxon, Google, this company 3) Industry-specific, tech business, oil and gas, pharma firms, this sector
Example:	1) 'American companies have high cash stashed overseas for several reasons' 2) 'Cash-rich Apple (APPL) noted in its last filing that…' 3) 'Analysts and academic say the volatile nature of the oil and gas industry is a reason to hoard cash'
Decision rule:	1) If only banks are dealt with - or utilities - the articles may be omitted. 2) 3) 'Analysts and academic say the volatile nature of the oil and gas industry is a reason to hoard cash'
Name: The articles cites	
Brief description and when to apply:	When the articles lend arguments from someone else e.g. an academic or a CFO. In other words, the source of the arguments. To see if the article leans towards academia, practitioners, both or none 1) CFO: An article citing one or more CFOs or corporate treasurers. This includes surveys or

Coding manual: Description and application of categories	
	interviews as well. If it is a survey, please write 'survey' after the '1'. 2) Academic: An article citing one or more academic or studies in direct quotes or actual interview 3) Other: For comments, surveys of interviews of non-academic and non CFOs, politicians and investors
Indicators/special attention:	1) Survey, CFO, treasurer, interview, manager, treasurer 2) Stulz, interview, professor, PhD, name of university, researchers, academics, academia. Please write the name of the professor after the '1'. 3) Investment managers, economist, moody employee, hedge fund manager, employee, politician, CEO, HR employee
Example:	1) 'A survey of chief financial officers and treasurers released Monday...' 2) 'As for companies' aversion to paying the repatriation tax, a 2007 study by C. Fritz Foley...' 3) 'Marketwatch talked to 'Dr. Doom, a Hong Kong based investment manager'.
Decision rule:	
Name: Main idea/take aways	
Brief description and when to apply:	Free text box that summarizes the article with main point in brief
Indicators/special attention:	Orange boxes and new chains of causations. Main arguments
Example:	'The main message of this article was...'
Decision rule:	
Name: Relevant notes/quotes	
Brief description and when to apply:	For any long quotes that may be of relevance for summarization of results or arguments or notes that can explain connections or chains of causations.
Indicators/special attention:	
Example:	
Decision rule:	

Table 22 – Intra- and inter-coder coefficient of agreement

The table shows the intra-coder and inter-coder coefficient of agreement, which measures the reliability of our coding frame, particularly in terms of the consistency in its application. This is calculated by dividing the number of units on which the coder agrees divided by the total number of units of coding. Thus, the closer to 1 the coefficient is, the higher the consistency in terms of coding. To calculate the intra-coder coefficient of agreement, one of us has conducted two separate codings three weeks apart on a similar sample of 12 articles and compared the results. To calculate the inter-coder coefficient of agreement, both of us have conducted two separate codings on a similar sample of 9 articles and compared the results. The table shows this for each of our main categories followed by the overall coefficient. The categories marked with a * have been redesigned due to low consistency and are not included in the overall inter-coder coefficient of agreement. These categories have not been coded in the inter-coder coefficient of agreement process.

Main category	Intra-coder coefficient of agreement	Inter-code coefficient of agreement
Mention of the financial crisis	1	1
Limited access to finance	1	0.89
A drop in demand	1	1
Increased uncertainty	0.91	0.67
General/Other	0.91	0.78
Cash holdings very low	1	1
Cash holdings low	1	1
Cash holdings high	0.91	0.67
Cash holdings very high	0.91	0.78
No effect	1	0.89
Other	0.82	0.89
More for firms with	0.91	0.56
Down during the crisis, up post-crisis	1	1
Only up after crisis	0.82	0.89
Increasing over decades	1	0.89
Future direction	1	1
Other	0.91	0.89
Pre-crisis: Opportunity cost	1	0.89
Pre-crisis: Transaction cost	1	0.78
Pre-crisis: Low ability to access finance externally	0.97	0.94
Pre-crisis: Low ability to access finance internally	1	1
Pre-crisis: High likelihood of being short of funds	0.98	0.89
Pre-crisis: High cost of being short of funds	0.95	1
Pre-crisis: Tax motive	1	1
Pre-crisis: Agency cost	0.97	0.97
Pre-crisis: Dynamics/Pecking order	1	0.83

Pre-crisis: Other	0.95	0.97
During crisis: Opportunity cost	1	1
During crisis: Transaction cost	1	1
During crisis: Low ability to access finance externally	0.96	0.90
During crisis: Low ability to access finance internally	1	0.94
During crisis: High likelihood of being short of funds	0.95	0.91
During crisis: High cost of being short of funds	1	1
During crisis: Tax motive	0.91	1
During crisis: Agency cost	1	1
During crisis: Dynamics/Pecking order	1	1
During crisis: Other	1	1
Post-crisis: Opportunity cost	0.91	0.78
Post-crisis: Transaction cost	1	0.89
Post-crisis: Low ability to access finance externally	0.95	0.62
Post-crisis: Low ability to access finance internally	0.99	0.83
Post-crisis: High likelihood of being short of funds	0.89	0.88
Post-crisis: High cost of being short of funds	1	0.83
Post-crisis: Tax motive	0.91	0.89
Post-crisis: Agency costs	1	0.96
Post-crisis: Dynamics/Pecking order	1	0.86
Post-crisis: Other	0.95	0.67
Non-crisis Explanations for cash holdings	0.81	0.56
Cash holdings are said to bring along/covary with	0.93	0.72
High cash holdings depicted as a problem: Yes	0.96	0.74
High cash holdings depicted as a problem: No	1	0.78
High cash holdings depicted as a problem: No mention	0.91	0.56
The high cash holdings are spend on	0.98	0.76
The high cash holdings should be spend on	0.96	0.91
Geography: The U.S.	1	0.89
Geography: Worldwide	1	0.89
Geography: Other	1	1
Time-period examined: Pre-crisis	1	1
Time-period examined: Crisis	0.91	0.78
Timed period examined: Post-crisis	1	1
The subject of the articles is: Firms in general	1	1

The subject of the articles is: A specific company	0.95	0.67
The subject of the articles is: A specific industry	0.91	0.78
The subject of the articles is: Other	1	1
Article cites: CFO	0.95	0.67
Article cites: Academic	0.95	0.67
Article cites: Other	1	0.56
Firm performance: During crisis*	0.79	N/A
Firm performance Post-crisis*	0.85	N/A
Firm performance: More for firms*	0.91	N/A
Firm investment: During crisis*	0.85	N/A
Firm investment: Post-crisis*	0.82	N/A
Firm investment: More for firms*	0.91	N/A
Overall coefficient of agreement	*0.96*	*0.86*

Table 23 – Summary statistics of categories

The table summarizes the summary statistics of our analysis on the sample of 113 articles according to each category, subcategories, and sub-subcategory. This is done by outlining each category and noting how many codings, or entries, that have occurred during the process. Some of our 210 categories have been further segmented to clearly illustrate the mechanisms included herein. It should be noted that the statistics are purely quantitative and do therefore not include notes and comments that may be particularly relevant to some categories. N/A denotes purely qualitative text categories where quantitative summary statistics are thus not applicable.

Specific categories and subcategories	Frequency
Mention of the financial crisis of 2007-2008?	74
Overall effect: Limited access to financing	37
Overall effect: A drop in demand	15
Overall effect: Increased uncertainty	24
Overall effect: General/other	34
Overall effect: Comments	N/A
Development since crisis: Cash holdings very low	2
Development since crisis: Cash holdings low	1
Development since crisis: Cash holdings high	26
Development since crisis: Cash holdings very high	65
Development since crisis: No effect	4
Development since crisis: Other	9
Development since crisis: More for firms with	29
Development since crisis: Comments	N/A
Overall trend: Down during the crisis, up post-crisis	5
Overall trend: Only up after the crisis	37
Overall trend: Increasing over decades	20
Overall trend: Future direction	N/A
Overall trend: Other	16
Overall trend: Comments	N/A
Pre-crisis: Opportunity cost	3
Pre-crisis: Transaction cost:	0
Pre-crisis: Precautionary: Overall	17
Pre-crisis: Precautionary: Access to external: Original	8
Pre-crisis: Precautionary: Ability to external: Availability of financing	1
Pre-crisis: Precautionary: Ability to external: Cost of financing	0
Pre-crisis: Precautionary: Ability to external: Information asymmetry	3
Pre-crisis: Precautionary: Ability to external: Asset tangibility	0

