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Share Buyback Announcements and their Implications for Risk Management

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Abstract

This thesis is composed of two separate papers, examining the relationship between share buyback announcements and risk management: “Corporate Cash Holdings, Share Buyback Announcements and their Implications for Risk Management” and “Share Buyback Announcements and Market Liquidity”. Share repurchase announcements are often followed by a deterioration of a company's risk profile. While it appears intuitive that the announcement is the cause of the increase of the perceived risk level, in the first paper, the aim is to establish the causal nature of this relationship more formally. Credit default swap spreads are used as a proxy for the risk level and an event study using a market model extended by a generalized autoregressive conditional heteroskedasticity process is performed. I find that the credit risk level deteriorates especially for companies with low cash holdings, and for those sustaining an increasing trend of their corporate savings prior to the event. In the second paper, these results are amplified and I study the effect of the financial crisis of 2007 – 2008 on the relationship between share buybacks and credit risk. Thereby, the biggest credit risk deterioration happens for share repurchase announcements in the post-crisis period, and for rather elevated buyback values. Most of these repurchases are financed internally using corporate savings. Hence, the findings imply that liquidity management and cash buffers increased in importance after the recent financial crisis and became a central strategic topic for companies.

Keywords: Cash holdings; Credit risk; Financial crisis; Market liquidity; Share buyback announcements.

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1. Corporate Cash Holdings, Share Buyback Announcements and their Implications for Risk Management

Abstract

Share buyback announcements are often followed by a deterioration of a company's risk profile. While it appears intuitive that the announcement is the cause of the increase of the perceived risk level, in this thesis, the aim is to establish the causal nature of this relationship more formally. Credit default swap (CDS) spreads are used as a proxy for the risk level and an event study using a market model extended by a generalized autoregressive conditional heteroskedasticity (GARCH(1,1)) process on a sample of 142 companies located in Europe and North America is performed. The 381 events covered by the analysis span a period of eight years (06/17/2004 - 02/26/2013). The results indicate that CDS spreads increase after a buyback announcement with a magnitude almost two percentage points higher than would be expected under normal market circumstances. Companies with either low cash holdings or an increasing trend of their corporate savings prior to the event, exhibit particularly large amplitudes. To the best of our knowledge, this work is the first event study of the relationship between credit default swaps and share buyback announcements. Whereas the methodology employed is rigorous, the discussion of the results provides considerable insight as to how to optimize risk management in real-world situations.

1.0 Introduction

Cash management became a vital topic for companies in the first decade of the 21st century. The recent financial crisis did not only lead to a recession in many countries, but also to a decreased willingness by banks to extend or grant credit. Hence, markets are not frictionless and the capital structure is not irrelevant for the firm value. This is contrary to what has been suggested by Modigliani and Miller (1958), who argue that financing decisions and the amount of cash a company holds do not have any influence on the value of a firm, because they have a net present value of zero.

During the financial crisis, the frictions in the market increased, since external sources of financing became less easily accessible. Cash flows over time are likely to be bigger in terms of size when an economic downturn is expected to happen. According to the Economist (November, 2012) companies from the S&P 500 recorded a total of around 900 billion USD of cash in June 2012, up by 32% compared to 5 years before. In Japan the situation is even more dramatic, cash piles increased by 75% since 2007, amounting to 2.8 trillion USD in 2012. In Canada, liquid company assets account for around 300 billion USD in 2012. Thus, this phenomenon can be observed worldwide.

The goal of the underlying study is to analyze the significance of corporate cash savings with respect to the risk management of companies. The research question is what impact announcements of share buybacks have on the risk profile of a company. Share buyback announcements are often followed by a deterioration of a company's risk profile. While it appears intuitive that the announcement is the cause of the increase of the perceived risk level, in this thesis, the aim is to establish the causal nature of this relationship more formally. Credit default swap (CDS) spreads are used as a proxy for the risk level and an event study using a market model extended by a generalized autoregressive conditional heteroskedasticity (GARCH(1,1)) process on a sample of 142 companies located in Europe and North America is performed. The 381 events covered by the analysis span a period of eight years (06/17/2004–02/26/2013). The relationship between changes in corporate cash holdings due to share repurchase announcements and CDS spreads is ambiguous, from a theoretical point of view. Therefore several hypotheses are tested in this study with respect to the CDS spread movements, but also related to certain company characteristics, such as the cash holdings level, the leverage structure and the sector or country affiliation.

To the best of our knowledge, this paper is the first to analyze empirically the relationship between corporate CDS spreads and share buyback announcements. It adds substantial new insight to the existing literature for what concerns the implications share buyback announcements have on the risk profile of a company and how this knowledge can be used to optimize risk management in real-world business situations.

The remainder of this paper is organised as follows: Section 1.1 surveys the existing literature on cash holdings, share buybacks and credit risk, Section 1.2 outlines the hypotheses, Section 1.3 describes the data and Section 1.4 presents the methodology used. Finally, Section 1.5 contains the empirical results together with the major implications and some limitations of this analysis and Section 1.6 concludes.

1.1 Literature Survey

1.1.1 Cash Holdings

In perfect capital markets, there exists no motive for companies to hold cash. It can be considered as negative debt and external financing is regarded as a perfect substitute for internal financing. Evidence suggests that this is not the case and that there do exist frictions in the market. Both, theoretical and empirical findings related to cash holdings are stated hereafter. There exists however no single theory that best explains the determinants of corporate savings, but there exist both firm-specific and country-specific factors for holding a certain amount of cash. Firm-specific factors are related to the pecking order theory, informational asymmetries, diversification and the trade-off theory, and country-specific factors concern cultural characteristics, shareholder rights protection schemes and the intensity of relations between companies and banks as summarized hereafter.

Pecking order theory. Myers et al. (1984) suggest that there exists a pecking order theory, implying that firms prefer to finance investment opportunities with internal funds instead of using debt or equity. The reasons for this pecking order are both transaction costs – fixed and variable costs – and a precautionary motive (Drobetz et al., 2007). Latter is related to information asymmetries in the market, agency costs and the opportunity costs of investments that cannot be undertaken due to a lack of financing. Corporate savings are less affected by information asymmetries, compared to debt or equity and are thus the preferred means of financing by companies. According to the pecking order theory, there does however not exist an optimal level of cash a company should hold. This theory only suggests that cash has lower information costs than other sources of funding.

Keynes' motives for holding cash. Keynes (1936) analyzes the motives and incentives of people for holding liquid assets and identifies the following four: the income motive, the business motive, the precautionary motive and the speculative motive. First of all, the income motive leads people to hold liquidity in order to bridge the time between the disbursement of income and the receipt, to dispose of more flexibility. The second motive, the business motive is similar to the first one, just that it refers to the balancing between outcomes and incomes of a company. Cash can also be a way of protection against unforeseen contingencies, as suggested by the precautionary motive. In the future, adverse negative cash flow shocks, windfall losses or unexpected investment opportunities can arise and external financing is costly or limited. These three motives exacerbate, the more costly external financing is, in terms of asymmetric information, transaction costs or market imperfections. The forth motive identified by Keynes (1936) is the speculative one, where individuals expect to gain profits, because of believing to know more about the future than the markets do.

Agency costs and asymmetric information. Jensen and Meckling (1976) analyze why markets are not perfect and cash has not a net present value of zero. There are agency costs related to each corporation which depend on both the legal framework in which a company is embedded and the human behaviour of the involved stakeholders. Agency costs arise when there is a misalignment of incentives between the

principal and the agent. In the case of a company, the principals can be, for instance, the shareholders, and the agents are the managers. The managers should act on behalf of the shareholders, but sometimes pursue also personal interests which could harm the interests of the principals. Thus, there is a misalignment of incentives. Agency costs arise because of asymmetric information, the agent disposes usually of more information relative to the principal. Agency costs and asymmetric information can also turn external means of financing into unattractive sources of funding. In the case of debt financing, for instance, the bank as principal disposes of less information than the company or the managers. Moreover, managers may prefer to engage in risky investment opportunities to gain from a potential upside, whereas creditors prefer more conservative projects since they bear the downside risk as well. This conflict of interest makes external financing more costly than internal financing (Jensen and Meckling, 1976). Thus, the higher the agency costs for a company, the more costly external financing is and consequently, the more corporate savings a company should hold.

Diversification and the coinsurance effect. Duchin (2010) investigates the relationship between corporate liquidity and corporate diversification for North American companies for the period 1990 until 2006 and finds that companies which are more diversified hold less cash reserves on average. Multidivisional companies hold on average only half of the cash reserves compared to specialized, stand-alone companies. Diversification leads to lower risk for a company due to the coinsurance effect. The likelihood of encountering simultaneous adverse cash flow shocks or simultaneous investment opportunities in all divisions of a company is lower compared to a specialized company where only one division exists. A prerequisite for this coinsurance effect is however a well-functioning internal capital market within a company in order to efficiently allocate cash from one division to another. The more efficient the cash transfers between divisions, the lower the corporate cash holdings. Moreover, Duchin finds that the effect is stronger for financially constrained companies. Also Mikkelsen et al. (2003) find that less diversified companies hold more cash due to the lack of internal capital markets and higher levels of risk. More diversified companies have a lower probability of entering into financial distress and have more stable cash flows. If companies are diversified across countries instead of industries or business segments, then this has a different impact on cash holdings. Ramírez et al. (2009) analyze a panel of firms from fifty countries over the period 1990 until 2004 and uncover that multinational companies have higher corporate savings than domestic companies. The reason for this might be related to a longer business cycle for multinational companies or the tax burdens companies have to sustain when repatriating income from abroad to their home country.

Asset tangibility. Similar to diversification, which improves the overall risk profile of the company and thus incentivizes companies to hold lower cash holdings, the tangibility of assets has a significant effect. The more tangible an asset is the easier and less expensive it is to convert it into cash which diminishes the need of large corporate savings. An asset which is highly specific is subject to a higher liquidity risk or a liquidity premium requested by investors, which makes especially the most illiquid assets unattractive in case of a sale of assets in order to obtain cash (Drobetz et al., 2007).

Firm size and economies of scale. Bigger companies in terms of total assets can access external financing more easily and at lower costs compared to smaller companies. Hence, larger companies are less

financially constrained and should as a direct consequence, retain less cash. Duchin (2010) finds an economies of scale effect for North American companies, in evidence, larger companies hold on average less cash reserves than smaller companies. External financing has both a fixed and a variable cost component. Smaller companies cannot distribute the fixed costs in such an extent as bigger companies can do and benefit hence less from an economies of scale effect. Larger companies are also less subject to information asymmetries and adverse selection costs which might be another reason why they hold less cash (Drobetz et al., 2007). Companies that are bigger can afford to keep lower cash holdings, due to their better access to capital markets compared to smaller companies. Opler et al. (1999) argue that by the same reasoning also credit ratings have an impact on cash holdings. The better a rating of a company, the easier and relatively cheaper is the access to the markets and thus, the lower are the cash holdings.

Leverage. A direct consequence of holding less cash is that companies have higher levels of net debt, all else equal. Net debt is the difference between overall debt and cash holdings. This implies that cash holdings influence the leverage structure of a company. Companies with lower levels of debt are subject to less market discipline which allows them to be more flexible in deciding how many corporate savings to retain. Due to more discretion on behalf of the managers, they tend to hold higher cash reserves. Companies with a rather low leverage ratio hold more cash reserves on average. However, companies which are highly leveraged might be forced by their creditors to hold higher cash reserves in order to decrease the probability of financial distress. Thus, the relationship between leverage and cash holdings is ambiguous from a theoretical perspective. Drobetz et al. (2007) find a negative relationship between leverage and cash for their sample of Swiss companies for the time period 1995 until 2004. Mikkelsen et al. (2003) find that higher cash holdings are related to less debt and associate this reduced leverage to several reasons, such as the managers' preference for cash instead of debt financing, the non-necessity of debt financing since internal funds are available, or the lack of good collateral for the case of future upcoming investment opportunities.

Ownership and governance structure. Also the ownership structure can influence the level of cash holdings. Firms that have a more dispersed ownership structure allow managers to be more flexible and lead to the tendency to hold more cash (Tirole, 2006). Managerial ownership on the other side is negatively related with cash holdings, as suggested by Jensen and Meckling (1976). There is an increased alignment of interests between managers and shareholders, and managers have an incentive not to waste resources. Companies with substantial cash reserves are more easily targets of hostile takeovers, which managers dislike. However, Drobetz et al. (2007) find that cash holdings augment, when the absolute size of the managerial ownership is very big, possibly due to increased risk aversion by managers. Also for companies with a high share of outside directors on their boards, cash holdings are lower on average. If there are one or more large shareholders and the rest of the stock is dispersed, Drobetz et al. (2007) observe again higher cash holdings. There is a conflict of interest between the large and the small or dispersed shareholders and the former try to reap private benefits from the corporate savings at the expense of the latter. Evidence from Switzerland is presented by Drobetz et al. (2007), using a sample of 156 Swiss non-financial companies for the period 1995 until 2004. They find that Swiss companies hold significantly higher cash reserves compared to the average UK or US firm. Switzerland is

particular for what concerns the governance structure of companies, since there exist no requirements for the leadership structure, such as in the UK where the CEO and the chairman of the board are separated or in the US where it is common to just have one person covering both roles, also known as dual system. Drobetz et al. find evidence suggesting that there are higher cash holdings for companies with a dual system.

Trade-off theory and costs associated to cash holdings. The ultimate goal of companies is to maximize shareholder's wealth. Thus, when deciding on the amount of cash to retain, they consider both the marginal costs and marginal benefits, as suggested by the trade-off theory. The benefits are the ones stated above by Keynes (1936), the income motive, the business motive, the precautionary motive and the speculative motive. The costs of holding cash are both direct and indirect ones. The direct costs are represented mainly by the difference between interest earnings on the cash holdings and interests paid to fund additional cash, in evidence, opportunity costs (Al-Najjar, 2012). Another direct cost of cash holdings is related to taxation. If a company holds liquid assets, there is a cost associated to this on behalf of the shareholders. Interest income on cash is taxed both at the company level and at the shareholder or investor level, thus, subject to double taxation. Would the shareholders own the liquid assets directly, could they benefit from avoiding one level of taxation. Shareholders that are exempt from the capital gains tax, such as pension funds, can avoid taxation all together by disposing of the liquid assets themselves (Drobetz et al., 2007 and Opler et al., 1999). The costs in an indirect way are referred to the agency problems, as stated by Jensen (1986), since managers have an incentive to increase the assets under their control beyond what is optimal for the shareholders. More assets under control imply more power for a manager, eventually leading to faster growth of the assets, which in some compensation schemes is also rewarded and leads to an increase of the manager's income. Excess cash on hand might also mislead a manager to invest it in projects with an expected reward below a company's cost of capital or use it for perks, organizational inefficiencies, mismanagement or unwarranted diversifications. Managerial self-interest can be limited with the use of external financing, where managers are additionally monitored by the markets or the creditors and not only by the shareholders. Jensen identifies several industries which have a more exacerbated free cash flow problem, such as steel, tobacco, brewing, chemical, TV/radio broadcasting, wood and paper production. Companies need to find the right balance between this above mentioned free cash flow problem and the liquidity shortage problem, which is exactly the opposite of the former. Higher corporate savings can increase financial flexibility, reduce the overall investment risk and mitigate a cash shortage, but they can at the same time be very costly to the company and its shareholders. A company has to engage actively in optimal liquidity planning (Tirole, 2006).

Cultural differences. Corporate cash holdings can be partially determined also by the environment the companies are embedded in, such as the legal and regulatory framework or the economic conditions. According to Ramir  z et al. (2009), a substantial part of the variation of cash holdings can be explained by the nationality of a company and the national culture. For instance, corporate cash holdings are higher for firms in countries with an increased tendency towards uncertainty avoidance. At the same time, national culture has a bigger impact for domestic companies with a low international exposure. Similarly, Chang et al. (2009) provide evidence, that not only increased uncertainty avoidance, but also

other cultural aspects, such as a masculine society and a long term orientation, are positively related with cash holdings. Hence, also the behavioural finance aspect is taken into consideration in their analysis. They conclude that countries with the same or similar corporate governance systems and degree of development of the financial system can still have considerable disparities among the overall corporate cash holdings. The costs related to cash holdings in terms of agency problems or the benefits in terms of financial flexibility can be perceived quite differently by investors and shareholders in dissimilar countries.

Shareholder rights protection. Dittmar et al. (2003) find, based on a sample of 11,000 firms from 45 countries that cash holdings are up to twice as much higher in countries with poor minority shareholder rights compared to countries with a decent shareholder rights protection. Hence, agency costs are quite important when deciding upon the capital structure and the cash holdings of a company. Al-Najjar (2012) investigates the determinants of cash holdings of developing countries, in evidence the BRIC for the period 2002 until 2008. He finds that both firm specific and country specific factors are important for describing differences between cash holdings. Especially leverage, firm size and dividend payout ratios determine corporate savings on the firm level. On the country level on the other hand, institutional, structural and industrial settings are important together with the national legal framework for the protection of shareholder rights. Al-Najjar relates these findings to the fact that in countries with weak shareholder rights protection, companies can hoard on average higher amounts of cash, as is implied also by the agency theory by Jensen and Meckling (1976). Moreover, in these countries it is also more difficult for companies to access capital markets, since investors are more reluctant to provide funding.

Relationship Banking. If companies do not dispose of liquid assets, such as cash and retentions, there exist other forms to mitigate contingencies, such as for example a credit line by a bank. Thus, in countries where companies have close ties to the creditors or banks, one could expect companies to keep lower cash reserves. Relationship banking guarantees companies relatively easier access to short and long term debt. Moreover, due to the monitoring by banks, managers have fewer incentives to engage in mismanagement and to hoard large cash reserves (Drobetz et al., 2007). On the other hand, due to increased relationship banking, creditors enjoy more power and can force or encourage companies to hold higher cash reserves. This increases the potential rents for banks and decreases the cost of monitoring. Ferreira et al. (2004) provide however evidence, based on their sample of EMU countries for the period 1987 until 2000, that bank debt and cash holdings are negatively correlated. Thus, relationship banking leads to lower cash holdings, since bank loans imply monitoring by banks and thus decrease information asymmetries.

After having discussed the theoretical foundations of cash holdings, some empirical evidence is presented hereafter. Mikkelsen et al. (2003) analyze US firms with persistent cash holdings that constitute more than one fourth of the company's total assets in the period from 1986 until 1991 and investigate what impact this phenomenon has on operating performance. They find that higher corporate savings lead to increased investments, especially in research and development, and an augmented assets-growth-rate. Thus, summing up, operating performance as the ratio of operating income to operating assets is increased for cash rich companies, controlling for size and industry.

Moreover, substantial cash reserves do not give rise to significant conflicts of interest between shareholders and managers and cannot be explained by certain governance characteristics such as share ownership by the founder or inside board composition, based on what Mikkelsen et al. found.

According to the Economist (November, 2008) however, cash-rich companies before the outburst of the recent credit crunch performed significantly worse than cash-poor companies. This trend has now changed, and it is the cash-rich companies that outperform the others. Hence, the device of many companies after the credit crunch goes towards “cash is king”.

Average annual cash holdings, measured using the cash-to-assets ratio, increased for both diversified and specialized firms over the last 20 years. According to Duchin (2010), there are several factors that gave rise to this upward moving trend, such as increased cash flow volatility, augmented idiosyncratic risk, more volatile investment opportunities and lower degrees of diversification of companies due to industry-wide consolidation trends. Idiosyncratic risk can lead to a rise in cash holdings due to mainly two mechanisms, the precautionary motive or the liquidity motive. Based on a sample of North American companies for the time period 1971 until 2006, it is especially the liquidity motive that led to an increase in cash holdings in the recent decade. Hence, in order to meet the ongoing liquidity requirements, a company prefers to pile up cash in advance instead of changing dividend, debt or investment policies when not enough liquid funds are available (Moyen et al., 2010).

There exists contrary evidence, based on US companies for the period 1980 until 2006, that the precautionary motive is still quite central. It is the change in certain company characteristics that lead to increased cash holdings, based on what Bates et al. (2009) analyzed. Moreover, they agree with Duchin (2010) that the idiosyncratic risk increased for companies, and not all types of risks are hedgeable even though more fancy derivatives and hedging instruments are available in 2006 compared to 1980. Everything else equal, one would expect lower cash holdings in 2006 compared to 1980 simply due to the fact that more advanced risk management tools are available and better means to forecast future cash flows. This is however not the case.

Increased idiosyncratic risk relate Bates et al. (2009) to lower inventories, higher spending for research and development and increased cash flow risk. In 1980 companies used relatively more funds for capital expenditures instead of R&D spending, but this phenomenon reversed in the last decade. R&D spending is riskier due to its substantial blowout rate and its low asset tangibility usually, requiring a bigger cash cushion as buffer.

It is especially non-dividend paying firms and those that got listed on the stock exchange recently that increased their cash holdings over the nearly 30 years time period. Bates et al. also find that in 2006, the average U.S. firm has a net debt nearly equal to zero. They do not find any evidence supporting the agency theory that cash holdings increased due to a non-alignment of interests between managers and shareholders.

Karabarbounis et al. (2012) investigate the macroeconomic aspect of corporate savings and analyze the relationship between companies' cash holdings and the global labour share. Corporate savings represent the biggest component of the overall national savings. Over the last 30 years, the global labour share has

significantly declined – by around 5 percentage points – and the corporate savings share increased by more than 20 percentage points. In the 1970ies it were still households' savings that financed the majority of investments; by the beginning of the 21st century it has moved towards corporate savings. In order to model the shift from labour towards capital, Karabarbounis et al. use a general equilibrium model based on the substitution elasticity between labour and capital. They observe that the cost of investment goods relative to labour decreased over the years, leading to a lower cost of capital and thus, in the long run, higher corporate savings.

1.1.2 Share Buybacks

After the above discussion of cash holdings, the concepts of corporate payout policies and share buybacks are introduced. Excess cash is paid out by companies especially using dividends or share repurchases. Over the last decade, companies made frequently use of share repurchases to pay out cash holdings to their shareholders, instead of using dividend payments. Historically, the latter was the preferred way to transfer funds to shareholders, but this trend has changed (Hsieh et al., 2009). There are several reasons for this; one is certainly related to the differential tax treatment. Dividends are subject to the capital gains tax, cash payoffs from share repurchases are not; otherwise share buybacks and dividends would be perfect substitutes. There exist however also large market participants that do not pay any tax at all, such as pension funds or endowments, and have thus no preference for any payout form (Shoven et al., 1987). Hsieh et al. (2009) point out that it still needs to be further researched whether companies pay out the same amount using share repurchases as with dividends, or if the cash amount paid out to shareholders has increased or decreased. Moreover, the resources used for dividends and share buybacks are usually different, since dividends are paid out using more permanent financing, whereas buybacks are usually financed with unexpectedly high cash flows a company disposes of (Lasfer et al., 2011).

According to Hsieh et al. (2009) there exist 5 major types of stock buybacks: Dutch auction tender offer, fixed price tender offer, open market transactions, targeted stock repurchases and transferable put rights distributions. More than 90 percent of the share buybacks are open market transactions already since the 1980ies, which is why the focus of the underlying thesis will be this form of share repurchases. The company determines a certain notional amount that it wishes to buy back, rather than establishing the number of shares, and then buys back the shares for this notional over a certain period of time on the open market. The major advantage for companies using this type of share buyback is that they are not forced to buy back the whole pre-established amount, but can repurchase only a part of it if they wish to do so.

The question might now arise if there exists an optimal way to pay out cash, that best maximizes shareholder value. Jiang et al. (2011) analyze if share repurchases and dividends can be mixed in such a way to best satisfy the shareholders' goal to maximize value and find that there does not exist an optimal solution. In the end it is the ability to generate cash flow, based on growth opportunities and the return on capital that creates value for a firm and its shareholders. When deciding between paying out cash in the form of dividends or share buybacks, managers should evaluate what degree of flexibility

they need in the future. When starting to pay out dividends, there exists an implicit commitment by the firm to the market to continue paying out dividends. This is not the case for share repurchases and the market generally does not expect other share buybacks to follow in the future.

Shoven et al. (1987) list several hypotheses that can be possible reasons for share repurchases and then try to predict if companies engage in such activities or not for around 2,000 companies for the period 1976 until 1984 using a probit model. The hypotheses are tax benefits, adjustment of the capital structure to an optimal debt-equity-ratio, signalling, takeover defence, principal agent theory or free cash flow implications, learning or habit formation over the years. They find that it is especially the latter that is economically and statistically highly significant in the probit model, since companies seem to specialize based on the needs of their shareholders if they engage in more than one share buyback action. Shoven et al. (1987) identify that those companies that frequently pay out dividends are held disproportionately more by tax-exempt shareholders, while the opposite is the case for companies engaging repeatedly in share repurchases.

Due to the aforementioned asymmetric information between managers and investors, share buybacks are also a way of signalling. Akerlof (1970) analyzed the market mechanisms and argued that a market can fail if there is asymmetric information and if “bad” companies can mimic “good” ones, because of costless signalling. Only if signalling is expensive so that only “good” companies can afford to send a signal, the signal itself becomes credible and leads to a separation equilibrium in the market. A company announcing share repurchases can signal to the market that it believes it is undervalued and therefore buys back the shares. This theory is called undervaluation hypothesis. Moreover, it is usually only firms of high quality which can afford such costly signalling. Hence, this fact itself is a way to transfer information to the investors (Hsieh et al., 2009). Lasfer et al. (2011) find that it is especially small firms, those with the highest information asymmetries that convey the most information and have the highest positive impact on the stock price.

Some claim (Hsieh et al., 2009) that share repurchases are a way of deterring hostile takeovers by others, which are usually unwanted by managers. A share repurchase does not only signal that the firm is undervalued, but increases also the purchasing costs for the firm aiming for a hostile takeover. Moreover, also the ownership structure is changed and voting rights are reshuffled which could help to repel a takeover.

Dobbs et al. (2005) analyzes the relationship between share buybacks and their impact on the share prices of companies and the market in general. While earnings per share, or EPS, are increased after buyback operations due to the lower amount of shares outstanding and a lower denominator in the formula, there occurs usually no change in the fundamental value of the company. There is however a tax-related effect, since holding less excess cash decreases the cost of capital of the company. Dividends are not tax deductible for the company, but interest payments on debt are, and interest income on cash holdings are also subject to taxation. Hence, the share price could potentially increase after a buyback, due to an improved capital structure, even though there occurs no change in the operational efficiency of a company. According to Dobbs et al. (2005) however, share prices tend to rise more than would be predicted based on the beneficial tax effect. Increases of around 16 percent can be observed for

substantial share repurchases. As was found also by Hsieh et al. (2009), share buybacks convey new information to the market and are a way of signalling not only that a company is undervalued, but that its managers believe that the firm can earn enough in the future to afford upcoming capital expenditures and other future commitments. In addition, less cash on hand for managers implies that they cannot engage in negative present value projects or unwise investments; this explanation is called excess cash flow hypothesis. The negative signal that the company lacks investment opportunities and pays out its excess cash because of that is usually not perceived by the market, according to Hsieh et al. (2009).

Lasfer et al. (2011) perform an event study, based on data from France, Germany and the UK for the period 1997 until 2006 and find that share repurchases do not have a homogeneous effect on stock prices, but are related to the countries' respective institutional settings. In France and Germany exist more legal restrictions on the amount of shares that can be bought back and the time frame to execute the operation, as opposed to the UK or the US. On the other hand, shareholder protectionism is higher in the two latter countries, thus allowing firms to engage more actively in the maximization of shareholder wealth and paying out cash in the form of share buybacks. The returns before the event of the share buyback are not negative, which implies that Lasfer et al (2011) cannot confirm the above mentioned undervaluation hypothesis. The market reacts in a more intense way to first announcements as compared to subsequent announcements, occurring within three years after the first one.