Specific categories and subcategories	Frequency
Pre-crisis: Precautionary: Ability to external: Other	0
Pre-crisis: Precautionary: Ability to external: Cheap and/or easy access to finance	5
Pre-crisis: Precautionary: Ability to external: Mention of credit lines	1
Pre-crisis: Precautionary: Low ability to internal	0
Pre-crisis: Precautionary: High ability to raise finance internally: Original	10
Pre-crisis: Precautionary: Ability to internal: Overall	5
Pre-crisis: Precautionary: Ability to internal: Investment/spending	5
Pre-crisis: Precautionary: Ability to internal: Dividends/Buy backs	0
Pre-crisis: Precautionary: Ability to internal: Employment	4
Pre-crisis: Precautionary: Ability to internal: Sell assets	1
Pre-crisis: Precautionary: Ability to internal: Receivables/inventory	2
Pre-crisis: Precautionary: Ability to internal: Other	0
Pre-crisis: Precautionary: Likelihood: Original	15
Pre-crisis: Precautionary: Likelihood: Overall uncertainty	11
Pre-crisis: Precautionary: Likelihood: Past uncertainty	7
Pre-crisis: Precautionary: Likelihood: Current and future overall uncertainty	5
Pre-crisis: Precautionary: Likelihood: Current and future demand uncertainty	2
Pre-crisis: Precautionary: Likelihood: Current and future political, legal and regulatory uncertainty	6
Pre-crisis: Precautionary: Likelihood: Industry-specific uncertainty	2
Pre-crisis: Precautionary: Likelihood: Hedging and diversification	0
Pre-crisis: Precautionary: Likelihood: Refinancing risk	0
Pre-crisis: Precautionary: Likelihood: Others	0
Pre-crisis: Precautionary: Cost of short: Original	9
Pre-crisis: Precautionary: Cost of short: Near future growth opportunities	7
Pre-crisis: Precautionary: Cost of short: Competitive	2
Pre-crisis: Precautionary: Cost of short: Others	0
Pre-crisis: Tax motive	5
Pre-crisis: Agency costs	11
Pre-crisis: Dynamics/Pecking order	11
Pre-crisis: Other: Risk averse	5
Pre-crisis: Other: Lack of investment opportunities	4
Precautionary: Other: Pretty balance sheet	3
Pre-crisis: Other: Original	22

Specific categories and subcategories	Frequency
Pre-crisis: Comments	N/A
During: Opportunity cost	0
During: Transaction cost	0
During crisis: Precautionary: Overall	27
During: Precautionary: Ability to External: Overall	21
During: Precautionary: Ability to External: Availability of financing	21
During: Precautionary: Ability to External: Cost of financing	6
During: Precautionary: Ability to External: Information asymmetry	2
During: Precautionary: Ability to External: Asset tangibility	0
During: Precautionary: Ability to External: Other	1
During: Precautionary: Ability to External: Cheap and/or easy access to finance	0
During: Precautionary: Ability to External: Mention of credit lines	9
During: Precautionary: Low ability to internal	0
During: Precautionary: High ability to internal: Original	26
During: Precautionary: Ability to internal: Overall	15
During: Precautionary: Ability to internal: Investment/spending	14
During: Precautionary: Ability to internal: Dividends/Buy backs	4
During: Precautionary: Ability to internal: Employment	8
During: Precautionary: Ability to internal: Sell assets	4
During: Precautionary: Ability to internal: Receivables/inventory	4
During: Precautionary: Ability to internal: Other	1
During: Precautionary: Likelihood: Original	17
During: Precautionary: Likelihood: Overall uncertainty	11
During: Precautionary: Likelihood: Past uncertainty	0
During: Precautionary: Likelihood: Current and future overall uncertainty	7
During: Precautionary: Likelihood: Current and future demand uncertainty	6
During: Precautionary: Likelihood: Current and future political, legal and regulatory uncertainty	7
During: Precautionary: Likelihood: Industry-specific uncertainty	1
During: Precautionary: Likelihood: Hedging and diversification	11
During: Precautionary: Likelihood: Refinancing risk	2
During: Precautionary: Likelihood: Others	0
During: Precautionary: Cost of short: Original	4
During: Precautionary: Cost of short: Near future growth opportunities	1

Specific categories and subcategories	Frequency
During: Precautionary: Cost of short: Competitive	4
During: Precautionary: Cost of short: Others	0
During: Tax motive	0
During: Agency costs	0
During: Dynamics/Pecking order	1
During: Other: Risk averse	1
During: Other: Lack of investment opportunities	1
During: Other: Pretty balance sheet	0
During: Other: Original	3
During: Comments	N/A
Post-crisis: Opportunity cost	12
Post-crisis: Transaction cost	0
Post-crisis: Precautionary: Overall	60
Post-crisis: Precautionary: Ability to external: Original	28
Post-crisis: Precautionary: Ability to external: Availability of financing	23
Post-crisis: Precautionary: Ability to external: Cost of financing	5
Post-crisis: Precautionary: Ability to external: Information asymmetry	4
Post-crisis: Precautionary: Ability to external: Asset tangibility	1
Post-crisis: Precautionary: Ability to external: Other	3
Post-crisis: Precautionary: Ability to external: Cheap and/or easy access to finance	18
Post-crisis: Precautionary: Ability to external: Mention of credit lines	8
Post-crisis: Precautionary: Low ability to internal	0
Post-crisis: Precautionary: High ability to internal: Original	38
Post-crisis: Precautionary: Ability to internal: Overall	8
Post-crisis: Precautionary: Ability to internal: Investment/spending	29
Post-crisis: Precautionary: Ability to internal: Dividends/Buy backs	6
Post-crisis: Precautionary: Ability to internal: Employment	8
Post-crisis: Precautionary: Ability to internal: Sell assets	2
Post-crisis: Precautionary: Ability to internal: Receivables/inventory	5
Post-crisis: Precautionary: Ability to internal: Other	0
Post-crisis: Precautionary: Likelihood: Original	60
Post-crisis: Precautionary: Likelihood: Overall uncertainty	13
Post-crisis: Precautionary: Likelihood: Past uncertainty	32
Post-crisis: Precautionary: Likelihood: Current and future overall uncertainty	26

Specific categories and subcategories	Frequency
Post-crisis: Precautionary: Likelihood: Current and future demand uncertainty	31
Post-crisis: Precautionary: Likelihood: Current and future political, legal and regulatory uncertainty	26
Post-crisis: Precautionary: Likelihood: Industry-specific uncertainty	5
Post-crisis: Precautionary: Likelihood: Hedging and diversification	7
Post-crisis: Precautionary: Likelihood: Refinancing risk	1
Post-crisis: Precautionary: Likelihood: Others	0
Post-crisis: Precautionary: Cost of short: Original	17
Post-crisis: Precautionary: Cost of short: Near future growth opportunities	15
Post-crisis: Precautionary: Cost of short: Competitive	3
Post-crisis: Precautionary: Cost of short: Others	3
Post-crisis: Tax motive	24
Post-crisis: Agency costs	15
Post-crisis: Dynamics/Pecking order	21
Post-crisis: Other: Risk averse	20
Post-crisis: Other: Lack of investment opportunities	21
Post-crisis: Other: Pretty balance sheet	2
Post-crisis: Other: Original	57
Post-crisis: Comments	N/A
Non-crisis: More risk and competition	8
Non-crisis: Fewer inventories	6
Non-crisis: Mentions of a new normal	6
Non-crisis: Original	32
Cash holdings bring along: Investor pressure	24
Cash holdings bring along: LBO interest	6
Cash holdings bring along: Original	38
Problem: Yes: Generally bad for economy	34
Problem: Yes: Spending/investment down	20
Problem: Yes: Employment down	16
Problem: Yes: Low return for investors	16
Problem: Yes: Others (Agency)	13
Problem: Yes: Original	51
Problem: No	26
Problem: No mention	51

Specific categories and subcategories	Frequency
Problem: Comments	N/A
CH are spend on: Original	91
CH are spend on: Not spend	45
CH are spend on: Dividends	34
CH are spend on: Capital investments	22
CH are spend on: Jobs	0
CH are spend on: Repatriated	0
CH are spend on: Financial investments	9
CH are spend on: Kept abroad	13
CH are spend on: Buy backs	24
CH are spend on: M&As	23
CH are spend on: Others (debt)	10
CH should be spent on: Original	35
CH should be spent on: Not spend	1
CH should be spent on: Dividends	13
CH should be spent on: Capital investments	19
CH should be spent on: Jobs	6
CH should be spent on: Repatriated	3
CH should be spent on: Financial investments	0
CH should be spent on: Kept abroad	0
CH should be spent on: Buy backs	7
CH should be spent on: M&As	9
CH should be spent on: Others (debt)	2
Geography: U.S.	106
Geography: Worldwide	12
Geography: Other	16
Geography: Comments	N/A
Time-period: Pre-crisis	29
Time-period: During crisis	28
Time-period: Post-crisis	79
Subject of article: Firms in general	105
Subject of article: Specific company: Mentions of Apple	24
Subject of article: Specific company: Mentions of Microsoft	23
Subject of article: A specific company: Original	59

Specific categories and subcategories	Frequency
Subject of article: A specific industry	11
Subject of article: Specific industry: Tech industry	8
Subject of article: Other	1
Article cites: CFO	38
Article cites: Academic	33
Article cites: Other	14

9.2 Appendix for empirical analysis

Table 24 – Variables

The table provides an overview of all variables, their description, their calculation, data amendments or restriction, and how the variable was winsorized. All variables are measured at time *t*, unless otherwise indicated. Winsorization is at 1% tails. Variables indicated by an * are only used in graphs or to replicate BKS' regressions.

Variable	Description	Calculation [Compustat codes in brackets]	Data amendments or restrictions	Winsori-zation
Cash-to-assets	Cash and cash equivalents divided by total assets	Cash and short-term investments [CHE] / total assets [AT]	Only firms with non-negative cash and short-term investments [CHE] and total assets [AT] larger than zero are included in the sample	None
LN cash-to-assets	Natural logarithm of cash and cash equivalents divided by total assets	LN (cash and short-term investments [CHE] / total assets [AT])	See cash-to-assets	None
Firm size	Natural logarithm of total assets, adjusted to 2012 dollar using the CPI	LN (total assets [AT] / CPI)	None	None
Tangible assets	Tangible assets divided by total assets	Net property, plant, and equipment [PPENT] / total assets [AT]	None	None
NWC	Net working capital net of cash divided by total assets	(Net working capital [WCAP] – Cash and short-term investments [CHE]) / total asset [AT]	None	Lower side only
Market-to-book	Market value of the firm divided by the book value of the firm	(Book value of liabilities ([AT]-[CEQ]) + market value of common equity ([PRCC_F]*[CSHO])) / total assets [AT]	None	Upper side only
Leverage	Total debt divided by total assets	(Long-term debt [DLTT] + short-term debt [DLC]) / total assets [AT]	None	Upper side only
Debt rating	Dummy for firms with an investment grade long-term debt rating	Indicator set to 1 if the company has an S&P domestic long-term issuer credit rating of BBB or higher in a given year. The indicator set to 0 if there is no credit rating	See calculation	None

Variable	Description	Calculation [Compustat codes in brackets]	Data amendments or restrictions	Winsori-zation
Debt due within 3 years	Long-term debt due within the next three years divided by total long-term debt	(Long-term debt due in year 1 [DD1] + due in year 2 [DD2] + due in year 3 [DD3]) / (long-term debt [DLTT] + long-term debt due in 1 year [DD1])	If long-term debt due is reported for year one, but not for the second or third year, we use the reported amount of long-term debt due in one year at time t+1 and t+2 respectively	None
Dividends	Dummy for dividend paying firms	Indicator set to 1 if dividend payments [DVC] > 0 in a given year and set to zero otherwise	None	None
T-bill rate	Fiscal year average of the three-month T-bill rate measured in %	Published by the Federal Reserve Bank (accessed via WRDS)	None	None
S&P VIX	Annual average of the S&P VIX (implied volatility on S&P 500 index options)	Published by the Chicago Board Options Exchange (accessed via WRDS)	None	None
Loan rate spread	Commercial and industrial loan rate spread over the intended federal funds rate (for loans greater than USD 1 million) measured in %. We use the four-quarter moving average value at year-end	Provided by the Federal Reserve Bank (accessed via the Federal Reserve Bank's homepage)	None	None
Operating cash flow (OCF)*	Operating cash flow divided by total assets	(Operating income before depreciation [OIBDP] – interest expense [XINT] – income tax [TXT] – dividends [DVC]) / total assets [AT]	XINT is set to zero if 10% of total debt ([DLC] + [DLTT]) is less than 1% of OCF before depreciation [OIBDP]	Lower side only
Operating cash flow (OCF) volatility, firm-level	Sample standard deviation of firm-level OCF over the ten years prior to t	$\sigma_{\text{Firm}} = \sqrt{\dfrac{1}{N\text{-}1} \sum_{i=1}^{N} (OCF_{t\text{-}i} - \overline{OCF})^2}$ $i = 1, \ldots, 10$	We require at least five observations of OCF during the ten-year window	Both sides
Operating cash flow (OCF) volatility, industry-level	Industry average, as defined by primary 2-digit SIC codes, of firm-level OCF volatility	$\sigma_{\text{Industry}} = \dfrac{1}{N} \sum_{j=1}^{N} \sigma_{\text{Firm } j}$	We require at least three observations of OCF to assets during the ten-year window	Both sides

Variable	Description	Calculation [Compustat codes in brackets]	Data amendments or restrictions	Winsori-zation
Financing gap	Correlation between industry-level investment ratio (IR) and firm-level OCF over the ten years prior to t. Industry is defined by primary 2-digit SIC codes	$IR_{Firm} = $ (Acquisition expense AQC] + capex [CAPX] + R&D expense [XRD]) / total assets [AT] $$IR_{Industry} = \frac{1}{N} \sum_{j=1}^{N} IR_{Firm, j}$$ $$FG = CORR\left(IR_{Industry\ t-i}, OCF_{t-i}\right)$$ $$i = 1, \ldots, 10$$	We require at least five observations of firm-level OCF and industry-level investment ratio during the ten-year window Missing values for [AQC], [XRD], and [CAPX] are set to zero	None
Diversification factor	Sales-weighted measure of the industry-level investment ratio correlation between a firm's primary industry and secondary industries (k). Industries are defined by 2-digit SIC codes	$$\rho_k = CORR\left(IR_{Primary,\ t-i}, IR_{k,\ t-i}\right)$$ $$i = 1, \ldots, 10$$ $$w_k = \frac{\text{Segment sales}_k}{\text{Total sales [SALE]}_{Primary}}$$ $$DF = \sum_{k=1}^{N} w_k(1-\rho_k)^2$$	See financing gap	None
HHI	Herfindahl–Hirschman Index calculated based on sample sales data and 3-digit primary SIC codes to define industries	$$s_j = \frac{\text{Firm Sales [SALE]}_j}{\sum_{j=1}^{N} \text{Firm Sales [SALE]}_j}$$ $$HHI = \sum_{j=1}^{N} s_j^2$$	None	None
Repatriation tax	Estimated tax cost of repatriating foreign earnings to the U.S. divided by total assets	((Pre-tax foreign income [PIFO] * marginal U.S. tax rate) - Foreign taxes already paid [TXFO]) / total assets [AT] Marginal U.S. tax rate is: - 35% if the company has neither a tax loss carry forward [TLCF] nor negative taxable income [PI] - 17.5% if either [TLCF] > 0 or [PI] < 0 - 0% if both [TLCF] > 0 and [PI] < 0	Missing values for [PIFO] and [TXFO] are set to zero	Upper side only

Variable	Description	Calculation [Compustat codes in brackets]	Data amendments or restrictions	Winsori-zation
Net debt issuance	Net issuance of long-term debt divided by total assets	(Long-term debt issuance [DLTIS] – long-term debt retirement [DLTR]) / total assets [AT]	None	Both sides
Net equity issuance	Net issuance of equity divided by total assets	(Sale of common and preferred stock [SSTK] – purchase of common and preferred stock [PRSTKC]) / total assets [AT]	None	Both sides
Acquisitions	Acquisition expense divided by total assets	Acquisition expense [AQC] / total assets [AT]	Missing values for [AQC] are set to zero	Both sides
OCF shock	Difference between current firm-level OCF to assets and the equally weighted moving average of firm-level OCF to assets measured over the five years prior to the observation	$\text{OCF shock} = \text{OCF}_t - \dfrac{1}{N} \sum_{i=1}^{N} \text{OCF}_{t-i}$ $i = 1, \ldots, 5$	We require at least three observations of firm-level cash flow to assets during the five-year MA window	Both
OCF MA	Equally weighted moving average of firm-level cash flow to assets measured over the five years prior to the observation	$\text{OCF MA}_t = \dfrac{1}{N} \sum_{i=1}^{N} \text{OCF}_{t-i}$ $i = 1, \ldots, 5$	We require at least three observations of firm-level cash flow to assets during the five-year MA window	Lower side only
Capex*	Capital expense divided by total assets	Capital expense [CAPX] / total assets [AT]	Missing values for [CAPX] are set to zero	Both sides
Capex shock	Difference between current firm-level capex to assets and the equally weighted moving average of firm-level capex to assets measured over the five years prior to the observation	$\text{CX shock} = \text{CX}_t - \dfrac{1}{N} \sum_{i=1}^{N} \text{CX}_{t-i}$ $i = 1, \ldots, 5$	We require at least three observations of firm-level capex to assets during the five-year MA window	Both sides
Capex MA	Equally weighted moving average of firm-level capex to assets measured over the five years prior to the observation	$\text{CX MA}_t = \dfrac{1}{N} \sum_{i=1}^{N} \text{CX}_{t-i}$ $i = 1, \ldots, 5$	We require at least three observations of firm-level capex to assets during the five-year MA window	Both sides
R&D*	Research and development expense divided by total assets	R&D expense [XRD] / total assets [AT]	Missing values for [XRD] are set to zero	Both sides

Variable	Description	Calculation [Compustat codes in brackets]	Data amendments or restrictions	Winsori-zation
R&D shock	Difference between current firm-level R&D to assets and the equally weighted moving average of firm-level R&D to assets measured over the five years prior to the observation	$$\text{RD shock} = RD_t - \frac{1}{N}\sum_{i=1}^{N} RD_{t-i}$$ $$i = 1, \ldots, 5$$	We require at least three observations of firm-level R&D to assets during the five-year MA window	Both sides
R&D MA	Equally weighted moving average of firm-level R&D to assets measured over the five years prior to the observation	$$\text{RD MA}_t = \frac{1}{N}\sum_{i=1}^{N} RD_{t-i}$$ $$i = 1, \ldots, 5$$	We require at least three observations of firm-level R&D to assets during the five-year MA window	Both sides

Table 25 – Aggregate Assets and Cash Holdings

The table provides summary statistics for our Compustat sample of U.S.-based publicly traded firms from 1998 to 2012. Assets [AT] and cash holdings [CHE] are adjusted to 2012 dollars by using the CPI. Total number of observations is 44,275.