Comment et al. (1991) claim that stock price returns are on average negative before open market share repurchase announcements, contradicting what has been found by Lasfer et al. (2011). One possible explanation for this phenomenon is that it enhances credibility. The higher the difference between the pre-announcement share price and the offer price, the more credible is the signal; the same holds for larger amounts bought back.

Ikenberry et al. (1994) differentiate between growth and value stocks when analyzing the impact of the announcement of share repurchases on the stock price. They base their analysis on data from the US for the time period from 1980 until 1990. Value stocks, in evidence those stocks with a high book-to-market ratio that suffer from undervaluation by definition, experience higher abnormal returns than growth stocks do. Companies with low book-to-market ratios experience zero or even negative abnormal returns, according to the study by Ikenberry et al. (1994). However, stock prices adjust only slowly after share buyback announcements and somehow under react to the news, due to market scepticism. Share prices increase on average only by 3.5 percent, but this is not consistent with what managers claim about the undervaluation of their companies. Hence, the efficient market hypothesis does not hold completely and not all the information available is reflected in prices. It often takes several years for prices to completely incorporate the information conveyed through a share repurchase announcement.

Chen et al. (2009) analyze another perspective of share repurchases, based on data for the US for the time period 1990 until 2007, namely they investigate the managers' response to the market reaction after an initial share buyback announcement. Hence, they look at how insiders, in evidence managers, respond to information from the outsiders, or the market. Buyback operations in the US are particularly useful for this kind of analysis, since managers can increase or decrease the pre-announced amount of shares to be bought back and do not have to strictly respect their announced quantity. Chen et al. (2009)

find that when the abnormal returns after a buyback announcement are low, managers tend to buy back more shares on average. Thus, first of all, market information is taken into consideration and used by managers, and secondly, it is especially used for timing purposes.

Jolls (1998) investigates the relationship between incentive-based compensation to managers and stock repurchases and explains the high level of share buybacks based on the agency theory approach. She finds that those companies that provide their executives with stock options are more likely to buy back shares. Consequently, managers prefer to pay out cash in the form of share repurchases and not dividends, because the former have the advantage to not decrease the per-share-value. Excess cash is paid out and at the same time the number of shares outstanding is reduced, thus, the value per share remains the same. This is not the case when dividends are used. In addition, holders of stock options do not obtain anything when dividends are paid out. Jolls (1998) relates the increased use of share buybacks since the 1970ies with the elevated practice to use incentive-based compensation.

Yet another approach is taken by Brav et al. (2005) to further analyze the corporate payout policy. They conduct over 380 interviews with executives to find out their motivations for paying out dividends or engaging in share buybacks. Most executives prefer share repurchases, because of the flexibility they provide. There prevails a conservative view about dividends, and executives are reluctant to cut them, once they started paying out a certain level of dividends. Share repurchases on the other hand can be carried on at the same or at a different level, or they can be cancelled all together and resources can be invested instead in positive NPV investment opportunities. Executives feel that they can better time share repurchases compared to dividend payments. Both tax implications and the use of a payout policy to attract a certain clientele of shareholders is not a fundamental factor in the decision making process by executives. Moreover, they do not consider share repurchases and dividends as substitutes, and do not relate their payout policy to signalling motivations, in order to separate their company from the competitors.

1.1.3 Credit Risk

Credit risk is the risk that a certain instrument changes its value due to unexpected changes in its creditworthiness or credit quality (Duffie et al., 2003). The creditworthiness of a company is very important in determining the capital structure of a company. The better the risk profile of a company, the more cash a company should be able to hold theoretically on average. Therefore, it seems intuitive to conclude that the higher the cash holdings, the lower the corporate credit spread. Acharya et al. (2011) analyze the relationship between credit risk and cash holdings and conclude that it is fundamental to take into account the endogeneity of corporate cash management. Several studies found a counterintuitive positive relationship between credit spreads and cash, without considering that the level of cash depends on the credit risk itself. When considering both credit quality and cash holdings, the relationship is U-shaped, because both the “safest” and the “riskiest” companies hold high levels of corporate savings on average. Companies act based on the precautionary motive, and adjust their corporate savings accordingly. If there exist financial constraints in the market, especially the riskier companies tend to hold a bigger cash buffer for possible future needs. Hence, when the corporate risk

profile worsens, the credit spread increases and the company tends to increase the cash holdings accordingly. Acharya et al. (2011) relate to them as the endogenous factors influencing the credit spread and the corporate savings. On the other hand, exogenous factors for cash holdings would be future growth potentials and the potential private costs managers incur in case of a financial distress, such as reduced stock based compensation or the loss of their job. Based on a sample of US data for the time period 1996 until 2003, Acharya et al. (2011) find that it is these exogenous factors, which do not depend on changes in credit risk factors that are negatively related to the credit spread.

The credit risk can be measured in two possible ways, either considering Credit Default Swap (CDS) spreads or the spreads of corporate bonds. Starting with the former, a CDS is a single-name hedging instrument used to transfer the credit risk from one counterparty to another. It is comparable to an insurance against the default risk or loss of a certain company, called the reference entity. Hence, it allows to divide the risks associated with a certain reference entity into several parts and trade them separately. The investor of a CDS pays on a regular basis, such as every quarter or every year a certain premium to the seller of the CDS. The CDS spread is the overall annual amount paid by the buyer to the seller as a percentage of the notional principal. The seller on the other hand is exposed to the credit risk of the reference entity and pays the investor only in case of a pre-agreed credit event. This contingent settlement can be physical or in terms of cash. In the case of a cash settlement, the buyer of a CDS receives the notional principal minus the recovery rate, or minus the after-default market value of the bond. When the counterparties agree upon a physical settlement, then the protection buyer can sell a bond issued by the reference entity with a face value equal to the notional amount to the protection seller (Hull, 2012).

A critical aspect of a CDS contract is the specification of the credit event, which includes usually failure to pay, bankruptcy and restructuring in Europe, but excludes the latter in the United States. Moreover, a CDS spread depends on the probability of default of a certain reference entity. Some claim that there might be informational asymmetry issues related to this type of hedging instrument, since some parties working close enough with the reference entity, such as banks or consultants, might have more information on the probability of default than others. Still, since the 1990ies the market for CDS grew exponentially and became ever more liquid. CDS played a major role in the recent credit crisis that outburst in 2008, too (Hull, 2010). Also in the future they are expected to remain important, since they are crucial for credit risk management. The regulatory requirements are likely to increase in the next years to come for CDS and central clearing houses are introduced to increase the transparency and stability in the market (Hull, 2012).

The second proxy to measure the credit risk of a certain company is the bond yield which also reveals information on the creditworthiness and default risk of a reference entity. The credit spread is the difference between the yield of a corporate bond and the risk free rate, such as the Treasury rate or the Libor rate. Thus, if an investor has a long position in both a CDS contract and a defaultable, coupon paying bond – both securities referred to the same reference entity – then by means of arbitrage the regular payoff to the investor should be equal to that of a risk-free, coupon paying bond (Hull, 2010).

Daniels et al. (2005) analyze a sample of 72 corporations over the time period 2000 until 2002 and find that credit spreads and CDS spreads are related to each other but are not equal. They perform an event study, using a constant mean model, to test whether spreads move following a credit rating change and find that changes in ratings influence both credit spreads and CDS spreads, especially downgrades have a profound impact. Moreover, they also find that CDS spreads react faster and more intense to an upgrade or downgrade than credit spreads do, suggesting that credit default swaps are more information efficient and absorb news in the market in a faster way. Higher rated companies should have a relatively safer risk profile and thus enjoy lower spreads, whereas the opposite is the case for lower rated companies or non-investment grade ratings (Daniels et al., 2005).

Also Hull et al. (2004) perform a similar event study based on changes in credit ratings, reviews and outlook reports. Using a sample of around 1,599 different entities for the time period 1998 until 2002, they find evidence that all three types of events are anticipated by the CDS spreads. Especially downgrades and reviews or outlooks related to a decrease of the rating have a significant influence on CDS spreads and credit spreads, whereas there exists no significant effect for upgrades. Hull et al. (2004) do not find that CDS spreads change after the announcement of a credit event, within one day the information is priced already. According to Duffie et al. (2003), CDS are the most actively traded instruments to hedge, transfer or replicate credit risk and are thus considered as a benchmark for credit pricing. The CDS market can be divided into four main categories, based on the credit quality of the underlying security: investment grade, non-investment grade / high yield, distressed credits and emerging market credits (Das, 2000).

A CDS spread is calculated based on the survival probability of a reference entity, the risk-free interest rate, such as the LIBOR, and the recovery rate. Since these variables can change over time, CDS are usually marked to market on a daily basis by both the protection buyer and the protection seller (Hull, 2012).

Given the above reasoning that credit spreads and CDS spreads are positively related to each other, we can also analyze what the causes for movements in bond prices are in order to infer possible motives for changes in CDS spreads. Merton (1974) argues that there are essentially three fundamental elements for bond prices: the risk free rate, the special characteristics of the bond contract such as maturity, coupon, call options, seniority level, and the third component is the probability of default.

Tang et al. (2011) analyze the determinants which cause changes in CDS spreads and find that it is especially variations in firm and market fundamentals that are relevant for CDS spread movements. They use data for the United States and for the sample period 2002 until 2009. Especially changes in the volatility of stock returns and in the leverage structure of a company can explain a substantial part of the variation in CDS spreads. A variation in the leverage structure alone can explain around 13% of the variation in CDS spreads, according to Tang et al. On the other hand, it is also excess demand, liquidity and the general risk perception or aversion in the market, approximated by the VIX in the study by Tang et al. (2011) that cause spreads to increase or decrease. Furthermore, during the crisis years of 2008 – 2009, there can be observed an increased co-movement between the credit spreads, due especially to changes in firm fundamentals and to a lower extent, due to market fundamentals.

Still, changes in CDS spreads are not only related to changes in firm characteristics or the credit quality of a reference entity. Tang et al. (2008) find that also liquidity risk is priced in credit default swap spreads. Sellers of CDS contracts charge a premium when they have the pricing power, and they usually allow for a discount when the supply of a particular contract is higher than its demand. Due to the particular nature of CDS contracts, being traded over-the-counter and on a non-standardized way, liquidity is a major concern for these types of securities. Liquidity can be referred to three aspects, tightness, depth and resiliency. The first refers to the bid-ask-spread and suggests that the lower the bid-ask-spread, the more liquid a CDS is. Depth is related to the volumes of a contract that can be traded without influencing the CDS premium, and resiliency indicates the promptness with which a CDS premium recovers after a supply or demand shock. Tang et al. (2008), find that around 20% of the CDS spread can be attributed on average to liquidity and liquidity risk.

1.2 Hypotheses

After having surveyed the current literature, the main hypotheses that are tested in this study are outlined hereafter. Share repurchases are a major instrument to transfer funds from the company's balance sheet to the shareholders. Dividends became less attractive in the last few years (Hsieh et al., 2009) and they also tend to be rather constant over time. Share buybacks are not that regular and less foreseeable and became also the preferred payout method in the last decade, according to both press and academic literature, for example Hsieh et al. (2009). Share buyback announcements are also interesting for this analysis, since the event is public and hence information can be gathered on it. The research question is what influence announcements of share buybacks have on the risk profile of a company and how corporate savings are related to risk management. The relationship between changes in corporate cash holdings due to share repurchase announcements and CDS spreads is ambiguous, from a theoretical point of view. The direction of the linkage cannot be predicted in advance based on theoretical foundations, as is possible to deduce from Section 1.1 of this paper. Hence, several hypotheses are tested in this study.

H1: Share repurchase announcements lead to a decrease in CDS spreads.

Share repurchases are a way of signalling something to the public (Shoven et al., 1987; Hsieh et al., 2009; Akerlof, 1970; et al.). For instance, shares are repurchased when companies think their stocks are undervalued, or when the company is sure to dispose of enough funding also for future upcoming investment opportunities and can afford to buy back some outstanding shares. Thus, there should be a negative relationship between share repurchases and CDS spreads, since the market obtains some promising, positive information about the company's future. The same should hold true according to the aforementioned excess cash flow hypothesis, since a waste of resources is avoided. Parts of the resources that are not invested into new business ventures or projects are paid out to the shareholders to avoid a liquidity trap.

H2: Share repurchase announcements lead to an increase in CDS spreads.

Share repurchases have a direct influence on the capital structure of the company, since there is an outflow of assets. If all else remains equal and share repurchases are financed through retained earnings and other cash reserves, then the amount of equity decreases and hence, the D/E ratio increases. This would suggest that CDS spreads increase instead of decrease and the risk profile of the company worsens. In addition, the markets could perceive an announcement of a share buyback as a negative signal, since it could also imply that a firm lacks investment opportunities and pays out excess cash because of that.

H3: CDS spreads of companies that dispose of relatively higher corporate cash holdings react in a stronger way to share repurchase announcements.

Companies with rather high levels of corporate cash holdings do so because they might find it more difficult to access capital markets, especially in the current environment of cold, illiquid markets. Or they might keep high cash piles simply because they can afford it, and it is in their managers' interest to do so. Hence, these companies fund growth internally and have a higher degree of flexibility by disposing of internal cash reserves. A change in cash holdings for companies that dispose of relatively higher cash reserves imposes a major modification to the company's leverage structure; thus, the effect on CDS spreads should be stronger.

H4: CDS spreads of companies that exhibit increasing cash holdings in the years before the event, react in a stronger way to share repurchase announcements.

In the case where companies exhibit an increasing trend of their corporate savings, ever more cash holdings are accumulated each year. Hence, assuming that a share repurchase is financed internally by cash, this would lead to a contrary movement. Therefore, it seems reasonable to assume that a share repurchase announcement by a company exhibiting such an increasing trend conveys a lot of new information to the market, leading hence, to a relatively stronger impact on the risk profile.

H5: CDS spreads of companies that have both low levels of net debt and high levels of corporate cash holdings react in a stronger way to share repurchase announcements.

In order to further analyze the effect of leverage, those companies are clustered that dispose of both, low levels of net debt and high levels of cash holdings. This suggests that the company has access to the capital markets or obtains loans by banks, but still, keeps high levels of cash at the same time. Corporate cash holdings are thus not kept because of precautionary reasons, informational asymmetries in the markets or the like, but in order to be able to engage actively in an optimal payout policy.

H6: CDS spreads of companies belonging to different sectors and different countries react in different ways to share repurchase announcements.

A differentiation by sectors and countries allows gaining deeper insight into the impact of share repurchase announcements on the risk profile of companies. In some sectors, companies are

characterized by higher levels of intangible assets, such as in the IT or health care sector, while in industries such as energy and industrials, firms have substantial amounts of tangible assets. Due to these industry-specific characteristics, CDS spreads might respond differently to share repurchase announcements. Finally, the events are analyzed also by countries where they are headquartered, to further gain information on the causal mechanism of share repurchase announcements on CDS spreads.

1.3 Data

Data is obtained from Bloomberg, Factiva and Wharton Research Data Services for the time period 06/17/2004 until 02/26/2013. The dataset includes different companies quoted on European and US markets. These two geographic areas are considered due to a data availability issue and because these markets are also relatively more liquid than others and are thus better suited for this kind of analysis.

First of all, the historic time series of daily CDS spreads is obtained for all the companies forming the CDX North America Investment Grade Index and Markit iTraxx Europe for a maturity of 5 years. Hence, the sampling interval is one day. Both indices contain each 125 companies; of these 250 companies in total, some companies did not engage in any share buyback operation during the time period considered and are therefore excluded. Another 64 companies are excluded since they belong either to the financial or utilities sector. Companies from both the utilities and financial sector are excluded from this dataset, since their level of cash holdings is mostly affected by exogenous factors such as laws and capital regulations and this would lead to biased results.

In addition to the daily CDS spreads of the single companies, also the time series of the two indices is gathered. Both the Market iTraxx Europe and the CDX NA IG are equally weighted, so each of the 125 companies has a weight of 8%. In this analysis, market prices of the CDS spreads are used, or more precisely, the last price of the transactions or closing price of a trading day.

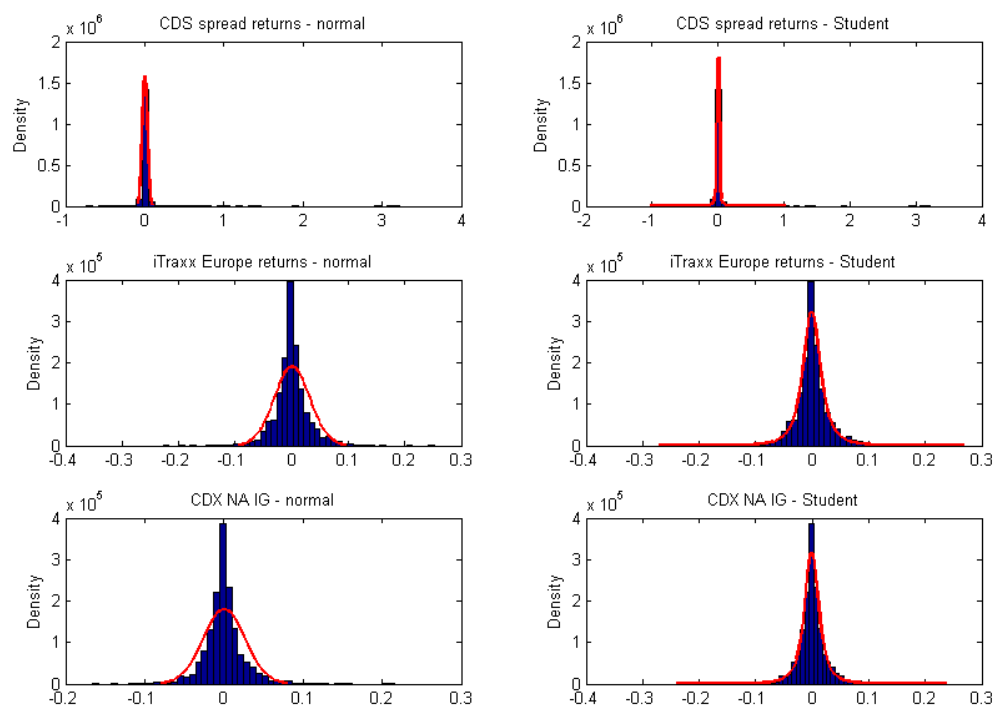


Figure 1: Histograms of the CDS spread returns and market indices

Figure (1) shows histograms of the CDS spread return series and the two market series and compares the density functions to a Gaussian normal distribution and a Student-t distribution. From the plots it seems that all three return series are leptokurtic due to their spikes around the mean. This graphical evidence is supported by the numbers shown in Table (1). The return series do not only show an elevated excess kurtosis, but are also skewed, especially the return series of the single companies' CDS spreads. Their arithmetic means are around zero.

	Obs	Mean	Variance	Skewness	Excess Kurtosis	Min	Max
CDS Return	866,758	0.0005	0.0010	11.4422	901.4473	-0.7468	3.2169
		(16.14)***		(4,343.23)***	(171,085.99)***		
CDX NA IG	2269	0.0004	0.0007	0.8264	8.6057	-0.1656	0.2156
		(12.97)***		(314.08)***	(1635.42)***		
iTraxx Europe	2269	0.0005	0.0010	0.3560	7.5269	-0.2276	0.2517
		(16.17)***		(135.32)***	(1430.41)***		

Table 1: Descriptive statistics for the return series

The values in brackets are T-statistics and *** indicate significance at the 1% level.

Moreover, a Jarque-Berra test for normality is performed leading to the conclusion that the null hypothesis of both skewness and excess kurtosis equal to zero has to be rejected. It is quite common for daily returns of financial assets to not be normally distributed (Campbell et al., 1997).

The dates of the share buybacks are collected. These dates are announcement dates of corporate share repurchases and do not refer to the date when the shares are actually bought back. Most of the

buybacks are open market transactions. Some companies dispose of several consecutive share buyback dates within a limited amount of time. In order to not interchange the effect of different buyback events, a minimum of 180 business days has to lie between one and the next event in order to be considered in the underlying analysis. This approach is suggested by Hull et al. (2004) where 90 business days are taken into consideration as threshold. As a consequence, the effective minimum number of events is only one share buyback date and the maximum is 9 buyback dates for a single company. International Business Machines Corp, or IBM, would have had 14 share buyback events, all passing the threshold of being 180 days apart, but the company has been excluded nonetheless, because of too many consecutive event dates. The buyback dates are spread out over the whole time period as can be seen from the following graph, with a slight reduction after the year 2009.

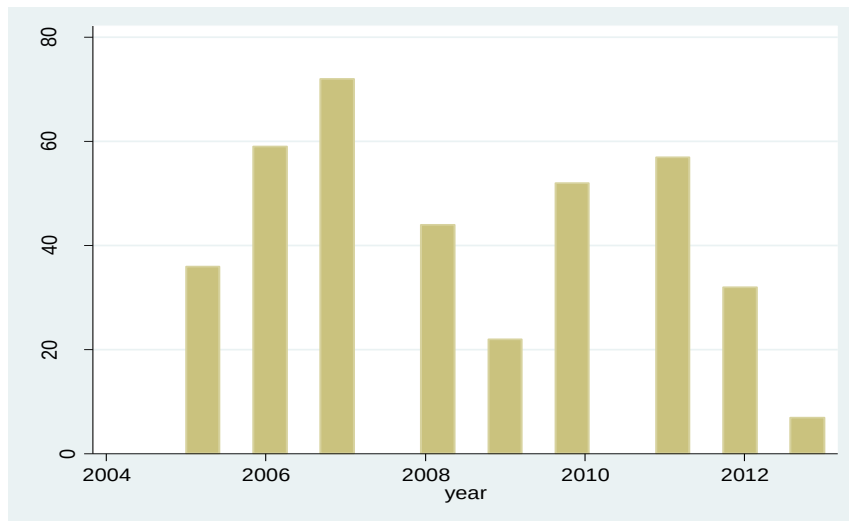


Figure 2: Frequency distribution of buyback dates through time

Finally, for all the companies, information regarding the sector and country is collected, together with balance sheet data. The latter includes annual data and refers to the amounts of cash and equivalents, total assets, short term debt and long term debt. Net debt is calculated by subtracting cash and equivalents from the sum of short term and long term debt.

Missing data in the different time series are substituted by linear interpolation. Most of the time the CDS spreads are quite constant, and do not show jumps or other disruptive patterns. Therefore, linear interpolation seems appropriate. Ford Motor Co. has been excluded due to excessive CDS spreads after a rather critical time and before receiving a loan and a line of credit by the government in 2008; hence, it is an outlier. For two companies not sufficient balance sheet information could be found on Wharton Research Data Services, so they are excluded. In the end there are 2,269 observations for each of the 142 companies. Given that some companies have several event dates, there are then 381 different events, each with 2,269 observations leading to a dataset of 864,489 observations in total. A list of the 142 companies considered in this analysis is included in the Appendix (1).

The following graph (3) gives an overview of the sector distribution of the companies. The biggest part of the companies included in this analysis is operating in the communications and consumer discretionary

sector, and only a minor part is from the technology and health care industry. Still, there is no reason why this unequal distribution of the companies by the sectors should bias the results.

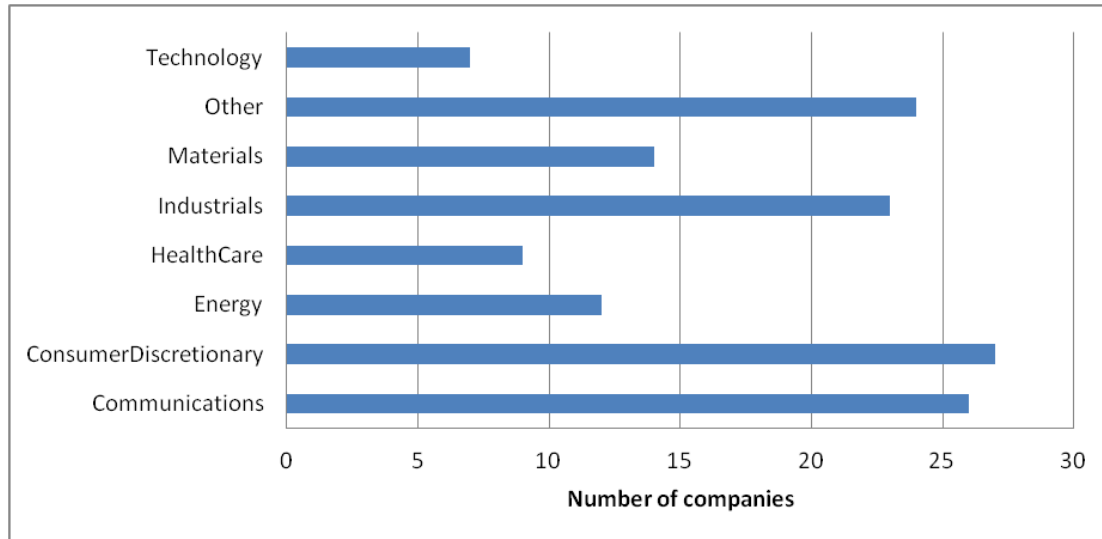


Figure 3: Distribution of companies by sector

In order to test the hypotheses outlined in the previous section, the companies need to be regrouped according to the balance sheet data. First of all, absolute values are turned into relative values, by calculating the following ratios:

$$\text{Cash Holdings Ratio} = \frac{\text{Cash \& Equivalents}}{\text{Total Assets}} \quad (1)$$

$$\text{Net Debt Ratio} = \frac{\text{Long term debt} + \text{Short term debt} - \text{Cash \& Equivalents}}{\text{Total Assets}} \quad (2)$$

Starting with the data needed in order to test the Hypotheses 3 and 5, the average of the annual Cash Holdings Ratios is taken for each company. Here it is taken into consideration when the share repurchase announcement occurred; hence, the average of the cash holdings is then taken only for the years prior to the event. Then, based on the 25th, 50th, and 65th quantile, the companies and events are divided into 3 groups as is shown in the following table.

Quantile	Obs	Mean	Std. Dev.	Min	Max
Upper quantile	134	0.1651	0.0732	0.0849	0.3899
$P(X \geq q) \geq 0.65$					
Middle quantile	151	0.0563	0.0149	0.0344	0.0847
$P(X > q) > 0.25 \text{ \& } P(X < q) < 0.65$					
Lower quantile	96	0.0230	0.0086	0.0007	0.0343
$P(X \leq q) \leq 0.25$					

Table 2: Descriptive statistics for the Cash Holdings Ratio

The company with the highest Cash Holdings Ratio holds an average of 39% of the total assets as cash and equivalents which is rather elevated. The majority of the companies do however have cash holdings in the range between 5% and 15%. The distribution is slightly positively skewed. The following graph (4) shows a histogram of the Cash Holdings Ratio for the various companies.