Year	Aggregate Assets	% Change on Previous Year	Aggregate Cash holdings	% Change on Previous Year	Observations
1998	4,402,950,367	-	285,121,127	-	2,355
1999	4,923,937,895	11.8%	366,459,264	28.5%	2,521
2000	6,379,620,224	29.6%	462,627,883	26.2%	2,915
2001	6,969,626,485	9.2%	564,219,228	22.0%	3,158
2002	6,871,468,534	-1.4%	641,109,939	13.6%	3,301
2003	7,508,948,479	9.3%	809,005,358	26.2%	3,455
2004	7,609,941,240	1.3%	904,340,584	11.8%	3,455
2005	7,708,096,028	1.3%	843,000,966	-6.8%	3,322
2006	8,092,233,962	5.0%	846,582,110	0.4%	3,181
2007	8,392,980,684	3.7%	823,018,790	-2.8%	3,062
2008	8,227,681,098	-2.0%	803,467,680	-2.4%	2,897
2009	8,967,506,134	9.0%	1,076,152,577	33.9%	2,802
2010	9,075,225,341	1.2%	1,113,895,314	3.5%	2,742
2011	9,739,644,630	7.3%	1,127,070,178	1.2%	2,619
2012	10,018,800,443	2.9%	1,158,882,233	2.8%	2,490

Table 26 – Development of the Cash Ratio from 1998 to 2012

The table summarizes the development of different measures of cash relative to assets for our Compustat sample of U.S.-based publicly traded firms from 1998 to 2012. Mean and median are computed for the entire sample as well as for the sub-sample of firms that are already present in 1998 (balanced). The aggregate cash ratio is computed by dividing aggregate cash holdings with aggregate total assets for the entire sample. The total number of observations is 44,275.

Year	Cash/assets Mean	Cash/assets Median	Cash/assets Mean (balanced)	Cash/assets Median (balanced)	Aggregate Cash/assets	Observations
1998	0.145	0.061	0.145	0.061	0.065	2,355
1999	0.153	0.063	0.146	0.061	0.074	2,521
2000	0.165	0.064	0.149	0.058	0.073	2,915
2001	0.179	0.082	0.156	0.068	0.081	3,158
2002	0.188	0.098	0.161	0.081	0.093	3,301
2003	0.219	0.127	0.173	0.096	0.108	3,455
2004	0.229	0.140	0.185	0.105	0.119	3,455
2005	0.224	0.142	0.182	0.104	0.109	3,322
2006	0.219	0.128	0.179	0.103	0.105	3,181
2007	0.213	0.121	0.174	0.097	0.098	3,062
2008	0.198	0.112	0.166	0.095	0.098	2,897
2009	0.220	0.146	0.187	0.127	0.120	2,802
2010	0.221	0.150	0.190	0.134	0.123	2,742
2011	0.209	0.135	0.176	0.113	0.116	2,619
2012	0.203	0.127	0.168	0.105	0.116	2,490

Table 27 – Base Regression with the Natural Logarithm of Cash-to-Assets

The table reports regression results for our base regression with the natural logarithm as the dependent variable. We use our Compustat sample of U.S.-based publicly traded firms from 1998 to 2012. Variables are discussed in section 5.2 and summarized in Table 24 (appendix). Models 1 and 2 in are pooled OLS regressions respectively without and with an industry dummy based on the primary 2-digit SIC code. Statistics and *p*-values for both models are based on standard errors robust to clustering by firm and year. Model 3 is estimated using a fixed effects transformation and we report within R-squared. Standard errors for this model are robust to clustering by firm, and the constant is the average of firm fixed effects. A linear time trend is included in all regressions. Z-statistics are in parenthesis while *, **, and *** indicate significance at the 90%, 95%, and 99% level, respectively.

	1	2	3
Model	OLS	OLS Ind.	Fixed effects
Dependent variable	LN(cash/assets)	LN(cash/assets)	LN(cash/assets)
Firms size	0.004	-0.003	-0.113***
	(0.44)	(-0.30)	(-6.16)
Tangible assets	-1.789***	-2.206***	-2.364***
	(-14.94)	(-18.19)	(-19.99)
NWC	-0.353***	-0.298***	-0.147***
	(-8.77)	(-8.08)	(-6.00)
Market-to-book	0.026***	0.025***	0.015***
	(7.62)	(7.13)	(4.82)
Leverage	-2.028***	-1.998***	-1.256***
	(-18.65)	(-18.24)	(-18.64)
Leverage-squared	0.349***	0.354***	0.227***
	(13.83)	(13.82)	(13.07)
Debt rating	-0.293***	-0.260***	-0.215***
	(-5.22)	(-4.42)	(-3.62)
Debt due within 3 years	-0.338***	-0.320***	-0.097***
	(-10.73)	(-11.62)	(-5.37)
Dividends	-0.145***	-0.091***	0.057*
	(-4.06)	(-2.68)	(1.85)
T-Bill rate	-0.042***	-0.044***	-0.044***
	(-5.44)	(-5.67)	(-9.59)
Loan rate spread	-0.107***	-0.114***	-0.088***
	(-2.71)	(-2.68)	(-3.62)
S&P VIX	-0.002	-0.002	-0.003***
	(-1.27)	(-1.13)	(-3.24)
OCF volatility	0.048***	-0.001	-0.000
	(2.64)	(-0.08)	(-0.04)
Financing gap	-0.078***	-0.075***	-0.034
	(-3.06)	(-2.97)	(-1.52)
Diversification factor	0.047	-0.010	0.163*
	(0.50)	(-0.11)	(1.82)
HHI	-0.540***	-0.398***	-0.084
	(-6.16)	(-3.34)	(-0.49)
Repatriation tax	25.639***	24.477***	6.794***
	(11.06)	(10.71)	(4.03)
OCF shock	0.239***	0.217***	0.137***
	(6.81)	(6.57)	(5.19)
OCF MA	0.373***	0.349***	0.152***
	(7.04)	(7.06)	(3.11)

Model	1 OLS	2 OLS Ind.	3 Fixed effects
Capex shock	-0.733**	-0.401	-0.402**
	(-2.23)	(-1.44)	(-2.23)
Capex MA	5.594***	5.705***	0.434
	(6.81)	(6.82)	(0.62)
Capex MA square	-15.298***	-14.235***	0.377
	(-5.21)	(-5.27)	(0.16)
R&D shock	0.552***	0.528***	0.088
	(3.87)	(3.95)	(1.02)
R&D MA	5.645***	5.228***	0.294
	(27.32)	(24.06)	(0.90)
R&D MA-squared	-4.972***	-4.660***	-0.542*
	(-18.52)	(-17.60)	(-1.77)
Acquisition	-2.897***	-2.746***	-1.826***
	(-14.85)	(-14.23)	(-19.63)
Net debt issuance	0.867***	0.808***	0.581***
	(9.12)	(9.31)	(9.55)
Net equity issuance	0.500***	0.456***	0.568***
	(8.71)	(8.05)	(14.32)
Year	0.033***	0.033***	0.021***
	(7.77)	(7.48)	(6.42)
Constant	-66.618***	-66.234***	-43.469***
	(-8.01)	(-7.64)	(-6.54)
Observations	43,938	43,938	43,938
Number of Firms	5,490	5,490	5,490
Adjusted R-squared	0.393	0.421	0.137

Table 28 – OCF shock, Net Debt Issuance and Net Equity Issuance from 1998 to 2012
The table shows the mean and median cash flow shock and mean net debt issuance and net equity issuance for our Compustat sample of U.S.-based publicly traded firms from 1998 to 2012. The total number of observations is 44,275.

Year	Cash flow shock Mean	Cash flow shock Median	Net debt issuance Mean	Net equity issuance Mean	Observations
1998	-0.0177	-0.0021	0.0326	0.0268	2,355
1999	-0.0102	-0.0043	0.0212	0.0401	2,521
2000	-0.0120	-0.0041	0.0117	0.0678	2,915
2001	-0.0297	-0.0094	0.0066	0.0457	3,158
2002	-0.0229	-0.0075	-0.0040	0.0372	3,301
2003	0.0234	0.0004	0.0027	0.0515	3,455
2004	0.0206	0.0082	0.0114	0.0766	3,455
2005	0.0166	0.0057	0.0169	0.0615	3,322
2006	0.0129	0.0034	0.0245	0.0502	3,181
2007	-0.0003	-0.0016	0.0257	0.0477	3,062
2008	-0.0187	0.0005	0.0157	0.0184	2,897
2009	-0.0153	-0.0092	-0.0066	0.0423	2,802
2010	0.0219	0.0049	0.0082	0.0399	2,742
2011	0.0087	0.0059	0.0187	0.0306	2,619
2012	-0.0045	-0.0010	0.0189	0.0326	2,490

Table 29 – Aggregate OCF, Net Debt Issuance, and Net Equity Issuance Ratio from 1998 to 2012
The table shows aggregate ratios for cash flow, net debt issuance, and net equity issuance for our Compustat sample of U.S.-based publicly traded firms from 1998 to 2012. The ratios are calculated by taking the cumulative value of the variable and dividing by cumulative total assets for each year. The total number of observations is 44,275.

Year	Aggregate cash flow ratio	Aggregate net debt issuance ratio	Aggregate net equity issuance ratio	Equity purchases	Equity sales	Observations
1998	0.0823	0.0375	-0.0166	0.0308	0.0142	2,355
1999	0.0821	0.0232	-0.0087	0.0265	0.0178	2,521
2000	0.0768	0.0190	-0.0035	0.0231	0.0196	2,915
2001	0.0708	0.0254	-0.0037	0.0184	0.0147	3,158
2002	0.0708	0.0038	-0.0084	0.0180	0.0096	3,301
2003	0.0739	-0.0074	-0.0060	0.0165	0.0106	3,455
2004	0.0807	-0.0027	-0.0102	0.0247	0.0145	3,455
2005	0.0823	0.0052	-0.0237	0.0369	0.0132	3,322
2006	0.0826	0.0206	-0.0349	0.0493	0.0144	3,181
2007	0.0822	0.0267	-0.0395	0.0549	0.0154	3,062
2008	0.0887	0.0247	-0.0298	0.0400	0.0102	2,897
2009	0.0735	0.0036	-0.0048	0.0148	0.0100	2,802
2010	0.0887	0.0049	-0.0174	0.0278	0.0105	2,742
2011	0.0909	0.0160	-0.0288	0.0382	0.0094	2,619
2012	0.0863	0.0221	-0.0233	0.0322	0.0089	2,490

Table 30 – Average and Aggregate R&D, Capex, and Acquisitions Ratios from 1998 to 2012

The table shows average and aggregate ratios for R&D, capex and Acquisitions to assets for our Compustat sample of U.S.-based publicly traded firms from 1998 to 2012. Aggregate ratios are calculated by taking the cumulative value of the variable and dividing by cumulative total assets for each year. The total number of observations is 44,275.

Year	Average			Aggregate			Observations
	R&D	Capex	Acquisitions	R&D	Capex	Acquisitions	
1998	0.0591	0.0690	0.0315	0.0243	0.0741	0.0389	2,355
1999	0.0567	0.0616	0.0254	0.0222	0.0699	0.0279	2,521
2000	0.0586	0.0603	0.0192	0.0211	0.0672	0.0294	2,915
2001	0.0693	0.0534	0.0184	0.0204	0.0628	0.0184	3,158
2002	0.0740	0.0445	0.0158	0.0207	0.0506	0.0140	3,301
2003	0.0691	0.0414	0.0147	0.0194	0.0478	0.0125	3,455
2004	0.0723	0.0448	0.0217	0.0209	0.0490	0.0179	3,455
2005	0.0751	0.0474	0.0251	0.0206	0.0530	0.0235	3,322
2006	0.0726	0.0502	0.0251	0.0227	0.0572	0.0322	3,181
2007	0.0757	0.0496	0.0269	0.0216	0.0595	0.0310	3,062
2008	0.0807	0.0546	0.0222	0.0238	0.0666	0.0238	2,897
2009	0.0749	0.0378	0.0118	0.0212	0.0473	0.0189	2,802
2010	0.0681	0.0401	0.0185	0.0211	0.0475	0.0193	2,742
2011	0.0685	0.0471	0.0239	0.0203	0.0537	0.0242	2,619
2012	0.0680	0.0488	0.0237	0.0206	0.0573	0.0226	2,490

Table 31 – Average R&D and Capex Shock from 1998 to 2012   .

The table shows the average shock to R&D and capex for our Compustat sample of U.S.-based publicly traded firms from 1998 to 2012

Year	Capex shock	R&D shock	Observations
1998	-0.0025	0.0028	2,355
1999	-0.0113	-0.0039	2,521
2000	-0.0112	-0.0095	2,915
2001	-0.0145	-0.0020	3,158
2002	-0.0203	0.0007	3,301
2003	-0.0190	-0.0118	3,455
2004	-0.0096	-0.0071	3,455
2005	-0.0042	-0.0034	3,322
2006	0.0005	-0.0039	3,181
2007	0.0009	-0.0020	3,062
2008	0.0026	0.0096	2,897
2009	-0.0161	0.0008	2,802
2010	-0.0126	-0.0049	2,742
2011	-0.0042	-0.0030	2,619
2012	-0.0010	-0.0028	2,490

Table 32 – Median Operating Profit Margin from 1998 to 2012.
The table shows the media operating profit margin for our Compustat sample of U.S.-based publicly traded firms from 1998 to 2012. The margin is calculated as operating income before depreciation divided by total sales

Year	Median operating profit margin	Observations
1998	0.0977	2,355
1999	0.0963	2,521
2000	0.0859	2,915
2001	0.0710	3,158
2002	0.0724	3,301
2003	0.0728	3,455
2004	0.0803	3,455
2005	0.0816	3,322
2006	0.0817	3,181
2007	0.0816	3,062
2008	0.0770	2,897
2009	0.0758	2,802
2010	0.0981	2,742
2011	0.1003	2,619
2012	0.1001	2,490

Table 33 – Net Debt Issuance to Investment Ratio from 1998 to 2012
The table shows the average ratio of Net debt issuance to the sum of capex, Acquisitions, and R&D for our Compustat sample of U.S.-based publicly traded firms from 1998 to 2012. The sample is split into firms with and without and investment grade debt rating (BBB or higher). The total number of observations is 44,275.

Year	Investment grade debt rating	No investment grade debt rating	Observations
1998	0.6275	1.1889	2,355
1999	0.5803	1.2239	2,521
2000	0.7251	1.2603	2,915
2001	0.9521	1.2386	3,158
2002	0.6970	1.4093	3,301
2003	0.7506	1.6372	3,455
2004	0.5780	1.3415	3,455
2005	0.6134	1.3896	3,322
2006	0.7096	1.3725	3,181
2007	0.8084	1.4956	3,062
2008	0.7140	1.0195	2,897
2009	0.7146	1.4123	2,802
2010	0.8968	1.4061	2,742
2011	0.7948	1.1844	2,619
2012	0.9000	1.2271	2,490

Table 34 – BKS Regression

The table reports regression results for our replication of BKS' regression. We use our Compustat sample of U.S.-based publicly traded firms from 1998 to 2012. Variables are discussed in section 5.2 and summarized in Table 24 (appendix). Models 1 and 2 in are pooled OLS regressions respectively without and with an industry dummy based on the primary 2-digit SIC code. Statistics and p-values for both models are based on standard errors robust to clustering by firm and year. Model 3 is estimated using a fixed effects transformation and we report within R-squared. Standard errors for this model are robust to clustering by firm, and the constant is the average of firm fixed effects. A linear time trend is included in all regressions. Z-statistics are in parenthesis while *, **, and *** indicate significance at the 90%, 95%, and 99% level, respectively.