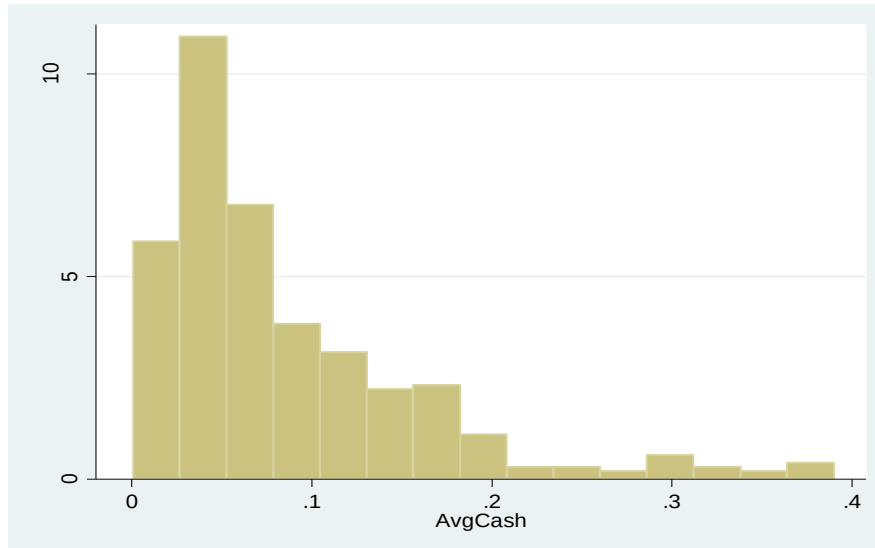


Figure 4: Histogram of the average Cash Holdings Ratio

In order to analyze Hypothesis 4 regarding the trends of cash holdings, the trends of the cash holdings ratios are analyzed. Thereby, all the companies are divided into three categories: increasing cash holdings ratios in the years prior to the event, rather constant cash holdings ratios or decreasing cash holdings ratios. The following table provides further information on the various groups.

	Obs	Mean	Std. Dev.	Min	Max
Companies with increasing cash holdings	127	0.1070	0.0774	0.0184	0.3900
Companies with constant cash holdings	160	0.0553	0.0562	0.0007	0.3790
Companies with decreasing cash holdings	94	0.1106	0.0797	0.0240	0.3630

Table 3: Descriptive statistics for companies with increasing, constant, decreasing cash holdings

In addition, companies are screened also for their Net Debt Ratios, calculated as in formula (2). Those companies are grouped together that dispose of both an average high Cash Holdings Ratio, in evidence in the upper 65th quantile, and a low Net Debt Ratio in the lower 25th quantile. For some companies net debt is even negative, so the highly liquid assets are bigger than the sum of both short and long term debt for those firms. The density function of the relative Net Debt Ratios of all the 142 companies seems to be normally distributed, as can be seen from figure (5).

Companies' Ratios	Obs	Mean	Std. Dev.	Min	Max
Avg Net Debt Ratio	73	-0.0568	0.1123	-0.3500	0.0700
Avg Cash Holdings Ratio	73	0.2009	0.0798	0.0854	0.3900

Table 4: Descriptive statistics for companies and events with high Cash Holdings Ratio and low Net Debt Ratio

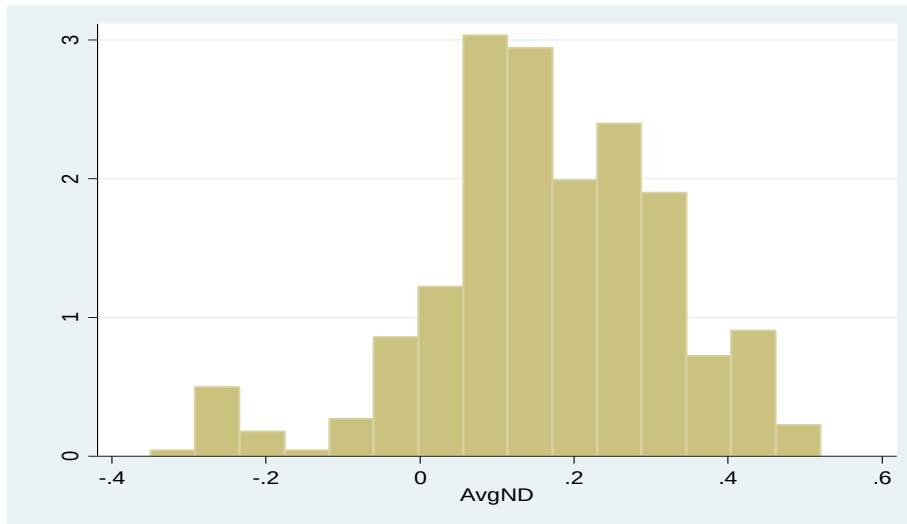


Figure 5: Histogram of the average Net Debt Ratio

A line plot of the historic evolution of the Net Debt Ratio and the Cash Holdings Ratio is provided in figure (6). The average Cash Holdings Ratio for the 142 companies remains rather constant and increases slightly after the outburst of the financial crisis in 2008. The opposite is the case for the Net Debt Ratio; it decreases sharply on average after the fiscal year 2008, partially also due to the increase in the cash holdings, since these two ratios are related with each other.

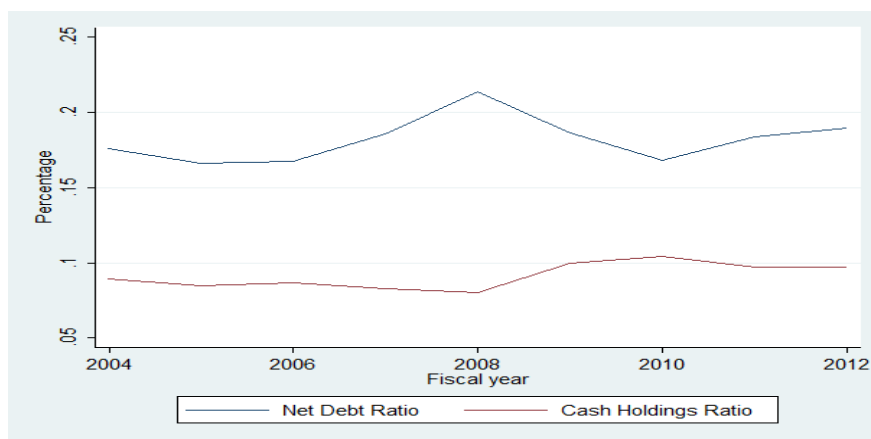


Figure 6: Line plot of the historical Net Debt Ratios and Cash Holdings Ratios

Finally, it might be interesting to look at the absolute level of CDS spreads. Generally speaking, the higher the premium paid for a credit default swap, the higher the risk of a company. It is worth noting to look at another aspect, namely, the relationship between the absolute level of cash holdings and the absolute level of CDS spreads.

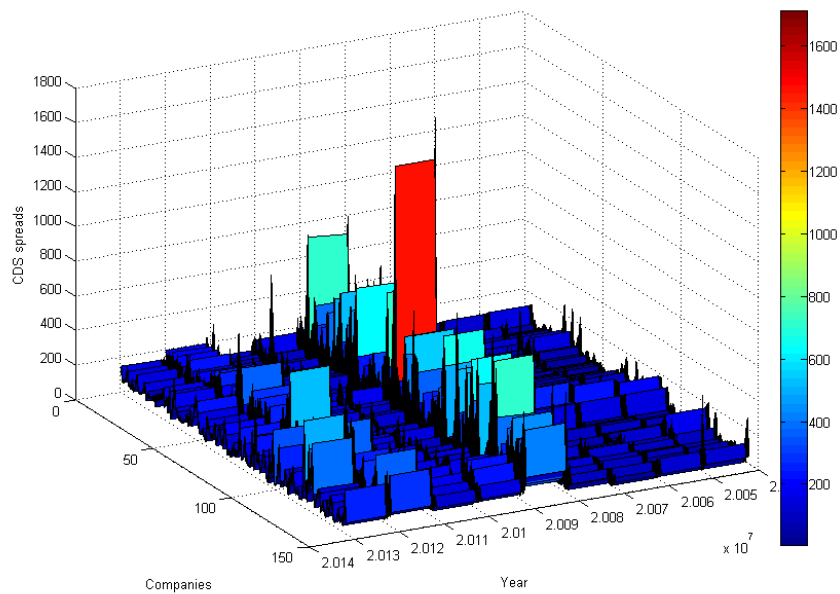


Figure 7: Historical evolution of daily CDS spreads for single companies

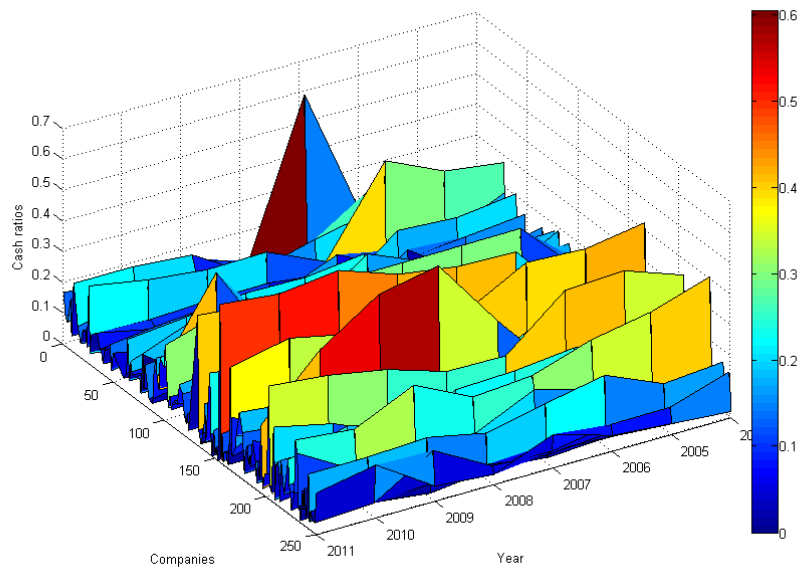


Figure 8: Historical evolution of annual Cash Holdings Ratios for single companies

Data for the year 2012 is excluded for the creation of this figure due to missing data for some companies.

Figure (7) shows that CDS spreads spiked during 2008 – 2009 for most of the companies, but remained rather stable for the rest of the time. The pattern is not particularly volatile, but changes in CDS spreads seem to endure for a limited period of time before jumping, in case there is a change in the risk profile of the company. Figure (8) provides information on the evolution of the annual Cash Holdings Ratio for the

single companies. While it was possible to derive from figure (6) that on average it remained constant throughout the 9 year period, from this graph it seems that it increased slightly over the years. There are more areas of red, yellow and green – referring to relatively higher cash ratios – to be found in the years 2008 until 2011, than in the years 2004 until 2007. Yet, no particular patterns can be observed for the financial crisis years 2008 – 2009 as is possible for the CDS spreads. Concluding, it is not possible to derive further implications for the relationship between the absolute level of CDS spreads and Cash Holdings Ratios.

1.4 Methodology

In order to test whether a change in corporate cash holdings has a significant effect on CDS spreads, an event study is used. The event study methodology is an ideal tool to identify the causality of an event on a certain outcome. It has been first used by Dolley in 1933 and has since been improved and amplified (Campbell et al., 1997). An event study builds on the fact that markets are efficient, and new, relevant information is incorporated by the prices after the event at some point.

The events in this analysis are the announcements of share buybacks. The outcomes which are examined are the periodic nominal returns of the CDS spreads, instead of the absolute levels, because returns have the attractive characteristics of being both scale-invariant and time-invariant.

Both an event window and an estimation window have to be defined. The event window covers the time period during which the event occurs and the estimation window is the time period before the event that is used to measure the normal performance and the parameters. The post-event window is not taken into consideration in this analysis. The event date is at time 0. For the analysis in question, the estimation window ranges over the interval $[-250, -7]$ and the event window over the interval $[-7, 7]$.

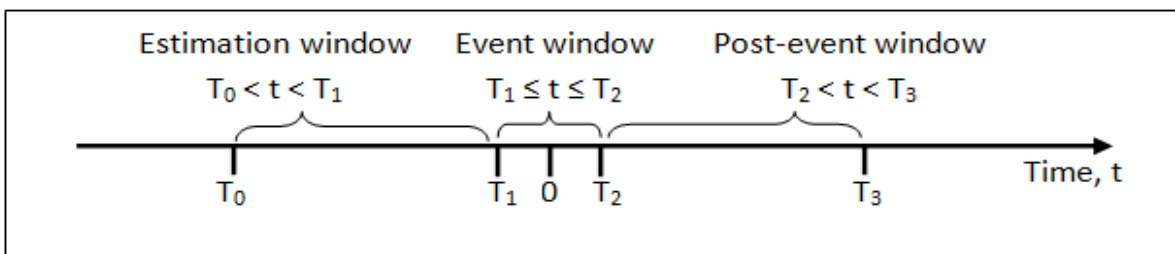


Figure 9: Timing of the event study

There are three crucial assumptions that have to be satisfied in order to be able to perform an event study. First of all, in the absence of the event, the CDS spread return would be close to the normal CDS spread return. Secondly, the no anticipation assumption should hold, meaning that there should not be any leakages before the event, since then the effect is underestimated. In the case of share repurchase announcements, sometimes it is not possible to exactly determine the event. In this study the date of the first announcement of this share buyback is used, but there might be some information that has been released already before the event date or there might be some additional information released

after the first announcement. Hence, a rather long event window is considered in this study, because the actual event date cannot be precisely determined with certainty. Finally, the third assumption is that the efficient market hypothesis should hold and that information is transmitted to the CDS spread returns.

In order to be able to measure the impact of the event on the CDS spread returns, knowledge of the counterfactual outcome is necessary, in evidence, the return that would have occurred if the event would not have happened. This is estimated by the so called abnormal returns. The abnormal return is the difference between the actual return over the event window and the “normal” return, that is however unknown and would have occurred if there would not have been any share repurchase announcement. In this analysis a statistical model is used to measure the normal. The advantage of using a statistical model instead of an economic model, such as the CAPM, is that there are fewer restrictions that have to be imposed. In the past, an extensive literature emerged on behalf of improvements of the CAPM, which undermines also the importance of the original model, but still it is difficult to make predictions for the future. The following formulas show the calculation of the abnormal return AR_{it} , based on the actual return R_{it} and the expected normal return $E[R_{it}|X_t]$. X_t stands for the conditioning information on which the expected normal return is based and is in this case the market return, as shown in formula (4).

$$AR_{it} = R_{it} - E[R_{it}|X_t] \quad (3)$$

$$E[R_{it}|X_t] = \alpha_i + \beta_i R_{mt} + \epsilon_{it} , \quad \text{with } E[\epsilon_{it}] = 0 \text{ and } Var[\epsilon_{it}] = \sigma_{\epsilon_i}^2 \quad (4)$$

Formula (4) represents the statistical model or more precisely, the market model. R_{mt} stands for the market index in order to control for common market movements that might perhaps coincide with the share buyback events, so that confounding factors are eliminated (Wooldridge, 2009). The CDX NA IG and Markit iTraxx Europe indices are used as proxies for market returns for the various companies, respectively.

The parameters of the market model, in evidence α_i and β_i are estimated over the estimation window and then used to calculate the abnormal returns over the event window. The higher the R^2 of the market model in equation (4), the higher is the ratio of the explained dispersion with respect to the total dispersion, and consequently, the larger is the part of the return that can be removed because of being related to a general market tendency and not the event (Campbell et al., 1997).

The first step is to estimate the market model using an OLS regression. The best linear unbiased estimators (BLUE) $\hat{\alpha}_i$ and $\hat{\beta}_i$, for the population parameters α_i and β_i are given by an OLS regression if 5 assumptions hold (Wooldridge, 2009):

- A1-The parameters α_i, β_i in equation $y = \alpha_i + \beta_i R_{mt} + \epsilon_{it}$ have to be linear.
- A2-Random sampling.
- A3-No perfect multicollinearity and no constant independent variables.
- A4-Zero conditional mean, $E[\epsilon_{it}|R_{mt}] = 0$
- A5-Homoskedasticity, $Var[\epsilon_{it}|R_{mt}] = \sigma_{\epsilon_i}^2$

Assumption 1 is satisfied, as is assumption 3, given that there is only one independent variable. The other assumptions will be further discussed or tested in Section 1.5. For inference testing it is further assumed that the CDS spread returns are both independent and identically distributed and jointly multivariate normal distributed through time (Campbell et al., 1997).

In addition to the market model, also an extension of it will be estimated, as in Corhay et al. (1996). Given that financial returns usually exhibit time-varying volatilities, a model that takes into account such a behaviour seems to be appropriate. A GARCH(1,1) or generalized autoregressive conditional heteroskedasticity model is used to account for this so called heteroskedasticity, or persistency in volatility. The order of both the ARCH and the GARCH term are kept at 1, in order to not have to estimate too many parameters, since for each of the 381 events a model has to be estimated.

$$E[R_{i,t}] = \mu_i + \gamma_i R_{mt} + u_{i,t} \quad (5)$$

$$u_{i,t} = \sigma_{i,t} \varepsilon_{i,t} \quad (6)$$

$$\sigma_{i,t}^2 = \omega_i + \beta_i \sigma_{i,t-1}^2 + \alpha_i u_{i,t-1}^2 \quad (7)$$

Where μ_i and ω_i are constants, γ_i is the coefficient of the market return, $\varepsilon_{i,t}$ is independently and identically distributed with $E(\varepsilon_{i,t}^2) = 1$, β_i is the coefficient of the GARCH term, α_i is the coefficient of the ARCH term, and i refers to the 381 events.

There are certain restrictions that have to be satisfied for the model and the estimates to be valid. The sum of the coefficients of both the GARCH and the ARCH term has to be less than 1, in order for the model to be covariance stationary. Moreover, ω_i , β_i and α_i have to be positive in order for the conditional variance to be well defined and positive (Campbell et al., 1997). The GARCH(1,1) model is estimated with a maximum likelihood function, using Matlab.

After having estimated the market model as in formula (4) and/or as in formula (5), it can be used to estimate the abnormal returns based on the returns during the event window and the parameters estimated based on the estimation window, as shows the following formula.

$$\widehat{AR}_{it} = R_{it} - \hat{\alpha}_i + \hat{\beta}_i R_{mt} \quad (8)$$

The abnormal returns $\widehat{AR}_{it}$ should be jointly normally distributed, have a mean conditional on the market return equal to zero and a conditional variance as shown in formula (9) and (10).

$$\widehat{AR}_{it} \sim N(0, Var[AR_{it}]) \quad (9)$$

$$Var[AR_{it}] = \sigma_{\varepsilon_i}^2 + \frac{\sigma_{\varepsilon_i}^2}{T_1 - T_0} \left[1 + \frac{(R_{mt} - \hat{\mu}_m)^2}{\hat{\sigma}_m^2} \right] \quad (10)$$

In formula (10) $\hat{\mu}_m$ and $\hat{\sigma}_m^2$ are the mean and standard deviation of the market return over the estimation period. As can be seen from formula (10), the variance of the abnormal returns has two parts,

the first referring to the real future disturbances, the latter however is the sampling error. This sampling error decreases to zero, the longer the estimation period is.

Furthermore, the abnormal returns are now aggregated, because the event period ranges from T_1 to T_2 as shown in figure (9) and is in the case of the underlying analysis 15 days long. Hence, the returns of this time period have to be aggregated to be able to engage in inference testing. This is done, since the information revealed through the share buyback announcement is not immediately incorporated in the CDS spreads, but it takes the market some time to adjust.

$$CAR_i[T_1, T_2] = \sum_{t=T_1}^{T_2} AR_{it} \quad (11)$$

These cumulative abnormal returns, calculated as in formula (11) are then averaged across the 142 companies in order to obtain the average influence of the events on the CDS spread returns.

$$\overline{CAR}_i[T_1, T_2] = \frac{1}{142} \sum_{i=1}^{142} CAR_i[T_1, T_2] \quad (12)$$

It is now possible to proceed with inference testing. In the underlying analysis the event windows of the various companies do also overlap, and they cannot be all excluded since then the sample would simply become too small. The co-variances between the single CAR_i might be bigger than zero. According to Brown et al. (1985), daily returns are well suited for event studies and also their special characteristics do not have a major impact on test results. They suggest that using models that control for this so called cross sectional dependence, because of overlapping event periods do not improve much and have disadvantages on their own. Therefore, this analysis proceeds with the calculation of the simple variance assuming there is no hidden correlation among the events, as follows:

$$Var(\overline{CAR}_i[T_1, T_2]) = \frac{T_2 - T_1 + 1}{N^2} \sum_{i=1}^N \hat{\sigma}_{\epsilon_i}^2, \quad \text{where } \hat{\sigma}_{\epsilon_i}^2 = \frac{1}{T_0 - T_1 - k} \sum_{t=T_0}^{T_1-1} AR_{it}^2 \quad (13)$$

In formula (13) k is the number of coefficients that have to be estimated in the market model, so it is two in this case. The T-statistic in order to test for the null hypothesis that the event has no significant impact on the CDS spread returns is then the following:

$$\frac{\overline{CAR}_i[T_1, T_2]}{\sqrt{Var(\overline{CAR}_i[T_1, T_2])}} \sim N(0,1) \quad (14)$$

In order to compare different groups of companies, another T-statistic is calculated, with the null hypothesis that the means of the cumulative average returns of the two groups are the same:

$$\frac{\overline{CAR}_A[T_1, T_2] - \overline{CAR}_B[T_1, T_2]}{\sqrt{Var(\overline{CAR}_A[T_1, T_2]) + Var(\overline{CAR}_B[T_1, T_2])}} \sim N(0,1) \quad (15)$$

1.5 Empirical Results

The empirical analysis is performed using the statistical software Stata and Matlab. At first, the market model is estimated as described in formula (4), based on data from the estimation period. The adjusted R^2 of the single regressions range from a minimum of around 0% to 73%, the average lying at 13.5%. Hence, for some companies' CDS spread returns the market model can explain most of the variation over time, for others it is not at all suited well. Still, in this analysis only a short period of time is considered, in evidence, the event window is only 15 days long, so the estimation errors accumulate only to a limited extend.

The variance of the error term does not remain constant when analyzing further the results from the market model regressions. In order to obtain a BLUE estimator, the variance of the error term should be homoskedastic and not heteroskedastic, as noted in the previous Section 1.4. When performing a Breusch-Pagan Test for heteroskedasticity, two thirds of the events exhibit a time-varying variance, while only one third of the events have homoskedastic error terms.

For the sake of completeness, the cumulative abnormal returns and the T-statistics, based on the OLS regression estimates are reported in Appendix 2. However, given the heteroskedasticity in the error term however, it seems more appropriate to use the extended version of the market model with the GARCH(1,1) process, as in formula (5).

A GARCH(1,1) model is estimated for each of the 381 events using a maximum likelihood function in Matlab. The parameter estimates together with the T-statistics are reported in Appendix 3. As mentioned in the previous section, there are certain restrictions on the parameters that have to be satisfied. All of the coefficients, β_i and α_i of the various events are indeed positive and their sum is less or equal 1. Hence, the GARCH model seems to be well-defined. From the table in Appendix 3, it can be observed that there are some coefficients that are not significant at the 10% significance level. Those events are excluded where both the ARCH and the GARCH coefficient are statistically not significant. There are then in total 381 events for 142 companies that are further analyzed.

In order to validate the appropriateness of the GARCH(1,1) market model once more, the sample autocorrelation function and the partial autocorrelation function, or ACF and PACF, are calculated before and after the estimation of the GARCH(1,1) model. The results of the first 10 events are reported in Appendix 4, as examples. The ACF and PACF before the estimation are reported for the CDS spread returns, and the ones post-estimation are reported for the standardized squared residuals. When the bars are higher than the dotted lines in the graphs, it means that there is substantial autocorrelation. When comparing the graphs pre-estimation with the ones post-estimation, it can be seen that the autocorrelation decreases quite a lot for most of the 381 events.

The following graphs show the main results of the event study. The cumulative abnormal returns are calculated as illustrated in formula (8), (11) and (12). Also a table with the detailed CAR, based on the GARCH(1,1) market model over the whole event window is provided in Appendix (5).

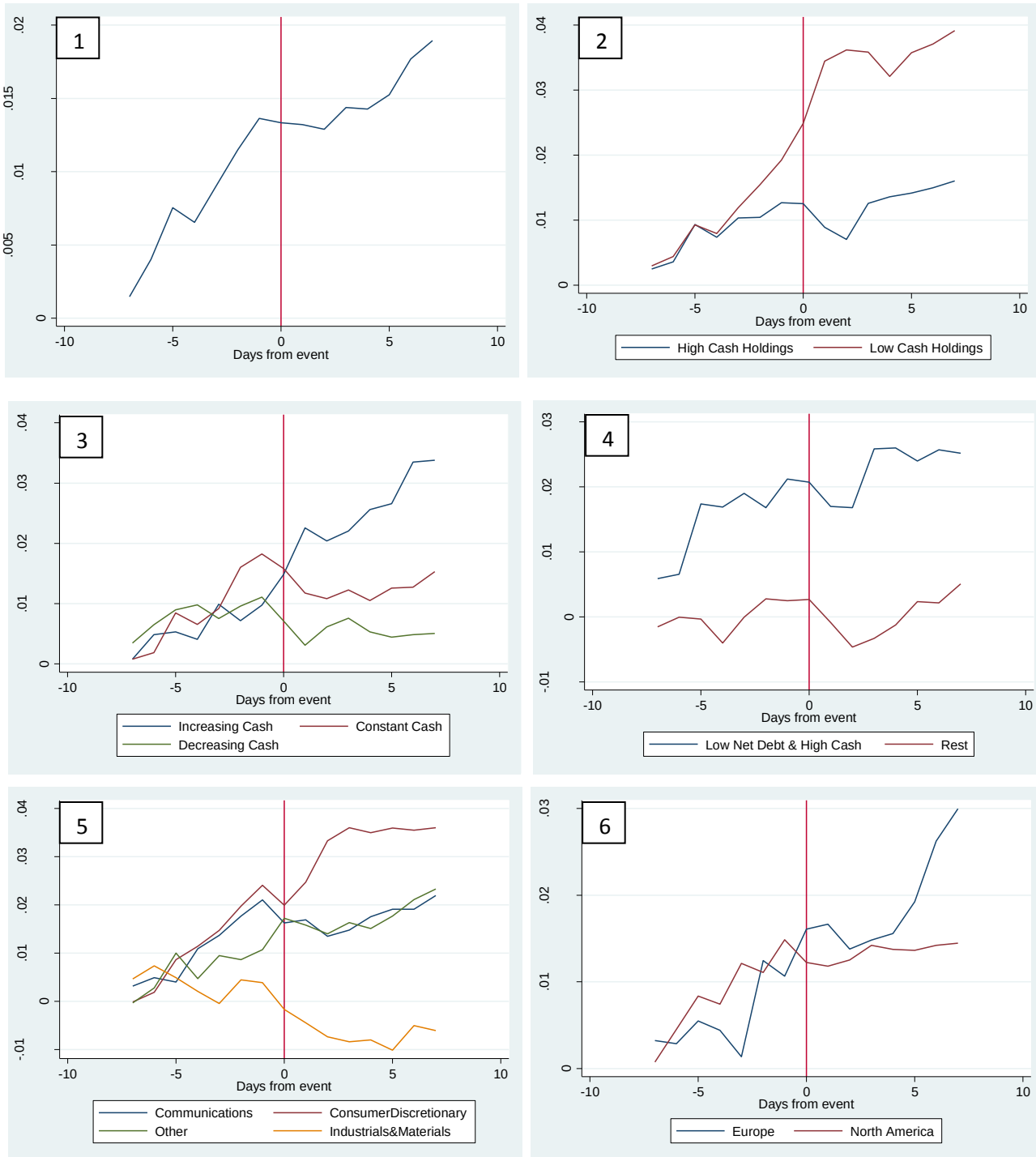


Figure 10: Plots of cumulative abnormal returns for share repurchase announcements

Plot 1 shows the general movement of the cumulative abnormal returns for all companies. *Plot 2* depicts the cumulative abnormal returns for companies with high cash holdings ratios – above the 65th quantile – versus companies with relatively low cash holdings ratios – below the 25th quantile. *Plot 3* provides further evidence on the companies with increasing, constant or decreasing cash holdings. *Plot 4* separately shows the cumulative abnormal returns for those companies that do not only have high cash holdings but also low levels of net debt – below the 25th quantile. *Plot 5* provides the evolvements of the cumulative abnormal returns differentiated by sector. Finally, *plot 6* shows the reaction of the CDS spreads returns for companies from Europe versus North America.