	1	2	3
Model	OLS	OLS Ind.	Fixed effects
Dependent variable	Cash/assets	Cash/assets	Cash/assets
OCF volatility	0.028***	0.004**	0.001
	(4.77)	(1.96)	(0.53)
Market-to-book	0.007***	0.006***	0.004***
	(6.67)	(6.19)	(6.74)
Firm size	-0.004***	-0.004***	-0.007***
	(-3.44)	(-3.17)	(-2.69)
OCF	0.064***	0.057***	0.024***
	(6.05)	(6.16)	(5.14)
NWC	-0.074***	-0.071***	-0.041***
	(-10.14)	(-10.37)	(-9.33)
Capex	-0.623***	-0.553***	-0.344***
	(-15.37)	(-13.02)	(-16.40)
Leverage	-0.206***	-0.195***	-0.101***
	(-22.17)	(-21.22)	(-16.05)
R&D	0.427***	0.333***	-0.096***
	(18.69)	(14.81)	(-5.65)
Dividends	-0.052***	-0.043***	0.011***
	(-9.64)	(-7.43)	(3.24)
Acquisitions	-0.485***	-0.471***	-0.336***
	(-20.99)	(-20.99)	(-28.65)
Net debt issuance	0.200***	0.181***	0.126***
	(9.99)	(9.46)	(13.55)
Net equity issuance	0.155***	0.143***	0.147***
	(9.05)	(8.98)	(17.98)
Year	0.002***	0.003***	0.002***
	(3.86)	(5.28)	(5.42)
Constant	-3.873***	-5.456***	-2.928***
	(-3.61)	(-5.05)	(-4.97)
Observations	44,275	44,275	44,275
Number of Firms	5,502	5,502	5,502
Adjusted R-squared	0.359	0.395	0.124

Table 35 – Results from Augmented Dickey Fuller Test

This table summarizes p-values for the Augmented Dickey Fuller test performed for each variable of each tested firm. It tests the null hypothesis that the coefficients of lags in an autoregressive model are equal to one, because this indicates that the time series is not weakly dependent. Due to already short time series, we restrict the sample to firms with valid observations for all years between 1998 and 2012.

	Mean	Min	1st Percentile	5th Percentile	10th Percentile	Median	Max	Number of firms
Cash-to-assets	0.373	0.000	0.000	0.002	0.016	0.311	1.000	674
Firm size	0.556	0.000	0.000	0.008	0.038	0.602	1.000	674
Tangible assets	0.427	0.000	0.000	0.005	0.026	0.397	1.000	674
NWC	0.346	0.000	0.000	0.000	0.005	0.289	0.998	674
Market-to-book	0.360	0.000	0.000	0.002	0.010	0.304	1.000	674
Leverage	0.433	0.000	0.000	0.001	0.018	0.401	1.000	674
Leverage-squared	0.406	0.000	0.000	0.000	0.005	0.354	1.000	674
Debt due within 3 years	0.343	0.000	0.000	0.000	0.006	0.239	1.000	674
T-Bill rate	0.329	0.329	0.329	0.329	0.329	0.329	0.425	674
Loan rate spread	0.186	0.186	0.186	0.186	0.186	0.186	0.186	674
S&P VIX	0.086	0.086	0.086	0.086	0.086	0.086	0.120	674
OCF volatility	0.481	0.047	0.047	0.096	0.136	0.371	1.000	674
Financing gap	0.454	0.000	0.001	0.019	0.064	0.427	0.997	674
Diversification factor	0.781	0.000	0.000	0.057	0.162	1.000	1.000	674
HHI	0.521	0.000	0.000	0.027	0.037	0.583	1.000	674
Repatriation tax	0.617	0.000	0.000	0.016	0.061	0.964	1.000	674
OCF shock	0.269	0.000	0.000	0.004	0.020	0.200	0.998	674
OCF MA	0.421	0.000	0.000	0.003	0.013	0.396	0.999	674
Capex shock	0.229	0.000	0.000	0.001	0.004	0.160	1.000	674
Capex MA	0.398	0.000	0.000	0.000	0.007	0.370	1.000	674
Capex MA-squared	0.357	0.000	0.000	0.000	0.001	0.326	1.000	674
R&D shock	0.624	0.000	0.000	0.015	0.057	0.673	1.000	674
R&D MA	0.678	0.000	0.000	0.003	0.036	0.960	1.000	674
R&D MA-squared	0.668	0.000	0.000	0.000	0.013	0.958	1.000	674
Acquisitions	0.358	0.000	0.000	0.000	0.003	0.115	1.000	674
Net debt issuance	0.215	0.000	0.000	0.000	0.001	0.097	1.000	674
Net equity issuance	0.242	0.000	0.000	0.000	0.006	0.152	1.000	674

Table 36 – Results from Augmented Dickey Fuller Test with Trend

This table summarizes p-values for the Augmented Dickey Fuller test with trend performed for each variable of each tested firm. It tests the null hypothesis that the coefficients of lags in an autoregressive model are equal to one because, this indicates that the time series is not weakly dependent. Due to already short time series, we restrict the sample to firms with valid observations for all years between 1998 and 2012.

	Mean	Min	1st Percentile	5th Percentile	10th Percentile	Median	Max	Number of firms
Cash-to-assets	0.400	0.000	0.000	0.001	0.010	0.357	1.000	674
Firm size	0.515	0.000	0.000	0.001	0.023	0.553	1.000	674
Tangible assets	0.466	0.000	0.000	0.001	0.018	0.455	1.000	674
NWC	0.420	0.000	0.000	0.000	0.003	0.409	0.996	674
Market-to-book	0.401	0.000	0.000	0.001	0.011	0.359	1.000	674
Leverage	0.505	0.000	0.000	0.001	0.029	0.508	1.000	674
Leverage-squared	0.468	0.000	0.000	0.000	0.005	0.427	1.000	674
Debt due within 3 years	0.426	0.000	0.000	0.002	0.009	0.369	1.000	674
T-Bill rate	0.007	0.007	0.007	0.007	0.007	0.007	0.069	674
Loan rate spread	0.022	0.022	0.022	0.022	0.022	0.022	0.022	674
S&P VIX	0.329	0.329	0.329	0.329	0.329	0.329	0.405	674
OCF volatility	0.500	0.000	0.013	0.066	0.066	0.464	1.000	674
Financing gap	0.559	0.000	0.000	0.017	0.071	0.597	1.000	674
Diversification factor	0.795	0.000	0.000	0.036	0.184	1.000	1.000	674
HHI	0.555	0.000	0.001	0.010	0.107	0.595	1.000	674
Repatriation tax	0.657	0.000	0.000	0.005	0.049	0.960	1.000	674
OCF shock	0.415	0.000	0.000	0.005	0.028	0.389	1.000	674
OCF MA	0.487	0.000	0.000	0.001	0.016	0.484	1.000	674
Capex shock	0.365	0.000	0.000	0.001	0.010	0.321	1.000	674
Capex MA	0.486	0.000	0.000	0.001	0.011	0.480	1.000	674
Capex MA-squared	0.446	0.000	0.000	0.000	0.003	0.426	1.000	674
R&D shock	0.699	0.000	0.000	0.005	0.081	0.918	1.000	674
R&D MA	0.725	0.000	0.000	0.007	0.076	0.982	1.000	674
R&D MA-squared	0.716	0.000	0.000	0.000	0.032	0.990	1.000	674
Acquisitions	0.434	0.000	0.000	0.000	0.003	0.304	1.000	674
Net debt issuance	0.305	0.000	0.000	0.000	0.002	0.203	1.000	674
Net equity issuance	0.357	0.000	0.000	0.000	0.012	0.303	1.000	674

Table 37 – First Difference Regressions

The table reports regression results for a first difference regression of our base model with and without lags. We use our Compustat sample of U.S.-based publicly traded firms from 1998 to 2012. Variables are discussed in section 5.2 and summarized in Table 24 (appendix). Models 1 and 2 are estimated using OLS. Statistics and *p*-values for both models are based on standard errors robust to clustering by firm and year. Model 3 and 4 are estimated using a fixed effects transformation (FE) of the first differenced variables and we report within R-squared. Standard errors for this model are robust to clustering by firm, and the constant is the average of firm fixed effects. A linear time trend is included in all regressions (Year). Z-statistics are in parenthesis while *, **, and *** indicate significance at the 90%, 95%, and 99% level, respectively.

	1	2	3	4
Model	OLS	OLS	FE	FE
Dependent variable	ΔCash/assets	ΔCash/assets	ΔCash/assets	ΔCash/assets
ΔFirms size	-0.005	-0.000	-0.003	-0.001
	(-1.08)	(-0.04)	(-0.77)	(-0.08)
ΔTangible assets	-0.407***	-0.405***	-0.415***	-0.406***
	(-15.83)	(-17.69)	(-21.17)	(-17.17)
ΔNWC	-0.035***	-0.045***	-0.038***	-0.047***
	(-7.42)	(-8.78)	(-8.66)	(-9.43)
ΔMarket-to-book	0.001	0.000	0.001	-0.000
	(1.42)	(0.08)	(0.90)	(-0.41)
ΔLeverage	-0.099***	-0.089***	-0.093***	-0.076***
	(-11.96)	(-9.95)	(-8.58)	(-5.59)
ΔLeverage-squared	0.011***	0.008**	0.009***	0.004
	(4.70)	(2.52)	(3.04)	(1.14)
ΔDebt rating	-0.003	-0.001	-0.002	-0.001
	(-0.63)	(-0.27)	(-0.52)	(-0.30)
ΔDebt due within 3 years	-0.009***	-0.007***	-0.008***	-0.006***
	(-4.06)	(-3.55)	(-4.32)	(-3.01)
ΔDividends	0.001	0.003	-0.000	0.003
	(0.36)	(1.03)	(-0.08)	(0.90)
ΔT-Bill rate	-0.003**	-0.003*	-0.003***	-0.003***
	(-2.32)	(-1.92)	(-6.05)	(-4.35)
ΔLoan rate spread	-0.003	-0.002	-0.003	-0.002
	(-0.29)	(-0.17)	(-0.98)	(-0.82)
ΔS&P VIX	-0.000	-0.000	-0.000***	-0.000
	(-1.61)	(-0.45)	(-3.75)	(-1.16)
ΔOCF volatility	0.001	0.001	0.001	0.001
	(0.51)	(0.23)	(0.88)	(0.68)
ΔFinancing gap	-0.002	-0.001	-0.001	-0.000
	(-0.64)	(-0.23)	(-0.54)	(-0.14)
ΔDiversification factor	-0.013	-0.011	-0.013*	-0.012
	(-1.56)	(-1.42)	(-1.88)	(-1.54)
ΔHHI	0.006	-0.010	0.006	-0.007
	(0.51)	(-0.77)	(0.41)	(-0.50)
ΔRepatriation tax	0.249	0.172	0.205	0.106
	(1.20)	(0.74)	(1.12)	(0.51)
ΔOCF shock	0.030***	0.034***	0.029***	0.035***
	(7.10)	(5.52)	(5.65)	(4.69)
ΔOCF shock$_{t-1}$		0.007		0.007
		(1.23)		(1.33)

Model	1 OLS	2 OLS	3 FE	4 FE
ΔOCF shock$_{t-2}$		0.008		0.005
		(1.59)		(1.02)
ΔOCF MA	0.027***	0.039***	0.023*	0.024
	(2.61)	(2.92)	(1.85)	(1.45)
ΔCapex shock	-0.160***	-0.206***	-0.163***	-0.216***
	(-7.19)	(-8.78)	(-8.65)	(-9.90)
ΔCapex shock$_{t-1}$		-0.065***		-0.073***
		(-3.46)		(-4.86)
ΔCapex shock$_{t-2}$		-0.029**		-0.035**
		(-2.07)		(-2.21)
ΔCapex shock$_{t-3}$		-0.020*		-0.020
		(-1.76)		(-1.34)
ΔCapex shock$_{t-4}$		-0.008		-0.010
		(-0.67)		(-0.72)
ΔCapex MA	-0.212***	-0.190	-0.254***	-0.190
	(-3.19)	(-1.55)	(-2.62)	(-1.59)
ΔCapex MA-squared	0.133	-0.047	0.249	-0.032
	(0.43)	(-0.11)	(0.78)	(-0.08)
ΔR&D_shock	-0.105***	-0.107***	-0.106***	-0.107***
	(-6.85)	(-4.22)	(-4.95)	(-4.15)
ΔR&D shock$_{t-1}$		-0.057***		-0.064***
		(-2.89)		(-3.54)
ΔR&D shock$_{t-2}$		0.014		0.004
		(1.51)		(0.29)
ΔR&D MA	0.021	-0.112	-0.071	-0.130
	(0.26)	(-1.53)	(-0.81)	(-1.14)
ΔR&D MA-squared	-0.121	0.009	-0.063	0.017
	(-1.50)	(0.11)	(-0.77)	(0.16)
ΔAcquisitions	-0.338***	-0.516***	-0.339***	-0.529***
	(-13.95)	(-17.46)	(-31.30)	(-29.28)
ΔAcquisitions$_{t-1}$		-0.347***		-0.361***
		(-17.34)		(-22.01)
ΔAcquisitions$_{t-2}$		-0.236***		-0.249***
		(-18.12)		(-17.16)
ΔAcquisitions$_{t-3}$		-0.131***		-0.139***
		(-13.67)		(-11.87)
ΔAcquisitions$_{t-4}$		-0.064***		-0.067***
		(-9.00)		(-8.02)
ΔNet debt issuance	0.124***	0.145***	0.124***	0.143***
	(16.51)	(10.16)	(14.44)	(10.59)
ΔNet debt issuance$_{t-1}$		0.057***		0.055***
		(4.66)		(4.73)
ΔNet debt issuance$_{t-2}$		0.043***		0.043***
		(6.31)		(4.43)
ΔNet debt issuance$_{t-3}$		0.017***		0.017**
		(2.89)		(2.16)
ΔNet equity issuance	0.140***	0.176***	0.142***	0.185***
	(19.76)	(16.46)	(20.29)	(16.96)
ΔNet equity issuance$_{t-1}$		0.061***		0.066***

Model	1 OLS	2 OLS	3 FE	4 FE
		(7.60)		(6.41)
ΔNet equity issuance$_{t-2}$		0.021***		0.025***
		(2.97)		(2.71)
ΔNet equity issuance$_{t-3}$		0.009		0.010
		(1.28)		(1.26)
Year	-0.000	-0.000	-0.000***	-0.000***
	(-1.09)	(-1.07)	(-3.63)	(-3.42)
Constant	0.733	0.788	0.926***	0.992***
	(1.08)	(1.07)	(3.62)	(3.41)
Observations	37,095	28,598	37,095	28,598
Number of Firms	5,096	4,220	5,096	4,220
Adjusted R-squared	0.233	0.266	0.238	0.270

Table 38 – Regressions Omitting Potentially Problematic Variables

The table reports regression results for our base regression where potentially problematic variables have been omitted. Panel A excludes variables that may cause endogeneity (Leverage, R&D, capex, and Acquisitions). Panel B excludes times series that may not be weakly dependent (T-Bill rate, S&P VIX, and loan rate spread). We use our Compustat sample of U.S.-based publicly traded firms from 1998 to 2012. Variables are discussed in section 5.2 and summarized in Table 24 (appendix). Models 1, 2, 4, and 5 are pooled OLS regressions respectively without and with an industry dummy based on the primary 2-digit SIC code. Statistics and *p*-values for these models are based on standard errors robust to clustering by firm and year. Model 3 and 6 are estimated using a fixed effects transformation and we report within R-squared. Standard errors for both models are robust to clustering by firm, and the constant is the average of firm fixed effects. A linear time trend is included in all regressions (Year). Z-statistics are in parenthesis while *, **, and *** indicate significance at the 90%, 95%, and 99% level, respectively.

	PANEL A			PANEL B		
	1	2	3	4	5	6
Model	OLS	OLS Ind.	Fixed effects	OLS	OLS Ind.	Fixed effects
Dependent variable	Cash/assets	Cash/assets	Cash/assets	Cash/assets	Cash/assets	Cash/assets
Firms size	-0.008***	-0.007***	-0.011***	0.000	-0.001	-0.008***
	(-5.15)	(-4.31)	(-4.09)	(0.11)	(-0.66)	(-3.20)
Tangible assets	-0.305***	-0.362***	-0.424***	-0.195***	-0.283***	-0.393***
	(-27.71)	(-26.64)	(-28.03)	(-17.73)	(-21.23)	(-25.24)
NWC	0.008*	0.007	-0.003	-0.053***	-0.047***	-0.032***
	(1.84)	(1.62)	(-1.20)	(-10.92)	(-9.71)	(-8.83)
Market-to-book	0.003***	0.003***	0.002***	0.002***	0.002***	0.002***
	(3.67)	(3.26)	(3.50)	(3.63)	(3.59)	(3.24)
Leverage				-0.243***	-0.247***	-0.147***
				(-26.95)	(-28.68)	(-17.26)
Leverage-squared				0.035***	0.038***	0.021***
				(12.99)	(14.53)	(9.24)
Debt rating	-0.032***	-0.045***	-0.009*	-0.051***	-0.053***	-0.010**
	(-4.28)	(-5.76)	(-1.79)	(-9.26)	(-9.24)	(-2.06)
Debt due within 3 years	-0.087***	-0.080***	-0.024***	-0.064***	-0.060***	-0.021***
	(-18.22)	(-18.15)	(-10.02)	(-17.65)	(-18.03)	(-9.42)
Dividends	-0.027***	-0.020***	0.012***	-0.017***	-0.014***	0.009***
	(-5.90)	(-4.03)	(3.46)	(-3.60)	(-2.84)	(2.68)
T-Bill rate	-0.006***	-0.006***	-0.004***			
	(-7.74)	(-6.62)	(-7.67)			
Loan rate spread	-0.009*	-0.012**	-0.007**			
	(-1.95)	(-2.19)	(-2.44)			
S&P VIX	-0.000	-0.000	-0.000***			
	(-1.10)	(-1.53)	(-3.48)			
OCF volatility	0.021***	-0.000	0.000	0.008**	0.002*	0.000
	(3.93)	(-0.20)	(0.01)	(2.36)	(1.80)	(0.11)
Financing gap	-0.028***	-0.028***	-0.006*	-0.017***	-0.018***	-0.004
	(-6.02)	(-6.15)	(-1.84)	(-4.88)	(-5.21)	(-1.45)
Diversification factor	-0.078***	-0.079***	0.004	-0.032***	-0.036***	0.005
	(-6.02)	(-6.42)	(0.39)	(-2.91)	(-3.36)	(0.47)
HHI	-0.175***	-0.128***	-0.009	-0.069***	-0.072***	-0.015
	(-14.50)	(-9.35)	(-0.61)	(-7.65)	(-6.57)	(-1.08)
Repatriation tax	3.949***	2.855***	0.878***	1.555***	1.527***	0.678**
	(8.01)	(5.46)	(3.12)	(3.61)	(3.25)	(2.45)
OCF shock	0.044***	0.044***	0.040***	0.043***	0.041***	0.028***