Figure (10) shows various evolutions of cumulative abnormal returns, in order to test the hypotheses of Section 1.2. The red zero line indicates the event date, or the day when the share repurchase is announced by a certain company. The CARs are shown only for the 15 days long event period.

Starting with the discussion of the three general assumptions of an event study, as outlined in Section 1.4, the focus will be first on the left part of the graphs, before the actual announcement of the share repurchase. The assumption that in the absence of the event, the CDS spread would be close to the normal price after the event cannot be tested. It is not possible to observe the counterfactual. Though, the normal return is approximated using the GARCH market model.

The second assumption of the non-anticipation of the event can be discussed based on figure (10). The event period has already been set to start 7 days before the event, in order to account for information leakages, as mentioned in the previous Section 1.4. This approach to account for event date uncertainty has also been used by others, such as Lasfer et al. (2011). The problem is that share repurchases are regulated differently across countries. In some countries, such as in France, companies are not obliged to publicly communicate a share repurchase (Lasfer et al., 2011), while in others they have to announce it well in advance and some people might become knowledge of the corporate undertaking before others do. Such leakages lead an underestimation of the true effect of the event. The plots too are showing that there is some variation in the abnormal returns before date 0, or the date of the repurchase announcement. The divergence from the normal returns is however limited, and remains for three of the four plots below ± 2 percentage points from the zero. Especially for plots 2, 3 and 6 in figure (10) parallelism of the two groups can be observed and the two groups of companies exhibit different patterns after the announcement date.

For what concerns the efficiency of the markets, they do react to new information. However, financial markets are not perfectly efficient and it requires time to incorporate all the information. For this reason the event period has been set to last until 7 days after the event, but it could potentially even be prolonged in order to fully capture the effect. The drawback is however that there exists a trade-off between a higher power of the T-statistics of the CARs for a shorter event window and a higher absolute level of the CARs for a longer event period. Hence, 15 days seem to be an acceptable compromise.

Also, the cross-sectional dependence among CARs due to partially overlapping event windows in some cases is nearly for all cross-sections equal to zero. This implies that the T-statistics can be computed without any further modifications or considerations, as suggested by Brown et al. (1995).

Test results H1: Share repurchase announcements lead to a decrease in CDS spreads.

Test results H2: Share repurchase announcements lead to an increase in CDS spreads.

Focusing on the patterns of the cumulative abnormal returns after the announcement dates in figure (10), there seems to be tremendous variation, especially for some groups of companies. This is also confirmed by the following T-statistics.

Average CAR [-7,7]	0.0189
T-statistic	10.5637

Table 5: T-statistic for the cumulative abnormal returns of all companies

The cumulative abnormal returns are equal to 1.89 % after 7 days beyond the announcement of the share repurchase, meaning that the CDS spread returns are 1.89 percentage points higher than the normal expected returns. The average CARs are also significantly different from 0 from a statistical perspective. These findings provide evidence for the rejection of Hypothesis 1 and validation of Hypothesis 2. After a company announces a share repurchase the market reacts in a negative way and CDS spreads increase, hence sustaining positive cumulative abnormal returns. The signalling hypothesis cannot be confirmed and markets seem not to evaluate a share repurchase as a positive signal that the company has enough funds also for the future and can afford to pay out a portion of it to the shareholders. In the short run, the risk profile worsens for companies that decide to engage in share buybacks. After a share buyback announcement, the market expects a displacement of assets from the corporate level to the shareholders' level. All else equal, this implies a higher D/E ratio which could be the reason for the abnormal increase in the CDS spreads by 1.89 percentage points. It seems that the perceived signal by the market is negative, possibly due to the observation that the company lacks investment opportunities where the cash could be invested. When looking at plot 1 in figure (10), the market seems to react in a stronger way to the share repurchase announcement only after a period of 4 days. This implies that it takes quite a few days until the new information is absorbed by the market and transmitted to the CDS spreads.

Test results H3: CDS spreads of companies that dispose of relatively higher corporate cash holdings react in a stronger way to share repurchase announcements.

The question arises if there can be observed different patterns of the cumulative abnormal returns for companies with certain characteristics. To continue with Hypothesis 3, companies are separated into two groups. Those companies with a cash holdings ratio above the 65th quantile are grouped together and those with a cash holdings ratio of below the 25th quantile are classified together. There are then 134 events with high corporate cash holdings and 96 with low cash holdings. The thresholds are set in this way, because of further analysis that is done with the high cash holdings companies, to not end up with a too small sample. Further explanations and descriptive statistics are provided in Section 1.3. The

25th quantile corresponds to a corporate cash holdings ratio as in formula (1) of 3.4%, and the 65th quantile is equal to 8.5% of the total assets.

Average CAR [-7,7] for companies with high cash holdings	0.0160
Average CAR [-7,7] for companies with low cash holdings	0.0392
T-statistic high vs. low cash holdings	4.8096

Table 6: T-statistic for companies with high vs. low cash holdings

When looking at the results in table (6), the CAR are equal to 1.6% 7 days after the share repurchase announcement date for those companies with the higher level of cash holdings and equal to 3.92% for the lower cash holdings group. From plot 2 in figure (10) it seems that both groups move in a parallel way before the announcement and then drift apart three days before the event.

CARs for high cash holdings companies are growing less over the event period, than CARs for low cash holdings companies. Hence, it seems that CDS spreads for companies with relatively less corporate savings are reacting faster and incorporating new information in a more efficient way. The risk profile of those companies seems to worsen more than for the ones with higher cash holdings.

Hypothesis 3 can be rejected, since the difference among the two groups of events, equal to 2.32 percentage points, is statistically significant at the 1% level. The T-statistics are calculated as in formula (15). If companies dispose of relatively less cash holdings, and announce a share buyback, the market could assume that this share buyback is financed internally and thus the corporate savings are reduced even further. This implies less flexibility concerning financing options for future upcoming investment opportunities, while companies with comparatively higher cash holdings might still be able to finance positive net present value projects in the future with internal resources. This could be a possible explanation for the patterns shown in plot 2 in figure (10).

Test results H4: CDS spreads of companies that exhibit increasing cash holdings in the years before the event, react in a stronger way to share repurchase announcements.

Average CAR [-7,7] for companies with increasing cash holdings	0.0338
T-statistic - increasing trend	10.2088
Average CAR [-7,7] for companies with constant cash holdings	0.0153
T-statistic – constant trend	5.2013
Average CAR [-7,7] for companies with decreasing cash holdings	0.0051
T-statistic – decreasing trend	1.8308

Table 7: T-statistic for companies with increasing, constant and decreasing cash holdings

Table (7) shows the results of the T-statistic related to the groups of companies in plot 3 of figure (10). There are in total 127 events where companies exhibit an increasing trend of their cash holdings before the announcement of the share buyback, 160 events where a constant trend and 94 where a decreasing trend is observed.

While the CARs of the three groups of companies are behaving in a rather similar way before the event, there seems to be a breach in the pattern slightly before and then after day 0.

Hypothesis 4 can be confirmed. Companies with an increasing trend in their corporate savings do indeed react the strongest to the event, and the reaction is both economically and statistically significant. The CDS spread returns are 3.4 percentage points higher than expected. The risk profile of these companies might worsen the most, because the share buyback announcement could indicate a reversion of the increasing trend of the cash holdings, if the share repurchases are financed internally. A company that increased for several years the Cash Holdings Ratio and decides to reduce it by announcing a share buyback conveys a lot of new information to the market. That might be a possible reason why the market reacts in a stronger way for the group with the increasing trend.

Test results H5: CDS spreads of companies that have both low levels of net debt and high levels of corporate cash holdings react in a stronger way to share repurchase announcements.

In order to test Hypothesis 5, the 134 companies with high cash holdings are regrouped again, considering also the leverage structure of the companies. Those companies with a net debt ratio as in formula (2) below the 25th quantile – which is equal to 8% – are filtered out among the high cash holdings companies. A company that can afford to dispose of a high cash holdings ratio and at the same time keep low levels of net debt is actually accessing the capital markets or requesting bank loans, while keeping high corporate savings. Hence, this regrouping allows to acquire more subtle information on why companies hold high cash holdings, and to test if it is due to the precautionary motive, or due to information asymmetries in the market, or due to other reasons. There are 73 events among the events of companies with high cash holdings that have low levels of net debt, and 61 that do not.

Quite interestingly, companies with both low net debt and high cash sustain increasing CARs, while the rest of the companies with high cash holdings react first negatively to the share repurchase announcements and then only slightly positively. The abnormal CDS spread returns stay rather flat for these companies, as can be seen in plot 4 of figure (10). The difference among these two groups is also statistically significant at the 1% significance level, as can be deduced from table (8).

Average CAR [-7,7] for companies with low net debt & high cash holdings	0.0252
Average CAR [-7,7] for other companies with high cash holdings, but no low net debt	-0.0051
T-statistic low net debt & high cash vs. rest of companies	4.3984

Table 8: T-statistic for companies with low net debt & high cash vs. others

The absolute difference between the average cumulative abnormal returns among the two groups of companies is 3.03 percentage points on day 7. Thus, the effect of the share repurchase announcement is both statistically and economically significant when taking the leverage structure into consideration for the differentiation among high cash holdings companies. Hypothesis 5, that CDS spreads of companies with both low levels of net debt and high levels of cash holdings react more profoundly to share repurchase announcements can as a consequence be confirmed. Still, the results should be gazed at with

caution, because the pattern of the CARs before the event is quite volatile and there cannot be observed any parallelism among the two groups, which is one of the preconditions for performing an event study.

Test results H6: CDS spreads of companies belonging to different sectors and different countries react in different ways to share repurchase announcements.

Average CAR [-7,7] for companies from communications sector	0.0220
T-statistic communications sector	5.9910
Average CAR [-7,7] for companies from consumer discretionary sector	0.0360
T-statistic consumer discretionary sector	12.1717
Average CAR [-7,7] for companies from the industrials & materials sectors	-0.0061
T-statistic industrials & materials sectors	-1.4934
Average CAR [-7,7] for companies from other sectors	0.0233
T-statistic other sectors	7.3521

Table 9: T-statistics for companies from different sectors

Table (9) reports the T-statistics related to plot 5 of figure (10). It can be observed that the reactions to share buyback announcements are indeed rather different for companies belonging to different sectors. The risk profile worsens the most for those from the Consumer Discretionary sector, and CDS spread returns are lower than expected for those from the Industrials & Materials sector. Companies belonging to the Consumer Discretionary sector sell usually non-essential goods, whose sales are quite pro-cyclical. There are two explanations for this uneven pattern. Either cash holdings are more important in certain sectors, due to the goods the companies sell or the assets they possess, or the market's perception and reaction of the share buyback announcements is different for different industries. Both explanations could be the case, and it is not possible to exactly explain the reasons for the different patterns, based on the results in plot 5 of figure (10).

Average CAR [-7,7] for companies from Europe	0.0300
Average CAR [-7,7] for companies from North America	0.0145
T-statistic Europe vs. North America	3.4863

Table 10: T-statistic for companies from Europe vs. North America

Finally, table (10) reports the T-statistic for the companies from Europe versus North America. 110 events belong to companies from the Markit iTraxx Europe and are considered to be headquartered in Europe, and 271 belong to the CDX North America Investment Grade Index and are considered as North American consequently. The CARs are equal to 3% for companies from Europe, and only equal to 1.5% for those from North America on day 7. The difference among these two different groups is both economically and statistically significant. The risk profile of European companies seems to worsen more than the one from North American companies. A possible reason for this might be that there are cultural differences that have an impact on the effect, as suggested by Ramir  z et al. (2009). It could also be related to the market structure of the various countries. In the US for example, the corporate bond

market is more developed than in Europe. For companies in the US, it is thus relatively easier to obtain funds, when investment opportunities are arising in the future.

Concluding, Hypothesis 6 can be confirmed and companies from different sectors and different countries do react differently to share buyback announcements.

1.5.1 Implications

What implications do the above findings have for the risk management of companies? There are several conclusions that can be drawn.

Causality mechanism. Share repurchase announcements cause an overall increase in CDS spreads. The market perceives a share buyback as an outflow of assets and thus, as a negative signal which worsens the risk profile of the company. The null hypothesis that the event has no impact can be strongly rejected. All else equal, there are fewer assets available to service eventual outstanding debt payments and that might be the reason why CDS spreads actually increase. Another possible explanation is that the company lacks positive NPV investment opportunities and has to pay out the cash to the shareholders because of that. Overall, it becomes more expensive for investors to insure themselves against a possible default of the company in question. This paper is the first to analyze the relationship between CDS spreads and share buyback announcements. Having gained knowledge about the movement of CDS spreads after such corporate events, allows companies to optimize their risk management.

Cost of debt. CDS spreads are found to anticipate usually changes in credit ratings (Hull et al. 2004, Duffie et al., 2003). Hence, in the case where a share repurchase announcement causes a substantial increase in the CDS spread of a company, such companies might get downgraded in the future. Hence, it becomes more expensive for the company in question to finance its debt. Interests charged on loans by banks depend heavily on ratings. The capital costs for banks are a function of the risk weight, the return the bank's shareholders request and the minimum capital requirements they have to keep, according to bank regulations such as Basel II/III. The risk weight increases for rating downgrades, leading to an increase in capital costs which are passed on to the debtor of the loan (De Laurentis et al., 2010). Usually the interests on a bank loan consist of a variable part based on some reference interest rate such as the LIBOR or EURIBOR in Europe, and a fixed add-up. Hence, companies that in the near future want to both take out a loan and engage in a partial share buyback, should respect a certain "pecking order". Based on the above results, it is more profitable to first agree on the credit agreement with the bank and only afterwards announce the share buyback.

Level and trend of cash holdings. Generally speaking, the risk profile worsens relatively more for companies with low cash holdings than for companies with high cash holdings. So already the average level of the cash holdings alone of a company seems to influence the effect of share buyback announcements on the corporate risk profile. The CDS spread returns are nearly 4 percentage points higher than expected for companies with relatively low corporate savings. Moreover, companies that accumulate ever more cash holdings in the years before the event also exhibit CDS spread returns that

are 3.4 percentage points higher than expected. Both of these findings imply that CDS spreads and cash holdings of companies are highly interrelated with each other.

Leverage structure. CDS spreads increase relatively more after a share buyback announcement for those companies that have low levels of net debt and high corporate cash holdings. Accordingly, the leverage structure is a crucial factor for CDS spreads. Also Tang et al. (2011) find that variations in the leverage structure of a company are responsible for a substantial part of the movements of CDS spreads. Given that net debt is the difference between the sum of long and short term debt, and cash and equivalents, a company can dispose of low levels of net debt and high levels of cash at the same time because of two possible reasons. Either the company has both high levels of net debt and high levels of cash, or the company has only high levels of cash and no or nearly no debt at all. Considering again the data, there are 41 of 73 companies that have a negative net debt while also having high cash holdings. The remaining 32 companies keep both high levels of net debt and high levels of cash and fund growth using both internal resources and funds from the capital markets or banks. These companies do not hold cash because of asymmetric information in the market and agency costs, since they have access to the markets. They might hold cash in order to keep a higher degree of flexibility, or because of a managerial preference for cash or simply to dispose of enough funds for future upcoming investment opportunities. The informational asymmetry hypothesis (Jensen & Meckling, 1976) that companies hold cash, because of expensive external financing due to agency costs does not hold for these companies.

Sector-dependence. Given that it has been found that companies belonging to different sectors respond differently to share buyback announcements, firms should exploit this knowledge. For the case where share buybacks are used as a payout method, to transfer funds to the shareholders, firms especially from the consumer discretionary should look for alternative methods, such as paying dividends, where the corporate risk profile possibly does not worsen. It could be analyzed in further studies how the risk profile is related to dividend payments.

Management of the risk profile as defence measure. Companies that dispose of enough funds can actively influence CDS spreads, given what has been found for the data in this analysis. Using a mix of payout policy, liquidity management and leverage structure, CEOs and managers of a company can possibly attain an increase in the CDS spreads. Usually a company might want to improve its risk profile and decrease the CDS spreads, but there exist rare cases where it might also be interested in worsening its risk profile, as a defence measure against a hostile takeover for example. How is that possible? Given what can be derived from figure (10), CDS spreads increase especially for companies with low cash holdings. Hence, if a company that has low cash holdings announces that it intends to buy back a portion of the outstanding shares, it is sending a negative signal to the markets and achieving an increase in the CDS spreads. This study focuses only on announcements of share buybacks and not actual buybacks. Accordingly, the share buyback announcement only has to be credible in order to achieve an effect on the credit risk, at least in the short run.

Adding value to the firm. Ultimately the question arises if an active CDS spreads management can add value to the firm, since it is the maximization of shareholders' wealth what most companies want to achieve in the end. Through optimal timing of a share buyback announcement, respecting this "pecking

order” mentioned above, the costs of debt can be kept at lower levels, which does create value for the shareholders. The same is the case when a company wants to achieve an increase of the CDS spreads in the short run, or uses alternative payout measures instead of share buybacks to not worsen the risk profile. How big the impact is due to these value adding risk management initiatives can however not be determined based on the findings in this study. In the end it is still through profitable investment opportunities and positive NPV projects that a company creates value.

1.5.2 Limitations

The results shown above provide powerful insight into the causality mechanism between share repurchase announcements and CDS spreads. They do however also suffer from some limitations which are addressed hereafter.

Sample selection bias. In this study, the components of two major CDS indices are considered as sample subjects, due to a data availability issue. CDS spreads are nearly only available for firms that are publicly owned, quoted on a stock exchange and thus of relatively bigger extent. Focusing on big companies only, implies a sample selection bias. Smaller companies are not included in this analysis and there cannot be said anything whether the results apply also to these types of companies. CDS were developed only in the recent few decades and are relatively new derivative instruments. Hence, on one hand CDS are not available for all companies in the market, and on the other hand the CDS market is not always liquid. Often the market suffers from thin trading which leads the CDS premium to include also a component that is neither related to the firm characteristics, nor credit quality issues, but to liquidity risk (Tang et al., 2008). Further studies on share buyback announcements and risk management could take into consideration also the liquidity risk component.

Extended event window. The event window used in this analysis is rather long, given that it lasts for a total of 15 days. The reason for this approach is because of potential information leakages that could arise before the event. Leakages can thereby appear in two different forms. First of all, there might be some rumour in the market about the buyback already before the actual announcement date. This is quite delicate corporate information that should not be disclosed beforehand, but still it happens. Secondly, the company might first announce to pay out cash to the shareholders and only later then tell the form of the payout. Also in this case materializes a partial leakage of information. When a company announces to transfer part of the cash reserves to the shareholders, the market usually already has some expectations on the form of this payout and incorporates this information into stock prices and CDS spreads. It would thus be interesting to see whether the results change when incorporating this fact into the analysis by adjusting the event dates accordingly.

Endogenous cash reserves. Both utilities companies and financial companies such as banks and insurances are subject to stringent regulations regarding the level of capital requirements they have to hold. Hence, these legal restrictions also impact the level of cash holdings that is withheld and the one that is paid out to the shareholders. This is why they have been excluded from this analysis. Sometimes however the level of cash holdings is also endogenous for companies belonging to sectors other than finance and utilities, as suggested by Acharya et al. (2011). For instance, leverage and cash could be

related to each other, because of certain debt covenants or requirements by creditors to hold a certain amount of cash reserve. This issue is not controlled for in this analysis and impacts especially the interpretations regarding leverage structure and share buyback announcements.

Endogenous events. For an event to be exogenous, the change in the CDS spread return is caused by the event (Campbell et al., 1997). The opposite is the case if the share buyback announcement is a response to the CDS spread movement. This might be the case for some companies included in this analysis, however it is assumed to be quite rare and most of the time the event is independent of the ex-ante CDS spread movement.

Abnormal returns. The estimation of the abnormal returns is done using a statistical model. Hence, this model depends only on certain statistical assumptions, as outlined above, and not on any economic assumptions. This model is however not able to remove all the variation of the abnormal returns. The problem is that we obtain estimates, for the population parameters which cannot be observed. Moreover, a GARCH(1,1) process is imposed on all of the 381 events, without trying to fit a process with optimal lags for each of the datasets. There exists an extensive literature on how to estimate financial returns, but the prediction power of all the suggested models is rather low. For the event period of 15 days, the estimation errors do not add up that much as they would be problematic and distort the effect of the event window.

Different closing times. Another minor problem might be the fact that closing prices of CDS are considered in this analysis. The closing time is different sometimes, because the closing price refers to the last transaction that is made on any day. Hence, the time of this transaction can be different for different days, especially if the market is not highly liquid which the case for credit default swaps is sometimes. It is however uncertain, how and to which extent different closing times impact the results of this analysis.

Aggregate level. The results found in this analysis hold true on an aggregate level, since 142 different companies and 381 event dates are analyzed together. Above, it has been suggested that an optimal mix of liquidity management, leverage structure and payout policy should be used in order to improve the risk management of a company. An experiment would be needed to check if the results do really hold also for the single company.

1.6 Conclusion

The purpose of this paper is to analyze the relationship between corporate cash holdings, share repurchase announcements and risk management. An event study is performed, on the basis of a GARCH(1,1) market model, to examine how CDS spread returns behave after the announcement of a share buyback. The sample contains 142 different companies based in Europe and North America and 381 event dates during the time period 06/17/2004 until 02/26/2013, constituting thus a total of 864,489 observations.

Overall, CDS spreads increase after the announcement of a share repurchase, leading to 1.89 percentage points higher CDS premiums than would be expected in the case no event happened. The market reacts negatively in the short run and the risk profile of the companies worsens. This leads to a rejection of the signalling hypothesis, implying that the market does not perceive the buyback announcement as a positive signal about the future. After the event, the market is expecting a partial shift of the assets from the firm to the shareholders, which implicates – all else equal – a higher debt-equity ratio which could be a possible explanation for the increase in the CDS spreads, together with the lack of profitable investment opportunities.

There is a statistically significant difference between the reaction to share repurchase announcements of companies with high cash holdings and those with lower cash holdings. The risk profile worsens relatively more for companies with low cash holdings than for companies with high cash holdings. The CDS spread returns are nearly 4 percentage points higher than expected for companies with relatively low corporate savings. Moreover, companies that accumulate ever more cash holdings in the years before the event also exhibit CDS spread returns that are 3.4 percentage points higher than expected. Both of these findings imply that CDS spreads and cash holdings of companies are highly interrelated with each other.

In addition, when clustering only the companies with relatively high cash holdings to total assets, and taking into consideration the leverage structure of the company, an interesting phenomenon is detected. Those companies that dispose of both a high level of cash and a low level of net debt suffer from a bigger increase of the CDS spreads after the corporate event. Hence, these companies enjoy an elevated degree of flexibility beforehand, by being able to fund growth both internally – using the corporate savings, and externally – by accessing capital markets or approaching a bank for a loan, but intend to decrease this flexibility and these funds for upcoming contingencies by announcing a share buyback. The informational asymmetry hypothesis that companies hold cash, because of expensive external financing does not hold true for the dataset in question.

The findings have implications for the cost of debt too. According to Hull et al. (2004) and others, CDS spreads can anticipate changes in credit ratings. Hence, in the case where a share repurchase announcement causes a substantial increase in the CDS spread of a company, a rating downgrade might follow. Ratings are a major factor for the determination of the interest rates charged on a bank loan. That is why companies should respect a certain “pecking order” and first request a loan and sign the credit agreement, before announcing a partial share buyback. This approach allows companies to benefit from lower costs of debt.

Summing up, through optimal timing of a share buyback announcement, respecting the above mentioned “pecking order”, the costs of debt can be kept at lower levels, which does create value for shareholders. The same is the case when a company wants to achieve an increase of CDS spreads in the short run. How big the impact of these value-adding risk management measures is, can however not be determined based on the findings in this study. Whether it is efficient to hoard big amounts of cash, and whether the benefits are higher than the costs, can be addressed by further research. In the end it is

however still majorly through profitable investment opportunities and positive NPV projects that a company creates value and growth.

This study adds substantial new evidence on behalf of cash holdings and risk management. To the best of our knowledge, no event study has been performed so far using share buyback announcements and analyzing the causal mechanism of them on CDS spreads. The underlying study focuses however only on reductions of corporate cash holdings by considering share buybacks, without looking at increases of corporate savings. Due to a data availability problem the latter was not considered. Future research analyze if the effects on CDS spreads are symmetric and hold in both directions, or if the spreads behave differently for increases in cash holdings.

1.7 Sources

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1.8 Appendix

Appendix 1: List of companies used for the event study

Company Name	N. Event Dates	Sector	Index
Accor SA	3	ConsumerDiscretionary	Market iTraxx Europe
Electrolux AB	1	ConsumerDiscretionary	Market iTraxx Europe
Akzo Nobel NV	1	Materials	Market iTraxx Europe
Anglo American PLC	1	Materials	Market iTraxx Europe
Anheuser-Busch InBev NV	2	Other	Market iTraxx Europe
AstraZeneca PLC	1	HealthCare	Market iTraxx Europe
BAE Systems PLC	1	Industrials	Market iTraxx Europe
BASF SE	2	Materials	Market iTraxx Europe
Bayerische Motoren Werke AG	1	ConsumerDiscretionary	Market iTraxx Europe
Bouygues SA	2	Industrials	Market iTraxx Europe
BP PLC	3	Energy	Market iTraxx Europe
British Sky Broadcasting Group PLC	1	Communications	Market iTraxx Europe
British Telecommunications PLC	2	Communications	Market iTraxx Europe
CARREFOUR SA	1	Other	Market iTraxx Europe
Compass Group PLC	1	ConsumerDiscretionary	Market iTraxx Europe
Daimler AG	1	ConsumerDiscretionary	Market iTraxx Europe
Danone SA	2	Other	Market iTraxx Europe
Deutsche Telekom AG	3	Communications	Market iTraxx Europe
Diageo PLC	3	Other	Market iTraxx Europe
European Aeronautic Defence and Space Co NV	2	Industrials	Market iTraxx Europe
Experian Finance PLC	1	Technology	Market iTraxx Europe
France Telecom SA	3	Communications	Market iTraxx Europe
Imperial Tobacco Group PLC	1	Other	Market iTraxx Europe
Kingfisher PLC	1	ConsumerDiscretionary	Market iTraxx Europe
Koninklijke Ahold NV	1	Other	Market iTraxx Europe
Koninklijke KPN NV	5	Communications	Market iTraxx Europe
Koninklijke Philips Electronics NV	3	Industrials	Market iTraxx Europe
Lanxess AG	3	Materials	Market iTraxx Europe
Linde AG	1	Industrials	Market iTraxx Europe
Marks & Spencer PLC	1	ConsumerDiscretionary	Market iTraxx Europe
Nestle SA	3	Other	Market iTraxx Europe
Next PLC	1	ConsumerDiscretionary	Market iTraxx Europe
PostNL NV	2	Industrials	Market iTraxx Europe
PPR	1	ConsumerDiscretionary	Market iTraxx Europe
Publicis Groupe SA	1	Communications	Market iTraxx Europe
Royal Dutch Shell PLC	2	Energy	Market iTraxx Europe
WM Morrison Supermarkets PLC	1	Other	Market iTraxx Europe
Sanofi	3	HealthCare	Market iTraxx Europe
Siemens AG	1	Industrials	Market iTraxx Europe
Sodexo	2	ConsumerDiscretionary	Market iTraxx Europe
Solvay SA	1	Materials	Market iTraxx Europe
Statoil ASA	7	Energy	Market iTraxx Europe
STMicroelectronics NV	1	Technology	Market iTraxx Europe
Tate & Lyle PLC	3	Other	Market iTraxx Europe
Technip SA	1	Industrials	Market iTraxx Europe
Telefonica SA	3	Communications	Market iTraxx Europe
Telekom Austria AG	1	Communications	Market iTraxx Europe
Telenor ASA	2	Communications	Market iTraxx Europe

Company Name	N. Event Dates	Sector	Index
TeliaSonera AB	1	Communications	Market iTraxx Europe
Tesco PLC	2	Other	Market iTraxx Europe
Total SA	3	Energy	Market iTraxx Europe
Unilever NV	2	Other	Market iTraxx Europe
Valeo SA	3	ConsumerDiscretionary	Market iTraxx Europe
Vinci SA	1	Industrials	Market iTraxx Europe
Vodafone Group PLC	1	Communications	Market iTraxx Europe
Wolters Kluwer NV	3	Communications	Market iTraxx Europe
WPP 2005 Ltd	2	Communications	Market iTraxx Europe
Xstrata PLC	2	Materials	Market iTraxx Europe
Amgen Inc	5	HealthCare	CDX NA IG
Anadarko Petroleum Corp	2	Energy	CDX NA IG
Arrow Electronics Inc	4	Industrials	CDX NA IG
AT&T Inc	3	Communications	CDX NA IG
AutoZone Inc	8	ConsumerDiscretionary	CDX NA IG
Avnet Inc	2	Industrials	CDX NA IG
Barrick Gold Corp	1	Materials	CDX NA IG
Baxter International Inc	5	HealthCare	CDX NA IG
BEAM INC	1	Other	CDX NA IG
Bristol-Myers Squibb Co	1	HealthCare	CDX NA IG
CAMPBELL SOUP CO	4	Other	CDX NA IG
Canadian Natural Resources Ltd	4	Energy	CDX NA IG
Cardinal Health Inc	6	HealthCare	CDX NA IG
Carnival Corp	2	ConsumerDiscretionary	CDX NA IG
Caterpillar Inc	1	Industrials	CDX NA IG
CenturyLink Inc	3	Communications	CDX NA IG
Cisco Systems Inc	4	Communications	CDX NA IG
Comcast Corp	2	Communications	CDX NA IG
Computer Sciences Corp	2	Technology	CDX NA IG
CONAGRA FOODS INC	5	Other	CDX NA IG
ConocoPhillips	3	Energy	CDX NA IG
CSX Corp	3	Industrials	CDX NA IG
CVS CAREMARK CORP	6	Other	CDX NA IG
Darden Restaurants Inc	1	ConsumerDiscretionary	CDX NA IG
Deere & Co	3	Industrials	CDX NA IG
Dell Inc	2	Technology	CDX NA IG
Devon Energy Corp	1	Energy	CDX NA IG
DIRECTV Holdings LLC / DIRECTV Financing			
Co Inc	8	Communications	CDX NA IG
El du Pont de Nemours & Co	3	Materials	CDX NA IG
Eastman Chemical Co	4	Materials	CDX NA IG
Expedia Inc	2	Communications	CDX NA IG
Freeport-McMoRan Copper & Gold Inc	1	Materials	CDX NA IG
GENERAL MILLS INC	2	Other	CDX NA IG
Goodrich Corp	1	Industrials	CDX NA IG
HEINZ (H J) CO	1	Other	CDX NA IG
Halliburton Co	3	Energy	CDX NA IG
Hewlett-Packard Co	7	Technology	CDX NA IG
Honeywell International Inc	3	Industrials	CDX NA IG
Ingersoll-Rand Co	3	Industrials	CDX NA IG
International Paper Co	1	Materials	CDX NA IG
Kohl's Corp	2	ConsumerDiscretionary	CDX NA IG
MONDELEZ INTERNATIONAL INC	2	Other	CDX NA IG
Lockheed Martin Corp	6	Industrials	CDX NA IG
Lowe's Cos Inc	5	ConsumerDiscretionary	CDX NA IG
MDC Holdings Inc	1	ConsumerDiscretionary	CDX NA IG

Company Name	N. Event Dates	Sector	Index
Marriott International Inc/DE	4	ConsumerDiscretionary	CDX NA IG
McDonald's Corp	2	ConsumerDiscretionary	CDX NA IG
MeadWestvaco Corp	2	Materials	CDX NA IG
Motorola Solutions Inc	2	Communications	CDX NA IG
Nabors Industries Inc	1	Energy	CDX NA IG
Newell Rubbermaid Inc	2	ConsumerDiscretionary	CDX NA IG
News America Inc	1	Communications	CDX NA IG
Nordstrom Inc	5	ConsumerDiscretionary	CDX NA IG
Norfolk Southern Corp	3	Industrials	CDX NA IG
Northrop Grumman Corp	4	Industrials	CDX NA IG
Pfizer Inc	4	HealthCare	CDX NA IG
Pitney Bowes Inc	3	Technology	CDX NA IG
Quest Diagnostics Inc	4	HealthCare	CDX NA IG
Raytheon Co	3	Industrials	CDX NA IG
SWY	5	Other	CDX NA IG
Southwest Airlines Co	4	ConsumerDiscretionary	CDX NA IG
Staples Inc	2	ConsumerDiscretionary	CDX NA IG
Starwood Hotels & Resorts Worldwide Inc	4	ConsumerDiscretionary	CDX NA IG
TARGET CORP	3	Other	CDX NA IG
Dow Chemical Co/The	3	Materials	CDX NA IG
Gap Inc/The	8	ConsumerDiscretionary	CDX NA IG
HILLSHIRE BRANDS CO	3	Other	CDX NA IG
Home Depot Inc/The	3	ConsumerDiscretionary	CDX NA IG
Kroger Co	7	Other	CDX NA IG
Sherwin-Williams Co/The	3	Materials	CDX NA IG
Walt Disney Co/The	1	Communications	CDX NA IG
Time Warner Cable Inc	2	Communications	CDX NA IG
Time Warner Inc	4	Communications	CDX NA IG
Transocean Inc	3	Energy	CDX NA IG
TYSON FOODS INC -CL A	1	Other	CDX NA IG
Union Pacific Corp	3	Industrials	CDX NA IG
United Parcel Service Inc	5	Industrials	CDX NA IG
UnitedHealth Group Inc	5	HealthCare	CDX NA IG
Valero Energy Corp	2	Energy	CDX NA IG
Verizon Communications Inc	4	Communications	CDX NA IG
Viacom Inc	3	Communications	CDX NA IG
WAL-MART STORES INC	4	Other	CDX NA IG
Xerox Corp	4	Technology	CDX NA IG
Yum! Brands Inc	6	ConsumerDiscretionary	CDX NA IG

Appendix 2: Cumulative Abnormal Returns and T-statistics based on OLS estimates

Days from event		-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7
All companies	Avg CAR	0.0008	0.0028	0.0060	0.0046	0.0068	0.0088	0.0108	0.0102	0.0097	0.0090	0.0097	0.0090	0.0097	0.0116	0.0120
	Tstat	0.4482	1.1950	2.0721	1.3771	1.8024	2.1426	2.4228	2.1353	1.9226	1.6859	1.7316	1.5468	1.5985	1.8379	1.8433
Companies with high vs low cash holdings	Avg CAR of companies with high cash holdings	0.0018	0.0022	0.0077	0.0056	0.0084	0.0079	0.0104	0.0101	0.0063	0.0039	0.0087	0.0090	0.0089	0.0090	0.0093
	Avg CAR of companies with low cash holdings	0.0027	0.0038	0.0085	0.0067	0.0103	0.0132	0.0163	0.0218	0.0311	0.0325	0.0316	0.0274	0.0311	0.0319	0.0333
	Tstat high vs low	-0.2374	-0.2753	-0.1193	-0.1409	-0.2089	-0.5477	-0.5643	-1.0574	-2.1081	-2.2968	-1.7591	-1.3557	-1.5681	-1.5612	-1.5784
Companies with increasing, constant or decreasing cash holdings	Avg CAR of companies with increasing cash	-0.0001	0.0037	0.0037	0.0022	0.0079	0.0046	0.0067	0.0109	0.0184	0.0158	0.0160	0.0190	0.0196	0.0258	0.0254
	Tstat increasing cash	-0.0428	1.1063	0.9183	0.4610	1.5077	0.8011	1.0667	1.6346	2.5962	2.1135	2.0440	2.3282	2.3015	2.9199	2.7872
	Avg CAR of companies with constant cash	0.0002	0.0006	0.0066	0.0040	0.0059	0.0124	0.0146	0.0121	0.0074	0.0062	0.0071	0.0049	0.0070	0.0065	0.0081
Companies with low net debt & high cash vs rest of companies	Tstat constant cash	0.0790	0.1507	1.2958	0.6820	0.8956	1.7050	1.8591	1.4407	0.8378	0.6596	0.7242	0.4770	0.6514	0.5867	0.7096
	Avg CAR of companies with decreasing cash	0.0028	0.0055	0.0081	0.0090	0.0067	0.0085	0.0100	0.0060	0.0019	0.0046	0.0055	0.0026	0.0011	0.0011	0.0005
	Tstat decreasing cash	0.8405	1.1641	1.4097	1.3508	0.8986	1.0472	1.1344	0.6349	0.1914	0.4374	0.4998	0.2231	0.0906	0.0879	0.0400
Companies with low net debt & high cash vs rest of companies	Avg CAR of companies with low net debt & high cash	0.0052	0.0055	0.0159	0.0146	0.0162	0.0134	0.0181	0.0176	0.0137	0.0130	0.0215	0.0212	0.0182	0.0187	0.0180
	Tstat low net debt & high cash vs rest	1.5118	1.0070	2.0736	1.9927	1.5317	0.9951	1.2714	1.1786	1.0911	1.2664	1.7123	1.5580	1.1352	1.1550	1.0011

Companies from various sectors	Avg CAR for companies from communications	0.0026	0.0037	0.0022	0.0082	0.0098	0.0135	0.0168	0.0120	0.0123	0.0081	0.0088	0.0118	0.0138	0.0128	0.0152
	Tstat communications	0.9115	0.9189	0.4526	1.4401	1.5477	1.9500	2.2444	1.4971	1.4435	0.9077	0.9403	1.2049	1.3503	1.2015	1.3876
	Avg CAR for companies from consumer discretionary	-0.0010	0.0003	0.0066	0.0083	0.0108	0.0148	0.0184	0.0139	0.0181	0.0263	0.0282	0.0265	0.0267	0.0257	0.0252
	Tstat consumer discretionary	-0.3135	0.0614	1.1626	1.2635	1.4707	1.8355	2.1208	1.4917	1.8378	2.5263	2.5843	2.3271	2.2553	2.0873	1.9774
	Avg CAR for companies from industrials & materials	0.0045	0.0073	0.0040	0.0013	-0.0008	0.0044	0.0039	-0.0020	-0.0051	-0.0080	-0.0093	-0.0089	-0.0114	-0.0064	-0.0082
	Tstat industrials & materials	0.9721	1.1127	0.5028	0.1430	-0.0757	0.3910	0.3187	-0.1489	-0.3648	-0.5483	-0.6017	-0.5560	-0.6802	-0.3681	-0.4569
	Avg CAR for companies from other sectors	-0.0013	0.0012	0.0086	0.0032	0.0078	0.0063	0.0083	0.0144	0.0128	0.0105	0.0116	0.0093	0.0114	0.0143	0.0156
	Tstat other sectors	-0.4973	0.3371	1.9173	0.6125	1.3441	1.0037	1.2126	1.9707	1.6529	1.2817	1.3579	1.0445	1.2290	1.4791	1.5568
	Avg CAR for companies from Europe	0.0025	0.0016	0.0036	0.0025	-0.0007	0.0103	0.0082	0.0128	0.0128	0.0093	0.0093	0.0094	0.0126	0.0191	0.0218
	Avg CAR for companies from USA	0.0000	0.0034	0.0071	0.0055	0.0098	0.0082	0.0119	0.0091	0.0085	0.0089	0.0098	0.0089	0.0086	0.0085	0.0081
	Tstat Europe vs USA	0.6461	-0.3258	-0.5232	-0.3846	-1.2226	0.2201	-0.3650	0.3441	0.3717	0.0367	-0.0420	0.0394	0.2886	0.7346	0.9215

The T-statistics that are both italics and bold indicate statistical significance at the 5% level.

Appendix 3: GARCH(1,1) parameter estimates and T-statistics for the 381 events

Constant	Tstat Cons	Lambda	Tstat Lambda	GARCH	Tstat Garch	ARCH	Tstat Arch
-0.0008	-0.3923	0.7367	20.0684	0.4799	1.3761	0.0980	2.1226
-0.0017	-2.5255	0.3928	13.1630	0.7808	12.0907	0.1298	2.9326
-0.0022	-1.8585	0.5097	10.0416	0.7219	4.5657	0.0912	1.4322
-0.0002	-0.1586	0.4346	4.5675	0.6494	1.4696	0.0381	0.9777
-0.0008	-0.4065	0.5986	22.1893	0.8150	23.1606	0.1850	4.4851
0.0007	0.6221	0.4065	7.9306	0.0000	0.0000	0.0899	1.8762
-0.0016	-2.1321	0.2189	4.5858	0.0000	0.0000	0.3547	4.7253
-0.0002	-7.9641	0.0000	-0.0939	0.8995	28494.7286	0.0000	0.0000
-0.0001	-7.5136	0.0002	0.8227	0.9006	41520.2747	0.0000	0.0000
-0.0027	-2.2514	0.3532	6.6068	0.8515	12.1873	0.0859	1.9467
-0.0004	-0.3007	0.4774	12.5703	0.7887	11.8255	0.1392	2.6291
0.0172	4.7010	0.0470	0.8603	0.0000	0.0000	1.0000	5.5647
-0.0013	-0.9787	0.0311	0.3356	0.1288	0.7233	0.1832	3.8836
-0.0007	-1.3418	0.3915	13.2727	0.7869	21.3302	0.1966	4.5428
-0.0002	-0.2348	0.3512	9.8443	0.3084	2.8875	0.3916	4.5979
0.0002	0.2193	0.3248	22.4479	0.8787	36.7400	0.1209	4.5436
-0.0044	-2.1777	0.6107	10.6888	0.6736	13.2281	0.3264	5.6596
0.0004	0.3907	0.3244	13.9901	0.5517	7.1508	0.4483	5.5241
0.0005	0.2949	0.2382	2.3634	0.4999	0.0647	0.0058	0.0775
-0.0005	-0.7052	0.3744	21.3274	0.5726	7.8582	0.4274	4.3483
-0.0001	-0.0742	0.3635	12.1208	0.0000	0.0000	0.0782	1.3047
-0.0008	-0.7579	0.4534	15.5739	0.8976	27.9891	0.0741	2.9602
-0.0016	-1.9590	0.4686	25.4574	0.4210	7.3150	0.5780	7.3539
0.0000	0.0133	0.5204	23.3066	0.1833	2.4790	0.6405	5.6379
-0.0029	-2.2450	0.2340	3.1043	0.8745	82.5977	0.1255	7.9391
-0.0013	-1.6012	0.2886	12.5294	0.8491	14.9361	0.1074	3.1472
-0.0007	-0.2449	0.7212	17.7614	0.4629	0.0005	0.0000	0.0000
-0.0014	-1.4037	0.7536	27.4261	0.8221	34.4412	0.1779	6.3174
-0.0008	-0.7875	0.4150	14.6067	0.8550	10.4585	0.0729	1.6547
-0.0002	-0.3631	0.0981	2.2184	0.3972	5.1337	0.5410	6.7456
-0.0002	-0.2087	0.4122	15.6969	0.5724	3.4285	0.1466	2.4586
0.0006	0.7962	0.4485	13.9797	0.9923	38.6166	0.0038	0.4926
-0.0007	-0.5501	0.5806	31.2082	0.7331	14.1275	0.1761	3.9782
-0.0011	-1.0246	0.4954	19.5397	0.0000	0.0000	0.0878	1.5895
-0.0012	-1.4333	0.2973	8.4813	0.0000	0.0000	0.5929	6.9060
0.0009	0.3382	0.5702	7.3410	0.0000	0.0000	0.1239	2.4045
0.0013	0.7790	0.4551	38.3372	0.6862	10.7489	0.3138	4.1177
-0.0011	-1.0028	0.5540	15.9372	0.4077	4.8561	0.3880	4.2771
0.0032	2.4307	0.8007	14.3435	0.0659	2.2612	0.9341	7.3254

Constant	Tstat Cons	Lambda	Tstat Lambda	GARCH	Tstat Garch	ARCH	Tstat Arch
-0.0005	-0.2923	0.3296	8.7985	0.7029	41.4645	0.2971	9.2486
0.0010	0.9791	0.5111	17.1606	0.7831	21.1507	0.1820	4.8157
0.0019	1.1580	0.7046	36.9313	0.9102	9.8119	0.0233	0.9586
-0.0015	-2.1229	0.5371	15.5250	0.7881	2.9797	0.0371	1.1154
-0.0003	-0.4695	0.3199	13.2863	0.8964	41.4533	0.1036	4.4929
0.0014	0.6728	0.6430	21.0414	0.0000	0.0000	0.0235	0.6392
-0.0010	-0.8172	0.5175	15.3132	0.6952	2.5305	0.0531	1.1842
0.0009	0.9252	0.7935	11.6671	0.0220	0.7157	0.6389	5.4692
0.0002	0.2413	0.5053	16.4493	0.7725	7.0079	0.1047	2.2763
0.0019	1.1817	0.6396	23.3896	0.8836	25.1568	0.0797	3.5336
-0.0016	-1.4002	0.5221	9.5839	0.9266	13.7992	0.0193	1.2644
0.0025	1.4925	0.6862	15.6313	0.7247	8.3921	0.1050	2.9385
0.0003	0.3019	0.7226	23.5296	0.9005	28.6118	0.0826	2.8145
0.0017	0.6240	0.3339	3.1524	0.0000	0.0000	0.0023	0.0314
0.0032	1.3353	0.4192	11.8312	0.5666	2.5252	0.0514	1.2632
-0.0013	-2.5687	0.0938	2.8952	0.0000	0.0000	0.2712	4.8724
-0.0007	-0.7438	0.3479	10.4645	0.6178	3.0174	0.0583	1.9499
0.0010	0.8865	0.6750	21.0530	0.9060	52.1528	0.0940	6.4274
-0.0034	-2.9612	0.3161	14.7186	0.1985	2.4288	0.7794	6.5969
0.0008	1.7860	0.3192	39.8394	0.8751	80.2799	0.1249	7.9722
-0.0010	-1.2467	0.2716	12.0790	0.9075	124.4498	0.0925	9.2476
0.0000	0.0467	0.5684	21.1628	0.7117	12.8070	0.2883	3.7307
-0.0003	-0.1269	0.2000	5.6478	0.1199	1.4580	0.4108	4.5827
0.0013	0.5501	0.6144	18.8219	0.3268	2.1003	0.3509	3.4487
-0.0007	-0.4087	0.0824	1.0033	0.7860	3.0115	0.0590	1.0540
-0.0010	-0.8972	0.4168	15.5856	0.7363	14.3748	0.1960	4.2615
-0.0015	-0.4581	0.1815	1.4151	0.9406	243.9328	0.0424	14.3937
0.0097	0.0707	-0.1925	-0.0467	1.0000	78.6387	0.0000	0.0000
0.0020	2.8557	0.3844	11.5160	0.0272	0.4923	0.7956	10.9650
-0.0013	-0.8789	0.4398	20.5152	0.2637	2.9636	0.6426	8.9689
0.0000	-0.0147	0.0174	1.1257	0.6918	17.6961	0.3082	5.8546
0.0037	2.4829	0.2705	11.3911	0.7882	42.7462	0.2118	6.6322
-0.0003	-0.2148	0.4276	10.3689	0.0000	0.0000	0.3918	4.3469
-0.0014	-1.0444	0.5710	14.3695	0.7235	14.7791	0.2636	5.1419
0.0006	0.4147	0.2941	8.4117	0.6180	17.6114	0.3820	8.3250
-0.0011	-0.7323	0.1850	2.0731	0.3641	2.0409	0.2002	2.2602
0.0001	0.0918	0.4493	11.8200	0.3072	0.4317	0.0400	0.5246
0.0002	0.1440	0.2801	13.0383	0.8850	39.0528	0.1047	4.3666
0.0001	0.0237	0.7563	15.8438	0.6381	4.3231	0.2033	2.1340
0.0003	0.1667	0.6002	21.8169	0.7189	6.5377	0.1629	2.8052
-0.0044	-3.0422	0.2405	7.3907	0.0114	0.3322	0.7606	7.2546

Constant	Tstat Cons	Lambda	Tstat Lambda	GARCH	Tstat Garch	ARCH	Tstat Arch
0.0009	1.9730	0.1776	9.3203	0.7081	22.1495	0.2919	5.8591
-0.0009	-0.7829	0.0482	2.4138	0.7605	26.5542	0.2395	5.9148
-0.0015	-1.2934	0.1491	5.3523	0.8382	28.7230	0.1618	5.8853
0.0029	1.2512	0.4498	6.3518	0.6640	20.1676	0.3307	4.9689
0.0056	1.3626	0.2514	4.3697	0.7568	16.6209	0.1964	3.6495
-0.0025	-2.1470	-0.0127	-0.1691	0.8239	19.0064	0.1252	3.7329
-0.0030	-2.5522	-0.0516	-1.1034	0.6225	11.7128	0.3500	5.5155
-0.0013	-0.6835	0.4707	16.3891	0.5990	3.5445	0.1502	2.4914
-0.0011	-1.8190	0.2357	12.3339	0.7609	12.4324	0.1799	3.2782
-0.0007	-0.6054	0.1870	6.0743	0.5470	5.8579	0.3941	3.8929
-0.0010	-0.5204	0.6281	9.2970	0.0879	0.9536	0.4458	6.1149
-0.0026	-1.8083	0.1085	1.2994	0.0000	0.0000	0.0330	1.3043
0.0003	0.3282	0.6358	23.5907	0.9175	19.8139	0.0471	2.1013
0.0014	1.1667	0.8864	23.0159	0.6774	16.3703	0.3037	4.0587
0.0021	1.5091	0.6014	23.7589	0.8767	24.4990	0.1034	2.9710
0.0019	1.3201	0.6206	29.4720	0.7665	13.0830	0.1982	3.3806
0.0013	0.6013	0.6161	25.0536	0.0000	0.0000	0.2444	4.0019
-0.0013	-1.1253	0.3604	9.7826	0.0000	0.0000	0.0088	0.2439
0.0006	0.8958	0.2135	7.6478	0.7752	24.8457	0.2248	5.6979
-0.0024	-2.4748	0.3900	21.2656	0.2914	2.2053	0.3675	3.6724
-0.0004	-0.6477	0.2523	14.6083	0.1575	3.0619	0.8425	7.9601
0.0006	0.6419	0.4481	19.9860	0.9336	35.8931	0.0378	2.3649
-0.0012	-1.3847	0.1483	2.6081	0.6805	2.6899	0.0505	0.9124
0.0003	0.0987	0.4086	4.6680	0.0000	0.0000	0.0788	2.0047
0.0033	1.4351	0.4824	10.1765	0.9290	63.4558	0.0645	3.5746
-0.0014	-1.3931	0.0095	0.2508	0.8231	16.5942	0.1369	5.0631
-0.0019	-2.3014	0.2009	4.8532	0.4281	11.5408	0.5719	10.8844
-0.0010	-1.2663	0.1683	5.9179	0.8156	11.5145	0.0907	2.8198
-0.0010	-0.7720	0.6509	13.4347	0.9157	17.3206	0.0511	2.9375
-0.0011	-0.6546	0.7741	20.2179	0.8752	9.2541	0.0363	1.2060
0.0022	1.1865	0.6339	22.4138	0.9268	43.4672	0.0619	2.9951
-0.0035	-2.9671	0.4125	7.6554	0.0246	0.3848	0.9393	7.3992
0.0005	0.5987	0.5127	21.1490	0.9462	30.8045	0.0389	2.0610
-0.0002	-0.1371	0.4223	22.7502	0.5263	6.5312	0.4587	4.1643
-0.0007	-0.6816	0.4417	8.8088	0.0000	0.0000	0.2209	3.7353
-0.0003	-0.1291	0.4713	4.4950	0.0000	0.0000	0.0077	0.0846
-0.0015	-1.6932	0.5042	15.3848	0.8078	11.9882	0.1134	3.1280
0.0013	0.7335	0.5208	14.3000	0.8980	33.4105	0.0746	3.4713
0.0017	1.5447	0.5052	33.5922	0.5914	10.7423	0.4086	5.8077
0.0015	0.7458	0.3784	14.5205	0.7073	9.5106	0.1735	3.9279
-0.0001	-1.6016	0.0439	21.6952	0.4790	10.1643	0.5210	5.1613

Constant	Tstat Cons	Lambda	Tstat Lambda	GARCH	Tstat Garch	ARCH	Tstat Arch
-0.0001	-0.1706	0.1842	13.4578	0.3098	4.1523	0.6435	4.5470
0.0000	-0.0119	0.1734	5.5062	0.6073	5.8393	0.1766	2.5812
0.0011	0.3629	0.2531	2.2846	0.5098	9.5398	0.4183	5.1673
-0.0006	-0.4042	-0.1600	-2.7118	0.7351	21.0339	0.2649	6.0588
-0.0018	-0.8820	0.1185	1.5452	0.8743	27.4707	0.1051	3.2891
0.0024	1.5869	0.0671	2.5662	0.5463	4.5573	0.2497	3.8905
0.0032	0.5649	0.2125	1.4701	0.0000	0.0000	0.2207	2.5093
-0.0003	-0.2903	0.4090	14.2187	0.0858	0.3253	0.1891	2.6831
-0.0010	-0.7973	0.1518	4.6337	0.4131	3.3431	0.5869	3.8320
-0.0015	-0.9897	0.3198	7.3580	0.3661	1.9161	0.2548	3.0367
0.0141	0.2588	-0.1215	-0.2072	0.0000	0.0000	0.0378	0.2635
-0.0009	-0.6816	0.2911	5.7451	0.8996	19.0667	0.0576	2.0400
0.0002	0.2800	0.2939	12.5508	0.9278	27.7940	0.0542	2.4686
-0.0006	-0.5636	0.3107	13.7232	0.8476	6.8833	0.0532	1.5628
0.0009	0.4198	0.3465	10.6841	0.8520	32.9249	0.1069	4.2089
-0.0012	-1.2179	0.1325	4.0484	0.6426	7.2837	0.1686	2.7964
0.0005	0.5712	0.1729	5.0767	0.0000	0.0000	0.3192	4.0461
0.0006	0.4304	0.2308	7.4782	0.1946	0.9445	0.1789	3.1181
-0.0019	-1.2972	0.3077	6.5125	0.8153	9.5746	0.0876	2.4390
-0.0013	-0.7570	0.2505	9.3667	0.7944	27.2469	0.1915	5.3442
0.0009	0.3552	0.2182	7.0601	0.8999	11.6504	0.0361	1.3320
-0.0020	-2.3206	0.3340	8.9174	0.2668	1.6740	0.2342	2.6304
-0.0010	-0.6476	0.3515	5.7739	0.7823	23.9885	0.1610	5.0649
0.0003	0.4121	0.2189	7.0481	0.8227	14.9872	0.1163	3.0802
-0.0005	-0.4037	0.2784	7.3745	0.8666	35.3793	0.1209	4.4429
0.0002	0.0304	-0.0014	-0.0161	0.8330	11.5619	0.1670	1.7747
-0.0013	-1.1001	0.1352	3.9756	0.4208	0.2564	0.0210	0.4836
0.0010	0.8211	0.1311	5.0435	0.0132	0.1463	0.4753	5.5597
-0.0010	-1.0268	0.2395	9.3283	0.8348	25.8480	0.1460	3.9124
0.0026	1.4283	0.0776	2.8391	0.6838	16.9702	0.3162	5.9439
0.0008	0.9826	-0.2722	-2.9131	0.3335	13.6168	0.6665	13.8265
-0.0004	-0.3337	0.2021	3.0094	0.9587	78.9300	0.0307	3.3232
0.0003	1.2981	-0.0001	-0.0321	0.2273	3.4643	0.7727	7.2380
0.0003	0.2906	0.1347	3.4772	0.3793	5.5078	0.4922	5.8407
0.0012	1.3597	0.1573	4.8250	0.0000	0.0000	0.5228	8.1073
0.0026	1.0798	0.1536	4.0724	0.6384	8.1034	0.2539	4.3339
-0.0014	-0.8679	0.0290	0.3139	0.7450	7.2272	0.1501	2.0964
0.0002	0.1018	-0.0085	-0.1017	0.8558	29.0367	0.1181	4.2881
0.0001	0.1454	0.3140	10.6772	0.9082	26.8921	0.0632	2.7679
0.0000	-0.0067	0.1341	7.4963	0.5973	11.9332	0.4027	7.9269
-0.0023	-1.8632	0.1963	6.0537	0.1490	1.7504	0.7335	5.1460