	PANEL A			PANEL B		
	1	2	3	4	5	6
Model	OLS	OLS Ind.	Fixed effects	OLS	OLS Ind.	Fixed effects
	(4.42)	(5.02)	(10.16)	(9.82)	(9.23)	(7.05)
OCF MA	0.037***	0.040***	0.036***	0.064***	0.060***	0.028***
	(4.18)	(4.96)	(5.25)	(8.96)	(9.04)	(4.15)
Capex shock				-0.243***	-0.224***	-0.129***
				(-7.60)	(-6.41)	(-7.11)
Capex MA				-0.037	0.134	0.012
				(-0.40)	(1.42)	(0.15)
Capex MA square				0.394	-0.271	-0.054
				(1.42)	(-0.94)	(-0.23)
R&D shock				0.031	0.030	-0.076***
				(0.95)	(1.02)	(-4.49)
R&D MA				1.024***	0.980***	0.095
				(20.21)	(20.12)	(1.57)
R&D MA-squared				-0.792***	-0.789***	-0.147**
				(-13.42)	(-14.41)	(-2.32)
Acquisition				-0.485***	-0.463***	-0.343***
				(-17.16)	(-16.55)	(-30.20)
Net debt issuance	-0.007	-0.016	0.012	0.155***	0.147***	0.122***
	(-0.33)	(-0.86)	(1.55)	(11.42)	(10.84)	(14.45)
Net equity issuance	0.239***	0.204***	0.140***	0.150***	0.135***	0.138***
	(11.59)	(11.01)	(19.21)	(12.51)	(11.74)	(19.26)
				0.002***	0.002***	0.001*
Year	0.001**	0.002***	-0.000	(5.04)	(5.12)	(1.79)
	(2.21)	(3.08)	(-0.59)	-4.605***	-4.363***	-0.694
Constant	-2.449*	-3.666***	0.864	(-4.75)	(-4.70)	(-1.16)
	(-1.89)	(-2.72)	(1.11)	(-4.75)	(-4.70)	(-1.16)
Observations	44,275	44,275	44,275	44,275	44,275	44,275
Number of Firms	5,502	5,502	5,502	5,502	5,502	5,502
Adjusted R-squared	0.304	0.364	0.150	0.486	0.513	0.207

Table 39 – Correlations

Correlations between key variables for our Compustat sample of U.S.-based publicly traded firms from 1998 to 2012. Variable are described in Table 24 (appendix).

	Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Cash-to-assets	1.00														
2	Firm size	-0.23	1.00													
3	Tangible assets	-0.41	0.22	1.00												
4	NWC	-0.05	0.35	0.00	1.00											
5	Market-to-book	0.16	-0.36	-0.11	-0.69	1.00										
6	Leverage	-0.20	-0.21	0.11	-0.75	0.54	1.00									
7	Leverage-squared	-0.05	-0.29	-0.01	-0.80	0.63	0.91	1.00								
8	Debt rating	-0.17	0.50	0.10	0.04	-0.04	-0.02	-0.05	1.00							
9	Debt due within 3 years	-0.15	-0.14	0.02	-0.03	-0.00	0.08	0.03	-0.07	1.00						
10	Dividends	-0.20	0.43	0.17	0.12	-0.10	-0.08	-0.08	0.43	-0.10	1.00					
11	T-Bill rate	-0.07	-0.05	0.04	0.04	0.01	0.00	-0.02	0.01	0.01	-0.01	1.00				
12	Loan rate spread	0.05	0.07	-0.04	-0.03	-0.00	0.00	0.02	0.00	-0.01	0.04	-0.85	1.00			
13	S&P VIX	-0.05	0.00	0.06	0.01	-0.05	0.02	0.01	0.01	0.03	-0.01	-0.18	0.25	1.00		
14	OCF volatility	0.17	-0.09	-0.16	-0.11	0.09	0.03	0.06	-0.07	-0.00	-0.09	-0.14	0.20	-0.08	1.00	
15	Financing gap	-0.12	0.11	0.07	0.05	-0.06	-0.02	-0.03	0.08	-0.00	0.09	0.02	-0.01	0.01	-0.04	1.00
16	Diversification factor	-0.09	0.10	0.03	0.04	-0.05	-0.01	-0.03	0.09	0.01	0.12	-0.02	0.03	0.00	0.00	0.02
17	HHI	-0.23	0.11	0.11	0.05	-0.07	0.03	-0.01	0.11	0.03	0.17	-0.01	0.03	0.01	-0.16	0.06
18	Repatriation tax	0.06	0.16	-0.05	0.03	-0.00	-0.05	-0.03	0.11	-0.05	0.07	-0.04	0.05	-0.01	0.03	0.03
19	OCF shock	0.05	0.08	-0.03	0.30	-0.23	-0.27	-0.30	-0.00	0.01	-0.02	-0.01	0.01	-0.03	0.02	-0.03
20	OCF MA	-0.18	0.47	0.15	0.59	-0.61	-0.45	-0.49	0.12	-0.05	0.19	0.02	-0.02	0.03	-0.13	0.10
21	Capex shock	-0.03	0.01	-0.04	0.02	0.02	-0.03	-0.01	0.02	-0.02	0.05	0.04	-0.01	-0.06	0.04	0.01
22	Capex MA	-0.18	0.11	0.66	-0.02	-0.02	0.05	-0.01	0.01	0.03	0.00	0.07	-0.07	0.06	-0.08	0.03
23	Capex MA-squared	-0.14	0.06	0.55	-0.04	-0.00	0.06	0.01	-0.03	0.02	-0.04	0.04	-0.03	0.05	-0.02	0.02
24	R&D shock	-0.09	-0.03	0.06	-0.07	0.03	0.07	0.07	0.01	0.01	0.02	-0.00	0.00	0.03	-0.01	0.02
25	R&D MA	0.47	-0.34	-0.28	-0.27	0.38	0.12	0.19	-0.12	0.00	-0.22	-0.02	0.01	-0.02	0.14	-0.13
26	R&D MA-squared	0.31	-0.28	-0.15	-0.30	0.40	0.19	0.23	-0.08	0.01	-0.14	-0.02	0.02	-0.01	0.09	-0.10
27	Acquisitions	-0.13	0.15	-0.06	0.05	-0.05	-0.00	-0.04	0.04	-0.02	0.05	0.04	-0.03	-0.04	0.02	0.02
28	Net debt issuance	-0.02	-0.04	0.02	-0.16	0.15	0.26	0.20	0.00	-0.00	-0.01	0.05	-0.03	-0.04	0.03	-0.01
29	Net equity issuance	0.27	-0.32	-0.11	-0.25	0.41	0.14	0.17	-0.12	0.05	-0.17	0.02	-0.02	-0.05	0.06	-0.09

	Variable	16	17	18	19	20	21	22	23	24	25	26	27	28	29
16	Diversification factor	1.00													
17	HHI	0.10	1.00												
18	Repatriation tax	-0.00	-0.03	1.00											
19	OCF shock	0.00	-0.00	0.01	1.00										
20	OCF MA	0.05	0.08	0.07	-0.19	1.00									
21	Capex shock	0.02	0.02	0.01	-0.07	0.05	1.00								
22	Capex MA	-0.03	0.02	-0.03	0.03	0.04	-0.37	1.00							
23	Capex MA-squared	-0.04	0.00	-0.04	0.02	0.01	-0.34	0.93	1.00						
24	R&D shock	0.01	0.02	-0.00	-0.46	0.14	0.08	-0.01	-0.00	1.00					
25	R&D MA	-0.09	-0.22	-0.01	0.07	-0.54	-0.03	-0.12	-0.10	-0.24	1.00				
26	R&D MA-squared	-0.06	-0.13	-0.03	0.08	-0.56	-0.03	-0.05	-0.04	-0.28	0.91	1.00			
27	Acquisitions	0.03	-0.01	0.00	0.02	0.07	-0.02	-0.05	-0.04	-0.02	-0.07	-0.06	1.00		
28	Net debt issuance	0.00	-0.02	-0.02	-0.10	-0.18	0.07	0.05	0.05	0.00	0.09	0.10	0.27	1.00	
29	Net equity issuance	-0.04	-0.10	-0.07	-0.09	-0.50	-0.01	-0.00	0.01	-0.03	0.45	0.43	-0.03	0.01	1.00