Constant	Tstat Cons	Lambda	Tstat Lambda	GARCH	Tstat Garch	ARCH	Tstat Arch
-0.0004	-10.4824	0.0005	0.5770	0.8997	39885.3042	0.0000	0.0000
-0.0017	-1.4990	0.2024	7.3572	0.5119	3.5640	0.2514	3.3470
-0.0017	-1.3713	0.1728	6.1557	0.5061	12.0102	0.4939	6.9156
-0.0042	-3.2984	0.1408	5.7406	0.0000	0.0000	0.7600	8.3128
0.0007	0.9968	0.0851	6.2767	0.2897	6.2186	0.7103	6.1250
-0.0027	-2.7771	0.1215	1.7327	0.4708	4.1269	0.3157	4.7379
-0.0038	-1.9923	0.3858	5.0207	0.3576	5.2367	0.6424	5.4849
-0.0021	-1.9879	0.3066	6.4837	0.5324	8.2847	0.3673	4.3460
-0.0030	-1.1813	0.3428	5.0190	0.0000	0.0000	0.5014	5.3394
-0.0003	-0.2717	0.0508	0.7740	0.9007	41.8048	0.0993	4.0253
-0.0007	-0.6670	0.3303	12.8574	0.4914	7.5307	0.5040	5.0786
-0.0016	-1.7040	0.2264	12.8513	0.6394	18.6201	0.3606	8.3171
0.0007	0.3443	0.6071	4.3983	0.8457	60.4752	0.1543	7.0694
0.0002	0.2038	0.3034	13.8901	0.8124	18.4119	0.1230	2.9136
-0.0019	-1.1090	0.2178	5.1366	0.2585	3.6641	0.5111	5.6104
-0.0001	-6.4827	0.0000	0.0296	0.9002	22134.1246	0.0000	0.0000
-0.0001	-6.3223	0.0001	0.2943	0.9002	27706.2653	0.0000	0.0000
0.0002	9.6287	0.0000	-0.1035	0.8995	46073.8428	0.0000	0.0000
0.0003	9.8196	-0.0002	-0.4325	0.8997	24130.4003	0.0000	0.0000
0.0031	1.6478	0.2895	7.5841	0.2456	3.1394	0.5020	5.5917
0.0083	1.2258	0.2555	0.4193	0.0000	0.0000	0.4383	3.3538
-0.0004	-0.3919	0.1414	4.6022	0.0000	0.0000	0.8752	9.2923
-0.0005	-0.3250	0.1790	4.0782	0.6587	5.0608	0.0974	2.2111
0.0010	0.3407	0.2929	7.1133	0.6064	3.8132	0.1328	1.7246
0.0022	1.3891	0.2440	5.3103	0.7230	10.4557	0.2050	3.3388
-0.0025	-1.8568	0.3525	3.5274	0.0000	0.0000	0.1030	1.5790
-0.0006	-0.4624	0.2406	6.3801	0.9719	81.8971	0.0226	2.8093
-0.0013	-1.3636	0.2700	7.0134	0.9420	59.5199	0.0401	3.1905
-0.0022	-1.5293	0.0152	0.2597	0.7800	21.8224	0.2200	4.0663
-0.0007	-0.4619	0.2587	5.2928	0.2163	1.9039	0.2755	5.7623
0.0004	0.4324	0.1932	5.0079	0.9805	121.4523	0.0128	2.4308
0.0022	1.2944	0.2306	7.4991	0.8840	21.4224	0.0616	2.5350
-0.0028	-1.5334	-0.1014	-1.0732	0.7023	13.8042	0.1564	4.8202
-0.0024	-2.7833	0.1308	5.9690	0.7773	8.4251	0.0944	2.2755
-0.0003	-0.2953	0.1770	3.6158	0.4459	2.0600	0.1269	1.7440
-0.0012	-0.8316	0.3280	11.8881	0.7083	4.9781	0.1221	2.3282
-0.0046	-3.1245	0.2287	6.4000	0.0000	0.0000	0.4485	4.5588
0.0013	0.8024	0.2646	12.5900	0.4711	2.9030	0.2338	2.9221
0.0000	-0.0149	0.1081	1.6151	0.8469	8.7075	0.0566	1.9363
-0.0004	-0.5180	0.2380	14.8384	0.2350	4.7337	0.7650	7.8985
0.0034	1.6236	0.1966	6.6749	0.8589	24.5000	0.0921	3.1765

Constant	Tstat Cons	Lambda	Tstat Lambda	GARCH	Tstat Garch	ARCH	Tstat Arch
-0.0023	-1.5673	0.0693	0.7317	0.0311	0.8759	0.9689	7.9611
-0.0005	-0.4782	0.0902	1.9620	0.8500	35.8346	0.1500	4.7456
-0.0012	-1.2174	0.2688	8.4769	0.1360	2.2573	0.8640	5.9686
0.0009	0.6257	0.1349	6.0998	0.2210	3.9977	0.7790	5.8311
0.0000	-0.0099	0.2703	4.9794	0.0000	0.0000	0.0152	0.3532
-0.0022	-0.6198	0.4726	4.2226	0.8618	5.4326	0.0224	0.6891
0.0000	-0.0301	-0.0013	-0.1321	0.2739	8.1188	0.7261	24.5303
0.0000	10.5829	0.0000	-196.3866	0.8993	52849.7672	0.0000	0.0000
0.0000	7.1429	0.0000	69.2049	0.9002	50902.3969	0.0000	0.0000
-0.0027	-22.9190	0.0135	3.5389	0.2178	2.2680	0.7822	7.5682
0.0005	0.6258	-0.0026	-0.1868	0.3326	3.4807	0.4589	2.7363
0.0003	11.3412	0.0000	0.0343	0.8991	42914.9366	0.0000	0.0000
0.0004	10.9991	-0.0006	-0.6964	0.9002	15557.6007	0.0000	0.0000
0.0004	11.8538	-0.0002	-0.4837	0.8998	60018.7831	0.0000	0.0000
-0.0020	-1.8294	0.2599	6.4674	0.4290	2.9128	0.2969	3.2737
0.0001	0.1318	0.2049	7.5307	0.9736	85.6200	0.0188	2.4392
0.0036	1.0281	0.2777	2.6346	0.9044	48.0731	0.0762	5.5535
0.0003	0.1958	0.3107	16.0981	0.4953	7.4253	0.4006	5.4110
0.0002	0.1114	0.3132	15.8959	0.5538	8.2597	0.3322	5.9287
-0.0012	-1.2143	0.2870	20.0628	0.8365	28.7024	0.1583	7.5050
-0.0012	-0.9647	0.1530	1.8963	0.8908	3.4060	0.0085	0.4687
0.0003	10.4289	-0.0002	-0.2868	0.9000	21523.7644	0.0000	0.0000
0.0004	11.2380	0.0000	-0.0424	0.8998	13597.2254	0.0000	0.0000
-0.0030	-2.7805	0.4158	7.6139	0.3970	7.0834	0.6030	7.9969
0.0002	0.0325	-0.0006	-0.0124	0.6421	1.3401	0.1855	0.5531
0.0000	-5.4994	0.0000	-0.0888	0.9006	14775.3081	0.0000	0.0000
-0.0010	-0.6189	0.2173	6.6085	0.2640	4.1611	0.4553	5.3836
0.0012	0.5944	0.4118	5.4475	0.6755	12.0315	0.3245	3.2903
-0.0012	-0.8997	0.0612	0.6952	0.8453	26.6034	0.1547	4.3623
0.0004	0.2737	0.1103	1.9144	0.7590	103.3988	0.2410	18.5384
-0.0034	-1.7108	-0.2784	-4.2271	0.5956	27.4145	0.4044	5.3402
-0.0012	-0.9491	0.2977	3.4100	0.0000	0.0000	0.2374	4.2089
0.0003	0.1992	0.2879	7.8037	0.8776	25.9508	0.1191	3.0039
0.0016	1.2278	0.2148	4.6180	0.5937	6.3960	0.2020	4.5366
0.0010	0.8602	0.2071	8.6360	0.7982	16.6253	0.1105	3.6662
0.0041	1.9439	0.2071	6.1544	0.7990	14.5412	0.1535	3.0677
-0.0018	-0.6958	0.1283	2.5079	0.8656	35.3170	0.1284	4.1788
-0.0011	-0.5723	0.1909	2.1516	0.8888	32.5993	0.0835	3.8920
-0.0010	-0.6322	0.2075	2.1239	0.8750	19.3176	0.0619	2.9131
0.0010	0.9839	0.2360	5.0187	0.2488	3.4715	0.7512	6.6100
-0.0006	-0.7221	0.2041	12.9006	0.0037	0.1515	0.9660	6.8128

Constant	Tstat Cons	Lambda	Tstat Lambda	GARCH	Tstat Garch	ARCH	Tstat Arch
-0.0004	-0.4316	0.0916	2.4247	0.9324	64.6473	0.0676	4.4570
0.0006	0.4202	0.2036	2.8860	0.1398	1.3572	0.5554	6.9409
0.0013	0.8514	0.3062	8.6259	0.0130	1.2896	0.9870	15.7981
-0.0001	-0.1418	0.2491	14.9530	0.7584	14.1362	0.1438	4.7431
-0.0001	-6.9119	0.0002	0.5712	0.9002	10011.6413	0.0000	0.0000
-0.0003	-0.2258	0.3779	4.0249	0.9400	74.9521	0.0581	3.9263
0.0016	32.9681	-0.0009	-0.3437	0.4378	17.7737	0.5622	17.7826
-0.0010	-21.7220	0.0007	0.4582	0.9001	91179.7550	0.0000	0.0000
-0.0009	-0.9107	0.0894	1.5463	0.8019	44.8558	0.1981	9.8064
0.0005	0.4701	-0.0079	-0.1712	0.7876	14.5339	0.1597	3.6685
-0.0001	-0.0910	0.2890	8.0927	0.2994	41123.8242	0.0000	0.0000
-0.0010	-0.5377	0.3039	5.6327	0.0000	0.0000	0.4830	5.1386
0.0028	1.3867	0.1313	3.2527	0.8737	45.6148	0.0894	4.6789
-0.0014	-0.7124	0.1379	2.8977	0.7076	12.2996	0.1769	3.5076
-0.0007	-0.5178	-0.0149	-0.1333	0.6723	9.7468	0.1318	5.7951
-0.0011	-0.7823	0.2396	5.6033	0.7689	17.2736	0.1702	3.4227
0.0000	0.0404	0.1332	4.2466	0.8557	9.8204	0.0638	1.7106
-0.0022	-1.3386	0.3222	7.3189	0.8893	17.8207	0.0883	2.2056
0.0018	0.5403	0.1219	0.6775	0.8883	3.3684	0.0086	0.4542
-0.0082	-2.3403	0.6090	2.8952	0.0471	0.7182	0.6078	4.3607
0.0006	0.1745	0.1414	1.0537	0.6866	5.7237	0.1688	2.6364
0.0003	10.5875	-0.0003	-0.5770	0.9001	13868.8516	0.0000	0.0000
-0.0011	-0.9268	0.3800	16.9546	0.8911	34.0826	0.0698	4.2368
0.0013	0.7818	0.1883	2.0199	0.7314	23.5435	0.2534	5.9671
-0.0004	-0.5317	0.1246	3.0414	0.7836	9.9246	0.0919	2.3663
-0.0017	-1.2706	0.0320	0.6681	0.6061	20.1513	0.3919	5.0812
-0.0019	-0.9857	0.2679	6.5315	0.8885	19.2265	0.0712	2.4137
0.0005	0.1911	0.2054	3.5332	0.5942	4.7249	0.1716	2.5441
-0.0009	-0.9419	0.2822	10.7319	0.2706	1.5976	0.1746	2.4852
-0.0019	-1.3976	0.4027	14.5230	0.6221	16.2415	0.3779	6.2570
-0.0005	-0.5430	0.2218	5.2576	0.2369	1.9645	0.3109	3.1550
-0.0001	-0.0818	0.0731	1.1374	0.8510	12.3499	0.0752	2.2899
-0.0002	-7.0096	0.0001	0.2304	0.9008	24022.7648	0.0000	0.0000
-0.0002	-0.1987	0.1529	4.6842	0.4592	3.8206	0.2553	2.9867
-0.0010	-0.9063	0.2542	12.6034	0.7059	8.7677	0.2255	3.5514
-0.0036	-3.4234	0.4054	12.2856	0.0610	0.9999	0.5373	8.3875
-0.0008	-0.7834	0.2777	10.0093	0.7093	11.8075	0.2907	4.1350
-0.0007	-0.7437	0.2815	8.4561	0.9369	59.7048	0.0606	4.4831
-0.0022	-1.3743	0.2220	6.4589	0.2081	3.0851	0.5281	4.6571
-0.0004	-0.4895	0.1087	3.9957	0.5461	10.6902	0.4539	7.4372
-0.0031	-1.7595	0.1280	0.8534	0.3779	4.9442	0.3980	4.6316

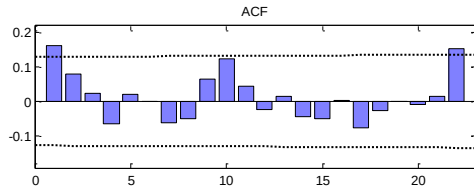
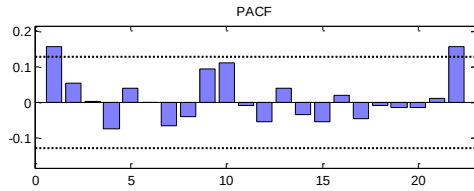
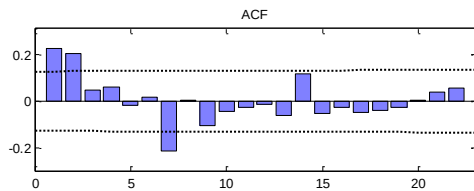
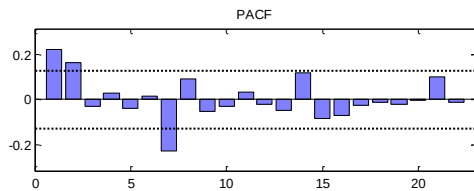
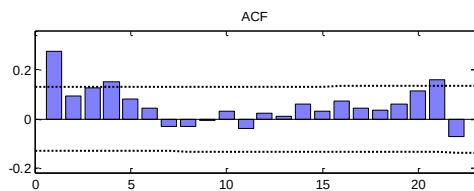
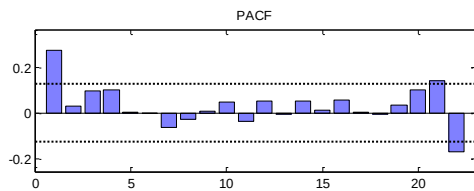
Constant	Tstat Cons	Lambda	Tstat Lambda	GARCH	Tstat Garch	ARCH	Tstat Arch
-0.0023	-1.9266	0.1836	5.9085	0.6014	8.6836	0.2421	4.4993
-0.0001	-0.1252	0.2043	7.3920	0.3053	3.5241	0.6884	5.7991
0.0010	0.6718	0.1017	1.8105	0.3584	2.7895	0.4034	3.7816
0.0025	1.9207	0.2343	13.7081	0.1202	2.1884	0.8649	7.0219
0.0017	0.5031	0.2505	3.6195	0.9020	9.1143	0.0332	1.2713
-0.0062	-1.9313	-0.0713	-0.4379	0.0000	0.0000	0.1702	2.0907
0.0014	0.3905	0.0712	0.5326	0.8658	14.1076	0.0828	2.4801
-0.0005	-0.5262	0.2210	12.0281	0.2001	1.1957	0.2480	2.5548
0.0016	2.2368	0.1623	6.0232	0.9118	45.6749	0.0749	4.2466
0.0011	1.3941	0.1714	7.2731	0.7449	15.4500	0.2104	4.3250
0.0019	1.1456	0.2488	3.5256	0.0000	0.0000	1.0000	3.7312
0.0013	0.9887	0.1657	5.6487	0.2171	3.3072	0.4389	4.8163
0.0033	0.1478	0.1832	0.1348	1.0000	82.2686	0.0000	0.0000
0.0008	0.4322	0.0341	0.3381	0.6936	11845.5315	0.0000	0.0000
-0.0014	-2.4283	0.1396	7.3573	0.5898	13.8323	0.4102	7.4565
-0.0018	-1.7298	0.0436	1.5265	0.5917	12.5536	0.4083	4.2251
0.0037	21.6034	-0.0009	-0.1599	0.7051	50.7361	0.2949	14.8038
-0.0011	-24.2980	0.0005	0.3051	0.9006	15081.5214	0.0000	0.0000
0.0010	0.6585	0.3400	8.8073	0.4345	3.4382	0.2087	3.3752
0.0028	1.8682	0.1789	8.0329	0.8709	66.0973	0.1291	5.4436
-0.0004	-0.3879	0.0544	1.6642	0.7410	14.4303	0.2590	4.5871
-0.0013	-1.9234	0.1081	5.4375	0.5450	11.6858	0.4550	6.2061
0.0019	1.4255	0.2898	10.8754	0.0000	0.0000	0.1564	1.7687
0.0006	0.4918	0.1632	4.5054	0.5860	3.1899	0.1280	2.2224
-0.0004	-0.2583	0.2540	12.1867	0.5532	6.1891	0.4468	3.9590
-0.0035	-3.2618	0.2627	3.9529	0.7262	19.0607	0.2032	4.4785
-0.0006	-0.7221	0.2070	6.7377	0.0000	0.0000	0.1494	2.6007
0.0041	2.3988	0.2117	9.2771	0.9108	38.5877	0.0699	3.3775
-0.0021	-1.7662	0.0460	0.5461	0.5174	5.1309	0.1977	3.5481
-0.0004	-0.4270	0.1253	3.6998	0.6823	7.6375	0.1654	3.0609
-0.0001	-0.1633	0.0635	2.4754	0.5418	28.0783	0.4582	11.7804
0.0005	0.4584	-0.0102	-0.2502	0.8892	0.9461	0.0000	0.0000
-0.0033	-2.7787	-0.1749	-3.6058	0.4198	7.3005	0.5802	7.5131
0.0009	0.7477	0.3160	8.0281	0.8704	21.7254	0.0828	3.0888
-0.0015	-1.8434	0.0641	4.3152	0.0000	0.0000	1.0000	9.3899
-0.0022	-1.6501	0.0626	0.5046	0.9701	4.0951	0.0000	0.0000
-0.0018	-1.6733	-0.2104	-10.4970	0.3630	7.6980	0.6370	8.1806
-0.0005	-0.8188	0.1367	6.6464	0.5015	6.9442	0.4375	5.4461
-0.0002	-0.1231	0.0438	0.6486	0.7913	17.4805	0.1879	4.3000
0.0013	0.4509	0.1154	1.0718	0.2182	1.5489	0.2461	3.1630
-0.0008	-0.9143	0.3352	13.2617	0.0000	0.0000	0.2000	2.5263

Constant	Tstat Cons	Lambda	Tstat Lambda	GARCH	Tstat Garch	ARCH	Tstat Arch
-0.0004	-0.2788	0.1580	1.7319	0.8354	5.9484	0.0619	1.2327
0.0014	0.8317	0.4045	4.5398	0.4986	8.2263	0.3893	5.2571
-0.0028	-2.1296	0.1875	5.7276	0.0000	0.0000	0.2662	2.9883
0.0009	0.7798	0.2588	7.8994	0.0000	0.0000	0.2748	4.2207
0.0011	1.0745	0.2611	20.1902	0.5743	8.2295	0.4257	8.4349
0.0012	0.8873	0.2553	12.6482	0.6094	2.7630	0.1315	1.9097
-0.0043	-3.6447	0.1546	4.8840	0.0000	0.0000	0.4801	4.4277
-0.0012	-0.8257	0.3428	16.2024	0.8273	20.6007	0.1079	3.6236
-0.0019	-1.5660	0.4676	23.0624	0.2792	4.9912	0.7208	6.2017
0.0011	0.7926	0.3937	7.9073	0.0000	0.0000	1.0000	7.1340
0.0040	0.4183	0.1616	0.7790	1.0000	70.9704	0.0000	0.0000
-0.0039	-3.1565	0.2537	7.4844	0.9222	23.5768	0.0420	2.1913
0.0003	0.1260	0.1945	5.2853	0.7632	21.5974	0.1942	3.8113
-0.0003	-0.2127	0.2141	8.4019	0.5201	3.8968	0.2173	3.8158
0.0006	0.2358	0.4712	3.9740	0.1495	2.1096	0.8505	7.2005
0.0018	0.3446	0.2224	1.0846	0.4982	4.2435	0.2109	2.1382
-0.0009	-0.8612	0.1768	7.2068	0.7854	25.5552	0.1877	4.5174
-0.0011	-1.7910	0.0780	4.1090	0.4268	6.9390	0.5732	5.3557
0.0000	0.0298	0.1785	7.9256	0.7500	17.8796	0.1440	4.6984
0.0008	1.0361	0.2571	11.5106	0.8256	30.3801	0.1582	5.0696
0.0012	0.7043	0.3194	12.8192	0.1754	3.2676	0.8246	6.4945
-0.0010	-0.9419	0.3238	6.9068	0.4325	5.4020	0.5675	4.5785
-0.0019	-2.0450	-0.0213	-0.1915	0.0000	0.0000	1.0000	7.2905
-0.0009	-1.0801	0.2239	7.0198	0.9280	51.0127	0.0696	4.5752
-0.0041	-3.7692	0.0608	5.5176	0.7030	22.6077	0.2970	5.6281
0.0029	2.4799	0.2564	10.4591	0.1152	2.8593	0.8848	5.6492
-0.0013	-0.7015	0.2095	1.9243	0.8273	23.0680	0.1727	4.7200
0.0022	2.2602	0.3349	12.4900	0.0000	0.0000	0.3577	6.0525
-0.0018	-2.0316	0.1843	9.7027	0.5251	10.5756	0.4749	6.5316
0.0003	0.2564	0.3482	12.0200	0.9165	15.0839	0.0375	1.6326
-0.0004	-0.2459	0.2330	5.8700	0.1897	1.6708	0.5910	5.7704
-0.0017	-1.2221	0.3998	8.1137	0.2125	4.2071	0.7875	12.5966
-0.0016	-1.2049	0.3996	8.2671	0.3351	4.9087	0.6649	7.8130
-0.0036	-2.7129	0.2088	5.5510	0.8855	22.9248	0.0641	2.7333
-0.0020	-1.7077	0.1151	2.7370	0.7513	11.0272	0.1515	3.1025
-0.0037	-3.4572	0.0666	1.7705	0.0000	0.0000	0.6037	5.5654
0.0005	0.4467	0.2237	8.1448	0.3246	3.7139	0.5488	4.7613
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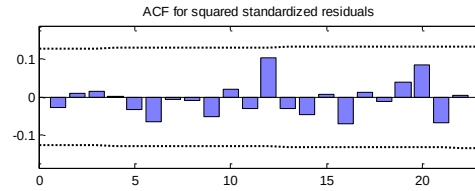
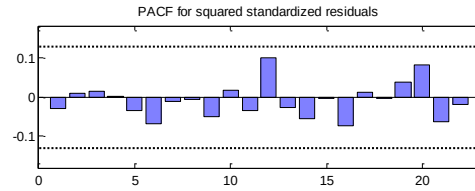
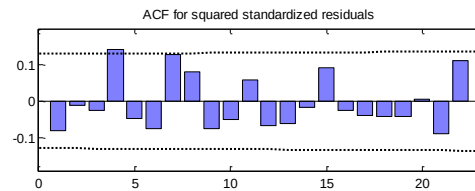
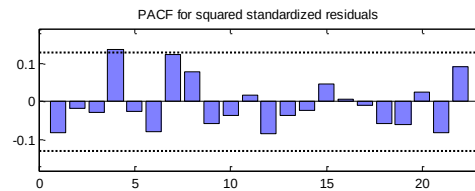
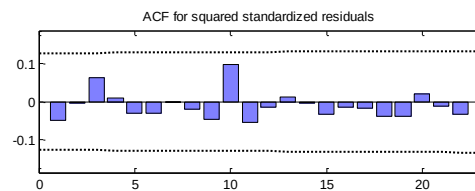
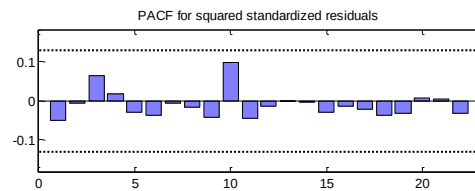
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-0.0006	-14.7260	0.0008	0.5693	0.9005	87312.0507	0.0000	0.0000
-0.0005	-12.1175	0.0007	1.0068	0.9005	68876.4142	0.0000	0.0000
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-0.0017	-2.4167	0.1646	6.1587	0.7274	3.6449	0.0452	1.2247
-0.0001	-0.0617	0.0867	3.0694	0.4134	5.7449	0.4524	5.1414
0.0003	10.2965	0.0000	-0.0698	0.8999	34686.4649	0.0000	0.0000
0.0004	11.1480	-0.0003	-0.4758	0.9002	56856.8711	0.0000	0.0000
0.0038	2.3429	0.2526	9.4548	0.0000	0.0000	0.1122	2.0044
-0.0011	-0.9205	0.1958	3.3994	0.0000	0.0000	0.4806	3.3985
-0.0009	-5.8339	-0.0019	-0.4477	0.4786	25.8475	0.5214	10.6123
0.0117	8.4287	-0.0037	-0.1336	0.8868	174.8362	0.1132	13.4070
0.0005	0.3649	-0.0073	-0.0855	0.5824	19.6245	0.4176	6.8840
0.0016	1.4597	0.1564	2.9281	0.6629	15.6424	0.3371	5.3196
-0.0015	-1.0843	0.2861	10.0558	0.6558	7.8137	0.2125	3.7291
0.0001	7.3118	-0.0001	-0.4142	0.9002	19358.9040	0.0000	0.0000
0.0001	8.6534	-0.0001	-0.4644	0.8993	18476.7327	0.0000	0.0000
0.0001	0.1337	0.0669	2.9823	0.0000	0.0000	0.5149	4.1472
-0.0004	-0.3446	0.3621	22.3297	0.7067	6.1143	0.1465	2.1722
-0.0033	-1.8199	0.1426	3.3330	0.5375	12.0063	0.4625	6.6588
0.0031	0.8871	-0.9153	-5.3479	0.0000	0.0000	1.0000	4.3321
-0.0004	-0.2650	0.0604	2.0230	0.8854	132.1065	0.1146	7.5146
0.0005	0.7066	0.1078	9.4746	0.5776	18.3116	0.4224	9.5270
-0.0008	-0.5580	0.0408	0.4184	0.8622	9.2345	0.0247	1.7356
0.0072	0.1463	0.1656	0.1509	0.0000	0.0000	0.0082	0.0454
-0.0018	-2.1305	0.1186	5.9556	0.7709	22.2939	0.1794	5.7011
-0.0020	-3.0641	0.0845	5.3480	0.6526	15.3908	0.3474	5.9560
-0.0014	-1.6967	0.2117	12.2535	0.1501	1.2109	0.2990	4.9533
-0.0025	-1.7864	0.2419	4.7123	0.7515	0.0207	0.0000	0.0000
0.0002	0.2895	0.0000	-0.0021	0.4529	22.6993	0.5471	80.3385
0.0001	1.2135	-0.0002	-0.0661	0.0575	1.0257	0.9425	4.0555
-0.0009	-20.2827	0.0011	0.5739	0.0026	0.0412	0.6974	5.2595
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Appendix 4:

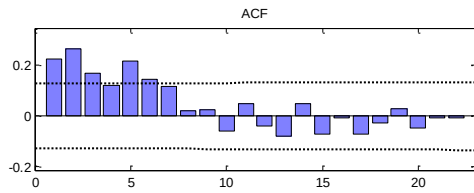
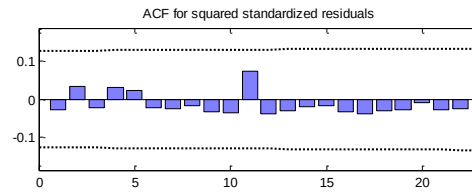
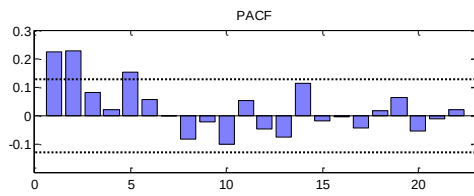
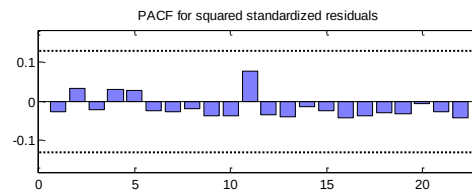
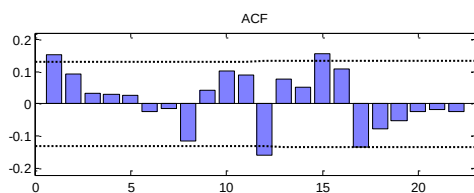
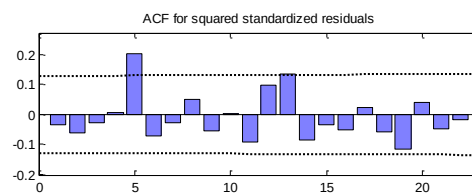
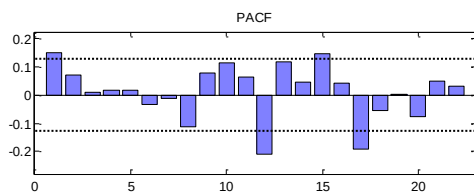
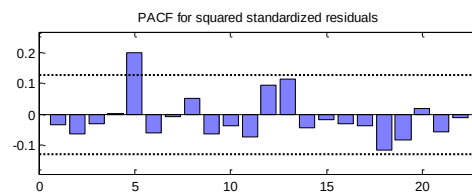
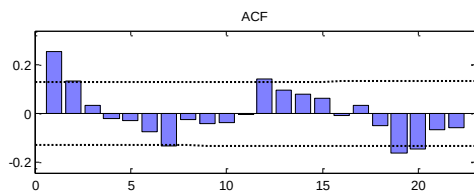
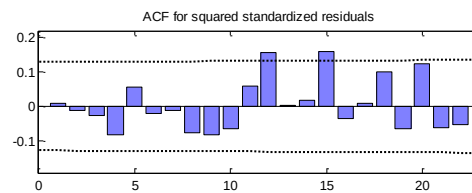
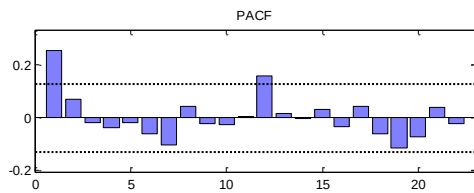
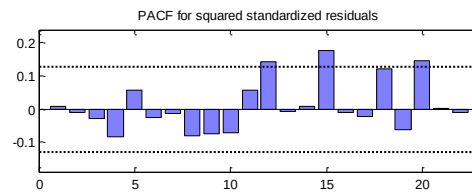
ACF & PACF Pre-Estimation



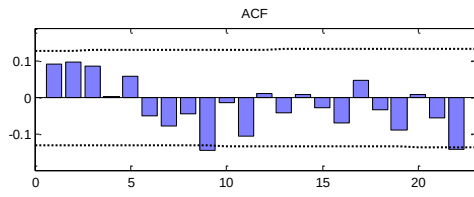
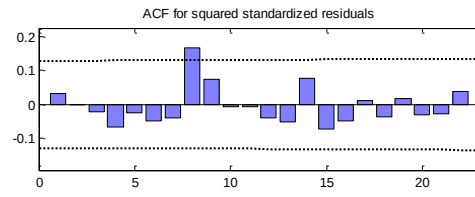
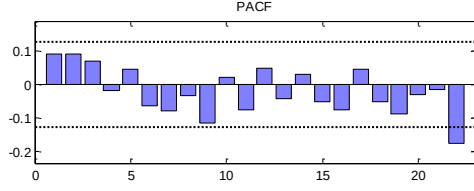
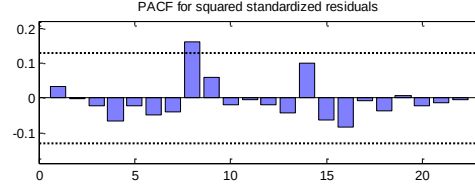
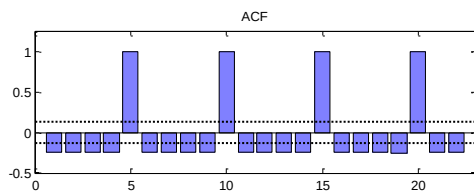
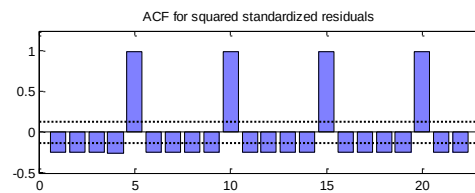
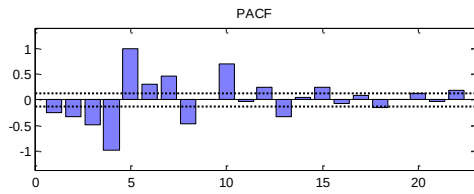
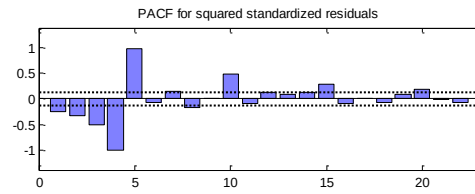
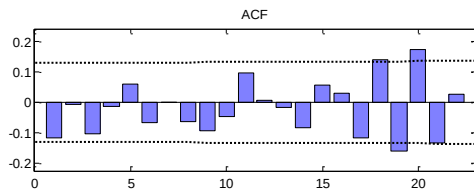
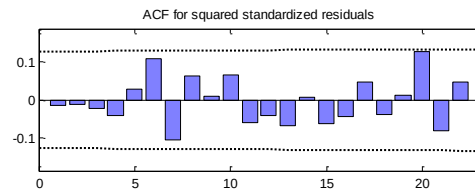
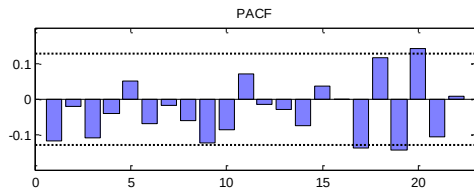
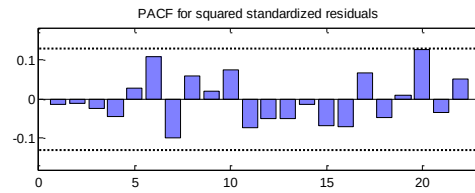
ACF & PACF Post-Estimation



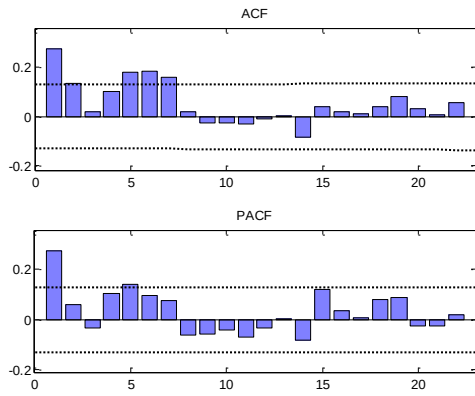
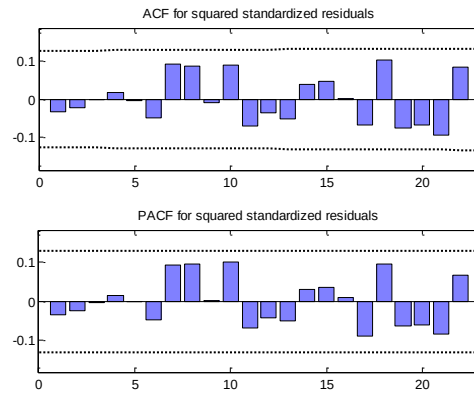
The dotted lines in each plot indicate the two-standard error boundaries of the ACF and PACF.



The dotted lines in each plot indicate the two-standard error boundaries of the ACF and PACF.



The dotted lines in each plot indicate the two-standard error boundaries of the ACF and PACF.



The dotted lines in each plot indicate the two-standard error boundaries of the ACF and PACF.

Appendix 5: Cumulative Abnormal Returns and T-statistics based on GARCH(1,1) estimates

Days from event		-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7
All companies	Avg CAR	0.0015	0.0040	0.0075	0.0065	0.0090	0.0115	0.0136	0.0133	0.0132	0.0129	0.0144	0.0143	0.0153	0.0177	0.0189
	Tstat	3.1554	6.1439	9.3901	7.0590	8.6968	10.1275	11.1353	10.1797	9.5034	8.7971	9.3590	8.8901	9.1374	10.2104	10.5637
Companies with high vs low cash holdings	Avg CAR of companies with high cash holdings	0.0025	0.0035	0.0093	0.0074	0.0103	0.0104	0.0127	0.0125	0.0089	0.0070	0.0126	0.0136	0.0141	0.0150	0.0160
	Avg CAR of companies with low cash holdings	0.0029	0.0044	0.0093	0.0079	0.0119	0.0154	0.0192	0.0249	0.0345	0.0362	0.0359	0.0321	0.0357	0.0371	0.0392
	Tstat high vs low	-0.3593	-0.4692	0.0266	-0.2382	-0.5538	-1.6538	-1.9933	-3.5182	-6.8646	-7.4221	-5.6550	-4.3121	-4.8266	-4.7561	-4.8096
Companies with increasing, constant or decreasing cash holdings	Avg CAR of companies with increasing cash holdings	0.0008	0.0049	0.0053	0.0041	0.0099	0.0072	0.0098	0.0148	0.0225	0.0204	0.0221	0.0256	0.0266	0.0335	0.0338
	Tstat increasing cash	0.9440	4.0396	3.5891	2.4010	5.1928	3.4189	4.3200	6.1431	8.7983	7.5631	7.7852	8.6590	8.6398	10.4723	10.2088
	Avg CAR of companies with constant cash holdings	0.0008	0.0019	0.0084	0.0066	0.0092	0.0160	0.0182	0.0158	0.0117	0.0108	0.0123	0.0105	0.0126	0.0127	0.0153
	Tstat constant cash	1.0657	1.7419	6.4077	4.3037	5.3850	8.6089	9.0565	7.3378	5.1369	4.5070	4.8637	3.9825	4.5898	4.4688	5.2013
Companies with low net debt & high cash vs rest of high cash companies	Avg CAR of companies with decreasing cash holdings	0.0035	0.0065	0.0090	0.0098	0.0075	0.0096	0.0111	0.0071	0.0031	0.0062	0.0076	0.0053	0.0045	0.0048	0.0051
	Tstat decreasing cash	4.8151	6.4353	7.2292	6.8397	4.6822	5.4573	5.8371	3.5077	1.4413	2.7172	3.1861	2.1451	1.7263	1.8052	1.8308
	Avg CAR of companies with low net debt & high cash holdings	0.0059	0.0065	0.0174	0.0169	0.0190	0.0168	0.0212	0.0207	0.0170	0.0168	0.0259	0.0260	0.0240	0.0257	0.0252
	Tstat low net debt & high cash vs rest of high cash companies	6.2711	3.9307	8.6438	8.8400	7.2082	4.8383	5.9948	5.3883	5.0316	5.7360	7.4405	6.6548	5.0721	5.3177	4.3851

Companies from various sectors	Avg CAR for companies from communications	0.0032	0.0049	0.0040	0.0109	0.0137	0.0177	0.0211	0.0163	0.0169	0.0135	0.0148	0.0176	0.0191	0.0191	0.0220
	Tstat communications	3.3550	3.6613	2.4358	5.7619	6.4634	7.6355	8.4180	6.0820	5.9531	4.5079	4.7153	5.3574	5.6126	5.3978	5.9910
	Avg CAR for companies from consumer discretionary	-0.0001	0.0019	0.0086	0.0114	0.0147	0.0197	0.0241	0.0200	0.0247	0.0333	0.0360	0.0350	0.0359	0.0355	0.0360
	Tstat consumer discretionary	-0.1611	1.7625	6.5333	7.4743	8.6064	10.5585	11.9378	9.2542	10.8018	13.7858	14.2180	13.2401	13.0565	12.4305	12.1717
	Avg CAR for companies from industrials & materials	0.0046	0.0073	0.0049	0.0021	-0.0004	0.0045	0.0039	-0.0017	-0.0044	-0.0074	-0.0084	-0.0080	-0.0101	-0.0050	-0.0061
	Tstat industrials & materials	4.4250	4.9576	2.7133	0.9848	-0.1903	1.7452	1.3977	-0.5609	-1.4129	-2.2244	-2.4058	-2.1922	-2.6838	-1.2778	-1.4934
	Avg CAR for companies from other sectors	-0.0003	0.0028	0.0100	0.0048	0.0095	0.0087	0.0108	0.0172	0.0158	0.0140	0.0164	0.0151	0.0177	0.0211	0.0233
	Tstat other sectors	-0.3618	2.4279	7.0499	2.9002	5.1779	4.3163	4.9588	7.4282	6.4471	5.4038	6.0227	5.3316	5.9876	6.8817	7.3521
	Avg CAR for companies from Europe	0.0032	0.0029	0.0055	0.0044	0.0013	0.0125	0.0106	0.0161	0.0166	0.0138	0.0148	0.0156	0.0192	0.0262	0.0300
	Avg CAR for companies from USA	0.0007	0.0045	0.0084	0.0074	0.0121	0.0111	0.0149	0.0122	0.0118	0.0125	0.0142	0.0137	0.0136	0.0142	0.0145
Companies from Europe vs USA	Tstat Europe vs USA	2.1655	-1.0123	-	-1.3029	-4.1916	0.4865	-1.3876	1.1884	1.4022	0.3408	0.1584	0.4636	1.3497	2.7932	3.4863
	The T-statistics that are both italics and bold indicate statistical significance at the 1% level.															

2. Share Buyback Announcements and Market Liquidity

Abstract

The aim of this study is to analyze the relationship between share repurchases, credit risk and market liquidity. First of all, it is analyzed what effect a share repurchase has on the credit risk of a company, and secondly, how this effect varies for changing levels of market liquidity. The financial crisis of 2007 – 2008 is the ideal time period for this analysis, given that a severe liquidity shortage occurred. 160 companies, headquartered in North America or Europe, and 428 share repurchases are analyzed over the time period 01/01/2005 until 12/31/2011. Credit default swap (CDS) spreads are used as proxy for the credit risk and an event study is performed using a GARCH(1,1) market model. This panel data analysis shows that the perceived risk level increases after a company announces a share buyback. Thereby, the biggest credit risk deterioration happens after share repurchase announcements in the post-crisis period, and for rather elevated buyback values. Most of these repurchases are financed internally using corporate savings. Hence, the findings imply that liquidity management and cash buffers increased in importance after the recent financial crisis and became a central strategic topic for companies. Still, no linear relationship between repurchases and market liquidity is found. As to my knowledge, this is the first study of the relationship between market liquidity, share repurchases and credit risk. The findings provide substantial new evidence on how to optimize corporate payout policies, and how to improve cash and risk management.

2.0 Introduction

This study aims to analyze the relationship between share buybacks, credit risk and market liquidity. When managers have to take corporate decisions, they are usually influenced by changing external market conditions. Especially market liquidity seems to be an important criterion when deciding upon the payout policy of a firm (Brav et al., 2005; De Cesari et al., 2012; Brockman et al., 2008). In this thesis, the effect of a share buyback announcement on the credit risk of a company is analyzed. In this regard, the influence of changing levels of market liquidity is investigated. Substantial research exists on behalf of the influence of payouts on stock prices, but not with respect to the corporate credit risk. This thesis further extends the results found by Niedermair (2013), who generally analyzes the effect of share buyback announcements on the credit risk of a company and discovers that the credit quality and creditworthiness of a company worsens as a direct consequence of such a payout. Possible explanations for this behavior are the rise in the debt – equity ratio, the loss of financial flexibility for future investment opportunities and the lack of positive net present value projects.

During the financial crisis of 2007 – 2008, a severe liquidity shock occurred and thus, this time period seems ideal for the analysis in question. A pre-crisis, crisis and post-crisis period are identified and then compared with each other in order to see how changing market and liquidity conditions influence the effect of a share repurchase on credit risk. The research question thereby is the following: How varies the effect of share buyback announcements on the risk profile of a company with respect to market liquidity, comparing the financial crisis to normal market conditions? As to my knowledge, this has not been researched previously and the results add substantial new evidence on how corporate payout policies can be optimized, how cash management can be improved and how risk management can be enhanced.

Several hypotheses are tested in this analysis. The credit crisis of 2007 – 2008 had a remarkable impact on the whole economy worldwide, and caused liquidity management and internal cash holdings to become more central and strategic (Polak et al., 2011; Chay et al., 2009; Brav et al., 2005; Bolton et al., 2013). Internal cash holdings were trivial for optimally surviving this period of decreased market liquidity. The concept of “Cash is King” became ever more evident and companies tended to hoard substantial amounts of cash to countervail an eventual external liquidity shock with internal funding buffers. Share buybacks are financed most often internally and cause a probable decrease in the level of future cash holdings. Hence, the influence of the recent financial crisis on the relationship between repurchases and credit risk is examined.

Furthermore, the amount of shares bought back during the financial crisis is analyzed. In this regard, it is also examined what influence the size of the buyback value has on the credit risk of a company. The worse the access to the capital markets, the higher the marginal value of a dollar of internal corporate savings, and hence, by theory, the lower the probability that a firm will engage in a share repurchase (Faulkender et al., 2006). Thus, it is expected that the overall amount of share repurchases decreases during the financial crisis. With respect to the communicated amount itself, it is tested whether a higher

buyback value causes a stronger effect on the risk profile of a company, given that it has a bigger incidence on a firm's balance sheet.

Finally, it is examined whether companies with ex-ante high cash holdings announce to buy back relatively more stocks, during and after the financial crisis, than cash-poor firms. When managers expect a financial crisis in the near future, cash-rich companies can use internal cash holdings in order to smooth out changing external conditions, while cash-poor firms usually forced to cut or delay the payouts to proactively react to the upcoming liquidity crisis (Bolton et al., 2013).

In order to test these hypotheses, an event study methodology is used, which is an ideal tool to detect the causal mechanism of one variable on another. The behavior of an outcome measure around the event date is compared to its normal pattern. The outcome measure in this case are credit default swap (CDS) spreads as proxy for the corporate risk level, and the events are the dates when a company announces a share repurchase. The market model extended by a generalized autoregressive conditional heteroskedasticity process of order 1 is employed to estimate the counterfactual outcome. Thereby, the event window lasts from 7 days prior to the event until 7 days after the event, and the estimation period ranges from 250 days before the event until 8 days before the event. Finally, statistical inference testing is used to examine the above mentioned hypotheses.

160 companies and 428 events are analyzed in the underlying study, over the time period of 01/01/2005 until 12/31/2011. The companies are listed on public stock exchanges and are incorporated in North America or Europe. Some companies engage in share buybacks rather frequently and transfer resources from the corporate to the shareholder level also several times during one year. Therefore, an approach similar to the one as in Hull et al. (2004) is employed and only those events are considered that lie at least 180 trading days apart.

The findings show that the average cumulative abnormal returns are around 2.2 percentage points higher than expected, and statistically significantly different from zero. This implies that the overall risk profile worsens and the corporate default risk increases after a share buyback announcement, confirming the results by Niedermair (2013) and Chen et al. (2012). When differentiating the events with respect to time and comparing the pre-crisis, crisis and post-crisis period with each other, there occurs a substantially bigger deterioration of the risk level for the events announced in the post-crisis period. These findings highlight the increased importance of internal cash holdings in the aftermath of the financial crisis. Also Polak et al. (2011) argue that the role of the corporate treasurer changed substantially and became more central and strategic in recent years. Especially for companies belonging to the financial, utilities and energy sector, this seems to be the case. Hence, companies, in particular those from these three industries, should be aware of the negative effect that share buyback announcements have on the perceived credit risk of a company and eventually look for alternative ways to transfer resources from the corporate to the shareholders' level. In addition, executives should be aware of the increased importance of internal cash holdings and incorporate them in their corporate strategy and business model.

With respect to the size of a share repurchase, there seems to be no substantial change in the pattern of the communicated values across time, not even during the years of 2007 – 2008. These findings are contradictory to those by Finn et al. (2009) and Grace et al. (2009), who discover a declining trend in the announced repurchase values during the crisis years, for UK firms and companies belonging to the S&P 500, respectively. The reason for this contradiction might not only lie in the different sample composition, but also in the way the buyback values are measured. For this analysis, absolute values in dollar terms are used.

The effect of the share buybacks varies for changing values of the repurchase amounts. Still, there cannot be observed a monotonically increasing relationship between the announced amount and the credit risk deterioration. The worst reaction to the buyback announcement with a rather high value is registered in the post-crisis period, enhancing again the importance of internal cash resources for companies in the aftermath of the 2007 – 2008 financial crisis.

Finally, companies with substantial internal cash holdings are announcing higher repurchase values over the whole time period analyzed in this study, when compared to cash-poor firms. These findings imply that buybacks are influenced by how they are financed, given that most repurchases are financed internally (Lasfer et al., 2011), and that the motivation for buybacks lies most often in the existence or non-existence of such unused internal cash resources. These findings are confirmed by the results by Bolton et al. (2013), arguing that cash-poor firms delay their repurchases when it is possible.

This thesis is innovative, given that an event study is performed using CDS spreads and share buyback announcements, and analyzing thereby the influence of market liquidity. This is rendered possible thanks to the exponential rise of the derivatives market in the last few decades, and the availability of daily observations of a company's credit risk, in the form of CDS spreads. As to my knowledge, this is the first study to investigate the interaction between market liquidity, share repurchase announcements and credit risk.

The remainder of this thesis is structured as follows: Section 2.1 surveys the existing literature, Section 2.2 lists the hypotheses, Section 2.3 shows the methodology, Section 2.4 explains the data used in the analysis, Section 2.5 discusses the empirical results and Section 2.6 concludes.

2.1 Literature Survey

The payout policy of a company can take two possible forms; either resources are transferred from the company to the shareholders using dividends, or they are paid out using share buybacks. The focus of this thesis is the latter, namely the share buyback. Repurchases were already at the center of the research conducted by Modigliani and Miller (1958). In perfect capital markets, the value of a firm should not be influenced by a firm's payout policy, a theory also known as the dividend irrelevance proposition. Reality however suggests differently, since capital markets are not perfect and there exist frictions, such as transaction costs, taxes or information asymmetries. Indeed, Lintner (1956) finds that firms seem to set certain goals in their corporate policies regarding how and when cash holdings are paid out. In setting

these goals, companies consider changing market conditions, information asymmetries and financing costs and respect a certain pecking order for the financing of the payouts or upcoming investment opportunities, namely, internal funds are used before debt or equity (Myers et al., 1984; Krigman et al., 2000). Most often, share repurchases are financed internally (Lasfer et al., 2011), and hence, the decision whether to engage in a repurchase or not depends in some parts on the marginal value of the internal cash resources. The higher the marginal value of an extra dollar of cash, the less likely a company will give up one of these dollars and the less likely a firm is to pay out cash to the shareholders. Faulkender et al. (2006) find that the marginal value of cash decreases with a higher leverage ratio, higher cash holdings and better access to the capital markets. When access to the capital markets is exacerbated, then companies prefer to hoard cash internally, in order to keep some buffer for eventual debt obligations that come due in the future. Additionally, the higher the uncertainty of future earning streams, the bigger the value associated by the market to corporate cash holdings (Chan et al., 2013). As a direct consequence, both the probability that a company engages in payouts and the amount itself paid out decreases (Chay et al., 2009).

Banerjee et al. (2007) analyze the payout policy of companies with respect to firm level liquidity. They find that companies are less likely to pay out resources, especially in the form of dividends, when stocks are more liquid. In recent decades, possibly due to improved general liquidity conditions based on increased market activity and decreased trading costs, fewer dividends are paid out. When stocks are highly liquid, investors can themselves simulate a dividend payment, by simply selling a portion of the stocks they hold. This explains the lower probability of companies to engage in such payouts. On the other hand, when companies are more liquid, they could also afford to pay out dividends to the shareholders, since funds can be collected relatively easily for eventual future investment opportunities; but this seems not to be the case, according to Banerjee et al. (2007). The optimal timing is dependent on market liquidity also for share buybacks, but the opposite trend is found, compared to dividend disbursements (De Cesari et al., 2012). It seems that in times of less liquid markets, transaction costs are relatively high, in the form of wider bid-ask spreads for example; so repurchasing shares would lead to lower profits for the companies than in times when the market is more liquid. Hence, the level of share repurchases is reduced in times of decreased market liquidity.

These findings are confirmed by interview results with executives by Brav et al. (2005). Lower liquidity can lead to a reduction in the stock price, due to lower demand by investors and less possibilities to eventually sell the shares. Hence, managers are reluctant to engage in share repurchases when they expect that doing so impacts liquidity negatively.

Brockman et al. (2008) argue that companies do not only tend to switch from dividends towards share buybacks in times of high market liquidity, but managers are also inclined to increase the overall amount paid out. Liquidity has an influence on the frequency of the repurchases too, according to Farrugia et al. (2011). Companies that frequently buy back shares are influenced by adverse or stimulating business environments, whereas firms that buy back stocks only occasionally are not impacted by changing economic conditions.

After announcing a share buyback, stock price returns usually increase and financial analysts tend to adjust the companies' earnings forecasts upwards. In addition, according to Lease et al. (2000) the systematic risk of the companies decreases. Singh et al. (1994) analyze market liquidity before and immediately after the announcement of a share repurchase and find that bid-ask spreads increase substantially, the rise already starting 30 days prior to the event. After the event they do not find any further significant changes in the bid-ask spreads. Chen et al. (2012) differentiate for firms with and without financing constraints, when investigating the effects of buybacks in the post-announcement period. All else equal, a share repurchase leads to a drop in corporate liquidity, because resources are paid out to the shareholders and the leverage ratio increases. Financially constrained firms suffer thereby a bigger impact, and the stock prices react worse for this category of companies. Not only does the probability of financial distress increase, but also the competitive edge worsens. Hence, for financially constrained companies, value is destroyed, but according to Chen et al (2012), managers still announce buybacks, because of their overconfidence and hubris.

When financial constraints exacerbate ever more, a liquidity shortage or credit rationing occurs in the markets. As Tirole (2006) emphasizes, companies can be hit by a shortage in the lending channel, and banks and other financial institutions possess such weak balance sheets that they cannot grant as much financings as they would want to. This was the case during the financial crisis of 2007 – 2008. Duchin et al. (2010) analyze how companies engage in liquidity management during the financial crisis and find that especially firms with low cash reserves and those financially constrained suffer the most due to the sharp drop in the financings granted. Those that have cash holdings on hand are able to partially mitigate the shock, suggesting that internal liquid funds were valued rather positively by the markets in crisis times. In fact, Polak et al. (2011) claim that the role of the corporate treasurer has changed significantly due to the recent financial crisis. While before the crisis, the focus was especially on operational efficiency, cash management, hedging and funding, after the credit crisis his or her task is a broader and more strategic one. The treasurer has to keep an extensive overview of the risks of a company, hedge them accordingly and is responsible to secure that the company has enough liquid resources on hand, even when the financial markets cannot satisfy the corporate demand for funding anymore. Hence, the need for contingency plans becomes evident and treasurers are engaging in accumulating cash cushions as buffers.

Concerning the motivations for share buybacks during the financial crisis, only limited literature exists so far. Banyl et al. (2010) analyze share repurchases during the recent crisis for the financial industry and conclude that firms in this sector try to increase the stock price, already in a downwards trend for most of the companies during the years of 2007 – 2008, by announcing share buybacks. Another objective for financial firms, when engaging in share buybacks, is to send a positive signal to the market, while for industrial firms the free cash flow hypothesis fits better and shareholders want to assure that cash is not wasted by their managers, but instead paid out to them (Floyd et al., 2013).

2.2 Hypotheses

The interaction between share buyback announcements, the risk profile of a company and the recent financial crisis is analyzed in this thesis. The research question is the following:

How varies the effect of share buyback announcements on the risk profile of a company with respect to market liquidity, comparing the financial crisis to normal market conditions?

There has been tremendous research on the influence of share buybacks on the companies' stock prices and liquidity levels, but not on behalf of how the probability of default or credit risk of a company changes after such corporate actions. Generally, the goals of payouts are to convey some kind of information to the markets, to change the capital or ownership structure of the company, to avoid managerial waste, to deter a hostile takeover, to exploit preferential tax treatments or to pay out resources because of a lack of positive net present value projects (Niedermair, 2013). These objectives might vary in their importance across time which potentially leads to different effects of share buybacks on the corporate risk profile. In particular, in this thesis the effects of market liquidity and the financial crisis are analyzed. As to my knowledge, this has not been researched so far and the results add considerable insights regarding the relationship between share buybacks and credit risk during crisis times.

Generally, it is hypothesized that the credit risk increases after a share buyback announcement, as in Niedermair (2013) or Chen et al. (2012). In addition, the following hypotheses are tested.

H1: The financial crisis has a significant impact on how share buyback announcements affect the corporate risk profile.

The credit crisis of 2007 – 2008 had a remarkable influence on the whole economy worldwide. Liquidity dried up for an extended period of time, and the financing demands of companies could not be satisfied anymore. Hence, the role of liquidity management and cash changed, as in Polak et al. (2011), Chay et al. (2009), Brav et al. (2005) and Bolton et al. (2013), and became a central strategic topic for companies. A share buyback announcement causes a probable decrease in the level of cash holdings in the near future, given that most of the repurchases are financed internally. Since cash buffers increased in importance during the crisis of 2007 – 2008, it is expected that the risk profile of a company worsens relatively more after a repurchase announced during or in the aftermath of the crisis.

H2: The amount of shares bought back decreases during the financial crisis.

It is assumed that the number of share buybacks decreases during a financial crisis, as suggested by Chay et al. (2009). The higher the marginal value of an extra dollar of cash for a company, the less likely a firm will engage in a share repurchase (Faulkender et al., 2006), and the worse the access to capital markets, the higher the marginal value of cash. Moreover, the marginal value of cash is boosted by increased uncertainty of future earnings and cash flows (Chan et al., 2013). Nevertheless, according to Finn et al.

(2009), share buybacks are decreased during crisis times but not cancelled altogether. According to the Wall Street Journal, companies from the S&P500 stock index announced 42% less buybacks in 2008, compared to the year 2007 (Grace et al., 2009).

Share buybacks would increase during crisis times when companies want to signal something to the markets and try to distinguish themselves from others by announcing a repurchase. Given the existing literature, this seems however not to be the case.

H3: The size of a share repurchase is significant. The higher the communicated amount of shares intended to buy back, the bigger the risk deterioration.

Further elaborating on what has been found concerning Hypothesis 2, it seems rather intuitive that the amount of shares a company wants to buy back has a significant effect on how the market reacts to such an event. The higher the amount bought back, the bigger the incidence for the balance sheet of the company, and as a consequence, the stronger the effect. Hence, it is assumed that the credit risk deteriorates the most after those events that have the highest announced buyback values. Furthermore, it is expected that the influence of the size of the repurchase remains significant across time, namely in the pre-crisis, crisis and post-crisis period. As to my knowledge, there exists no literature concerning the interaction between the size of a repurchase announcement and credit risk.

H4: During and after the financial crisis, companies with ex-ante high cash holdings are announcing to buy back relatively more stocks than others.

Cash-rich firms have substantial resources on hand and are rather flexible in their decisions regarding liquidity management. Hence, when managers are expecting a financial crisis in the near future, cash-rich companies can use internal cash holdings in order to smooth out changing external conditions, while cash-poor firms have to cut or delay the payouts to proactively react to the expected liquidity crisis (Bolton et al., 2013). However, when external financing becomes cheap and the crisis relaxes, companies with ex-ante high cash holdings seem to actively buy back shares, because of a decreased need for precautionary savings and eventual contingency plans. On the other hand, those with lower liquid resources issue equity and try to increase their funds, even if they do not have an immediate need for it. Hence, cash-rich companies should buy back more shares during and after the financial crisis than cash-poor companies.

2.3 Methodology

The event study methodology is an ideal instrument to detect the causal mechanism of one variable on another. It is based on the comparison of the behavior of a certain outcome measure around the event date to the normal pattern prior to the event (Campbell et al., 1997).

In the underlying analysis, the events are the share buyback announcements, or rather the dates when a company communicates to the public that it intends to engage in a stock repurchase. Most of the time,

these events are sudden and unexpected by the markets, which makes them ideal for the methodology in question.

The outcome measures are credit default swap, or CDS, spreads. They are used as proxies for the credit risk level of a company and hence, indicate whether a company becomes more or less risky by looking at the changes in the CDS spreads over time. A CDS is a hedging instrument with the purpose to transfer the credit risk of a certain reference entity from one counterparty to another. Thus, its function is similar to an investor's insurance contract against the default risk of a company, where she or he is investing in. The spread of the CDS contract is the annual amount the buyer has to pay in order to insure himself or herself against the default risk of the reference entity (Hull, 2012). That is why it can be considered as proxy for the risk level of a company. To be precise, the periodic nominal daily returns of the CDS spreads are used in this analysis, to have scale-invariant measures. Positive returns would indicate that a company becomes more risky, and negative returns imply that the default risk of a firm decreases and its creditworthiness improves.

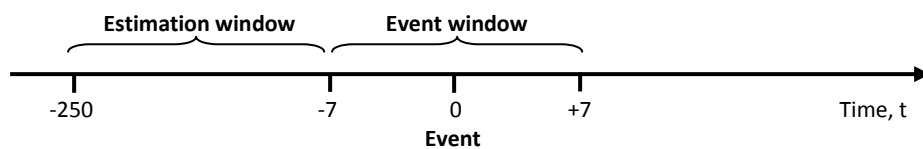


Figure 11: Estimation period and event period

An event study requires identifying an event period and an estimation period. The event period is the day on which a company's share buyback announcement occurs, and the estimation period are the days prior to the event, used to measure the typical behavior of the outcome measure in normal market conditions. As can be seen from Figure 11, the estimation window lasts from 250 days prior to the event until 7 days before the event; whereas the event period ranges from 7 days before until 7 days after the event. The event itself is on day 0.

To be able to carry out an event study, the following three assumptions have to be satisfied (Bach, 2012):

- *Common Trend Assumption*: If no event would occur, the outcome measure, or in this case the CDS spread returns, would be close to normal. Normal refers thereby to the behavior of the outcome measure that is similar to the one during the estimation period.
- *No Anticipation Assumption*: The share buyback announcement should be unexpected and completely new information to the markets. This allows to exactly measure the impact of the event on the outcome measure. In reality, it happens sometimes that there occur leakages of information, because companies or employees release minor news already before the actual announcement of the share repurchase. To counterbalance this pattern and to not underestimate the effect of the share buyback announcements, the event period is not restricted to day 0 only, but is extended to a 14 days period as shown in Figure 11.
- *Efficient Market Hypothesis Assumption*: The third assumption refers to the weak form of the efficient market hypothesis by Eugene Fama (1970), requiring that the past relevant information that is conveyed to the markets, is transmitted to the outcome measure instantaneously.

Though, in reality this is not always the case and sometimes an extended period of time is needed until new information is incorporated in the price of a financial asset.

In the next sections, these three assumptions will be further tested and discussed.

To begin with, the event study methodology requires the knowledge of the counterfactual outcome which is the outcome measure if no event would have happened. To measure these so called normal CDS spread returns, a statistical model is used, namely the market model as in Formula 17 – 19 extended by a GARCH(1,1) process, or generalized autoregressive conditional heteroskedasticity process. The market model is based on the market return, in order to control for confounding factors that are common to the whole stock market and to avoid an under- or over-estimation of the effect of the event. Hence, the market return and the GARCH terms are the independent variables in this multivariate regression function, and the CDS spread return is the dependent variable. The same companies are analyzed over an extended period of time, implying that in this thesis a panel data analysis is performed.

The returns of financial assets are usually time-variant and non-normally distributed (Campbell et al., 1997). Therefore, it seems appropriate to use a model that takes these characteristics into account. Actually, the GARCH process considers both the time-variance and the persistency in the volatility of the CDS spread returns.

To begin with, the parameters of the regression function in Formula 17 are estimated over the estimation period $[-250, -7[$ with a maximum likelihood function in Matlab, and then used to estimate the normal returns over the event period $[-7, +7]$. Afterwards, the normal returns are deducted from the actual CDS spread returns over the event period, to obtain the abnormal returns, as in Formula 20. The abnormal returns are the deviations from normality. They provide information on how big the impact of the share buyback announcements on the creditworthiness of a company is.

$$AR_{it} = R_{it} - E[R_{it}|R_{mt}] \quad (16)$$

$$E[R_{it}|R_{mt}] = \mu_i + \gamma_i R_{mt} + u_{i,t} \quad (17)$$

$$u_{i,t} = \sigma_{i,t} \varepsilon_{i,t} \quad (18)$$

$$\sigma_{i,t}^2 = \omega_i + \beta_i \sigma_{i,t-1}^2 + \alpha_i u_{i,t-1}^2 \quad (19)$$

$$\widehat{AR}_{it} = R_{it} - \hat{\alpha}_i + \hat{\beta}_i R_{mt} \quad (20)$$

$$\widehat{AR}_{it} \sim N(0, Var[AR_{it}]) \quad (21)$$

$$Var[AR_{it}] = \sigma_{\varepsilon_i}^2 + \frac{\sigma_{\varepsilon_i}^2}{T_1 - T_0} \left[1 + \frac{(R_{mt} - \hat{\mu}_m)^2}{\hat{\sigma}_m^2} \right] \quad (22)$$

where AR_{it} are the abnormal returns for company i at time t , R_{it} are the actual returns, R_{mt} is the market return, μ_i is a constant, γ_i is the coefficient of the market return, $u_{i,t}$ are the residuals, $\sigma_{i,t}$ and $\sigma_{i,t}^2$ stand for the volatility, $\varepsilon_{i,t}$ is a random variable identically and independently distributed with

$E(\varepsilon_{i,t}^2) = 1$, ω_i is a constant, β_i is the coefficient of the GARCH term and captures the time-variance of the volatility, α_i is the coefficient of the ARCH term and captures the persistency in the volatility, $\sigma_{\varepsilon_i}^2$ are the real disturbances, T_1 and T_0 refer to the length in days of the estimation period, $\hat{\mu}_m$ is the arithmetic mean of the market return, $\hat{\sigma}_m^2$ is the variance of the market return.

Finally, the estimated abnormal returns from Formula 20 are aggregated over the whole event period and then the average of these returns is taken across all of the companies and events included in the sample. The results are the cumulative abnormal returns as in Formula 23.

$$\overline{CAR}[-7, +7] = \frac{1}{N} \sum_{i=1}^N \sum_{t=-7}^{+7} AR_{it} \quad (23)$$

where CAR are the cumulative abnormal returns and N is the total number of companies and events.

To examine the hypotheses as explained in Section 2.2, statistical inference testing is necessary, in order to conclude whether the cumulative abnormal returns are significant deviations from the normal returns or not.

$$\frac{\overline{CAR}_A[-7, +7] - \overline{CAR}_B[-7, +7]}{\sqrt{Var(\overline{CAR}_A[-7, +7]) + Var(\overline{CAR}_B[-7, +7])}} \sim N(0,1) \quad (24)$$

$$Var(\overline{CAR}[-7, +7]) = \frac{+7 - (-7) + 1}{N^2} \sum_{i=1}^N \hat{\sigma}_{\varepsilon_i}^2, \text{ where } \hat{\sigma}_{\varepsilon_i}^2 = \frac{1}{-250 - (-7) - k} \sum_{t=-250}^{-7-1} AR_{it}^2 \quad (25)$$

where k refers to the estimated number of coefficients in the market model as in Formula 17.

The T-statistics are calculated as in Formula 24 – 25, in order to be able to compare different groups of events, such as a share buyback announcement before the crisis to one after the financial crisis. The null hypothesis thereby is that both groups of events, A and B, have the same cumulative abnormal returns.

2.4 Data

The sample used in this analysis consists of companies headquartered in both Europe and North America. These two regions are analyzed due to their advantage of providing daily observations for the credit default swaps. Moreover, these instruments are traded relatively frequently in these countries and are thus considered as rather liquid markets. In particular, the 250 companies forming the CDX North America Investment Grade index and the Markit iTraxx Europe index are analyzed. Daily observations for CDS contracts of a maturity of 5 years are obtained from Bloomberg, namely single closing prices, bid prices, ask prices and aggregate spreads for the whole indices.

The time period analyzed is 01/01/2005 until 12/31/2011 and a pre-crisis phase, the financial crisis itself and a post-crisis era are identified within this 7 year range. This time period is ideal to investigate the

relationship between market liquidity and share buyback announcements. As start date of the financial crisis, August 9th, 2007 is taken, the day when the bank BNP Paribas announced that three of its hedge funds, specialized in US mortgage debt, had problems (The Guardian, 2011). For what concerns the end date of the financial crisis, it is rather difficult to determine it, since the financial crisis changed into a credit and sovereign crisis in Europe, and is partially still going on, as of September 2013. Still, from Graph 2 it is possible to see that liquidity levels improved in the markets after December 31st, 2009, which is considered as the end date of the financial crisis in this analysis. As proxies for relatively normal and liquid markets, one year of data before the crisis period and one year from the post-crisis era is taken, namely the year 2005 and 2011. Both these years are not immediately adjacent to the financial crisis in order to avoid distortions. Hence, this allows to compare the effect of a share buyback announcement on the risk profile of a company during the crisis and during normal conditions.

Figure 12 shows arithmetic averages of the bid-ask spreads, or the difference between ask prices and bid prices, for the 250 companies. The two vertical blue lines indicate the start and end date of the crisis period. The red line represents the average bid-ask spreads in USD. In order to be able to calculate this average, the spreads of the iTraxx Europe, quoted in EUR, are converted into USD according to the proper exchange rate, taking the last price of the according day.

The level of bid-ask spreads is considered as proxy for market liquidity. The higher the difference between the offering price by a buyer and the selling price by a seller, the less liquid a market is. Bid-ask spreads increase excessively up to a difference of 35 bps on a 5 year CDS contract at the beginning of 2008. In order to insure 10 million USD against the risk of default using a CDS, 35 bps imply a price difference of 35,000 USD. The bid-ask spreads turn even slightly negative during the year of 2008, an anomaly suggesting that bid prices were higher than ask prices. This situation is also referred to as a crossed market. It is a phenomenon that is observed frequently for fragmented markets nowadays, where there prevails a fierce competition for order flow. Moreover, in the case of differential liquidity rebates and access fees for traders, the bid-ask spreads can also be negative, but potentially only for one of the participants (Garvey et al., 2006). Given that this phenomenon is still highly debated and researched, it is difficult to say what influence the negative bid-ask spreads have on the results of this study. Based on the fact that they are negative only for a rather short period of time, namely only for 20 working days, it can be assumed that this anomaly does not have any major impact on the findings.

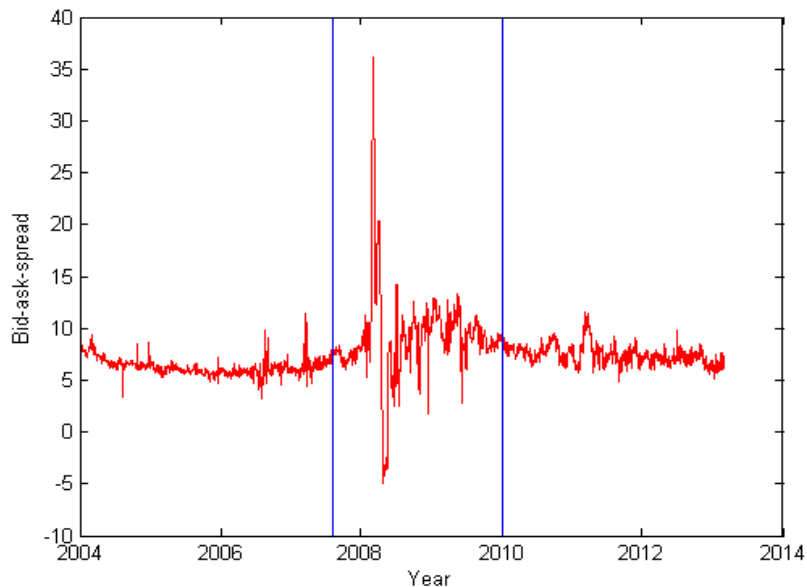


Figure 12: Historical bid-ask-spreads

The red line represents the average bid-ask spreads in USD, and the blue vertical lines indicate the start and end date of the financial crisis.

Further data is obtained from Bloomberg, Wharton Research Data Services and Factiva, that is annual balance sheet data and the dates of the announcements of the buybacks. In addition to these dates, also the value of the buyback is collected from Bloomberg and then converted into USD. This assures consistency and allows to compare the components of the iTraxx Europe, quoted in Euro, to the ones of the CDX NA IG, quoted in USD. Hence, also the daily exchange rates for the years 2005 until 2011 are gathered, considering always the closing prices of each day for the EUR-USD, SEK-USD, GBP-USD, CHF-EUR, NOK-EUR or CAD-USD rate.

Figure 13 shows the average daily historical CDS spreads for the 160 companies, depicted against time. As expected, during the crisis of 2007 – 2008, average daily spreads peaked at around 380 bps, indicating that the general credit risk level was excessively high. These observations confirm the above assumed start and end dates of the crisis, chosen based on Figure 12. Average CDS spreads decreased again after the year 2009 and seem to be still in a downwards trend in 2013.

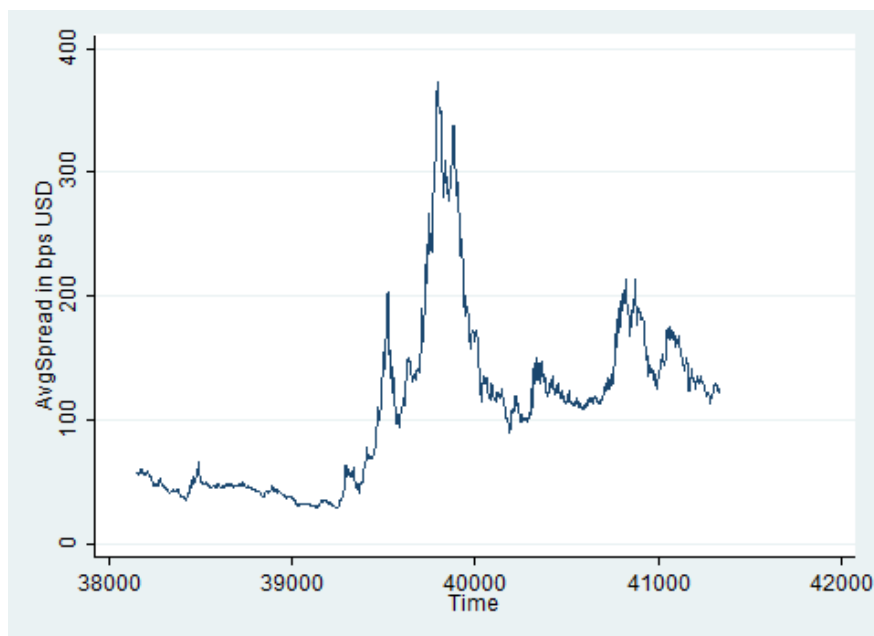


Figure 13: Historical CDS spread levels

The numbers on the x-axis refer to the following dates: 38,000 is Jan 2004, 39,000 is Oct 2006, 40,000 is July 2009, 41,000 is April 2012, 42,000 is Dec 2014.

Not all of the 250 companies forming the two stock market indices are included in the final sample. Some firms did not engage in any buybacks during the time period in question, so they were eliminated. Ford Motor Co. seems to be an outlier and is excluded as well, because of excessive CDS spread levels. This company was nearly facing bankruptcy and was saved by the US government in the end.

Several firms announced more than one buyback over the years from 2005 until 2011. In order to not under- or overestimate the effect of a single share buyback announcement, an approach similar to the one used by Hull et al. (2004) is used. Hence, only those events are included where there are at least 180 trading days between one and the next repurchase announcement. IBM Corp. is excluded in this context, because of having announced buybacks rather frequently. Other events are excluded because of not leading to statistically significant parameters in the quantitative analysis. For each of the events, a regression function as in Formula 17 is estimated. This regression function does not fit well the data for some of the events, and that is why these events are excluded. In the end, there are 160 companies and 428 events effectively analyzed for this thesis.

Figure 14 shows to which sector the 160 companies belong. The overall majority is either from the Communications, Consumer Discretionary or Industrials sector, but also the other industries are to a greater or lesser extent well represented in the sample. In order to test Hypothesis 1, not only the general impact of how the financial crisis impacts the effect of share buyback announcements on the risk profile of a company is analyzed, but the goal is also to distinguish among the companies by sector. This allows to see if there are differences among industries. Furthermore, it makes possible to test whether certain industries are more impacted by the financial crisis than others, in that perspective. Due to a data availability issue and to assure that the sample does not get too small in the end, the industries are aggregated as follows for Hypothesis 1: Communications & Consumer Discretionary, Energy & Utilities,

Financials, Industrials & Materials & Technology, Others. The whole sample is therefore split into subsamples according to the five groups of their sector affiliation, and then the average of the cumulative abnormal returns is taken for each of these groups.

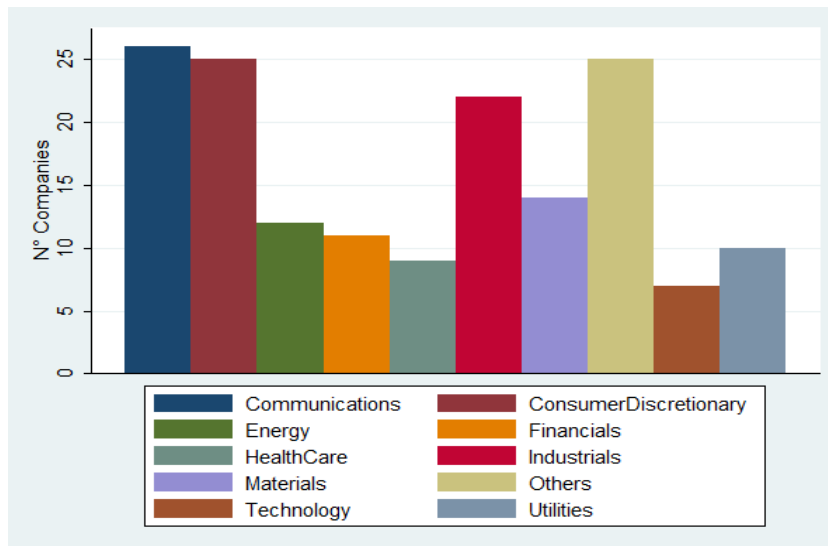


Figure 14: Sector affiliation

In order to test Hypothesis 3, as explained in Section 2.2, data on the size of the share buybacks is required. This information was available only for 220 events. Table 11 shows the quantile distribution of the share buyback values, dividing the 220 events into five groups. These five groups are then compared to each other in order to examine whether different sizes of the buyback have different implications for the credit risk level of a company.

The table evidences that there is a huge dispersion among the announced buyback values across the companies and across the events. This pattern is rather normal, given that different companies follow different goals when announcing a buyback. Some managers might try to completely change the ownership structure and the majority of the voting rights of a company, so they are announcing higher repurchases. Others, on the other hand, might only want to buy back a minor part of their outstanding shares. Hence, the lowest buyback value is equal to 11,000 USD and the highest is equal to 25 billion USD. At more than half of all the repurchase events, the firms' managers announced to buy back less than 1 billion USD worth of outstanding shares.

Quantile	Nr. Obs	Mean	Std. Dev.	Min	Max
$P(X \leq q) \leq 0.20$	68	291.0585	207.8172	0.0110	500.0000
$P(X > q) > 0.20 \text{ \& } P(X < q) \leq 0.40$	50	901.7504	140.9947	600.0000	1000.0000
$P(X > q) > 0.40 \text{ \& } P(X < q) \leq 0.60$	14	1427.4000	120.3723	1198.1000	1500.0000
$P(X > q) > 0.60 \text{ \& } P(X < q) \leq 0.80$	45	2519.5220	732.1594	1600.0000	4000.0000
$P(X \geq q) \geq 0.80$	43	8112.2950	4137.3560	4028.7000	25000.0000

Table 11: Descriptive statistics for the buyback amounts

The values in the table are reported in USD Million.

Furthermore, for each company, the ratio of Cash and Equivalents to Total Assets is calculated. This allows to examine Hypothesis 4 and to test whether cash-rich and cash-poor companies show different patterns for the share buyback announcements. In table 12, the descriptive statistics for the companies are reported, divided into quantile groups according to the average cash holdings over the whole time period. Average cash ratios are to be found in the range of 0% to an astonishing 42%, while the overall average of the sample is equal to 9%. Thus, some companies do not keep any liquid resources at all, while others dispose of more than one third of the overall assets in cash and equivalents. These amounts are highly related to the industry in which a firm operates, its business cycle and the type of the business. Cyclical or volatile businesses, for example, usually keep higher cash resources as a buffer or hedging strategy. These differences across the companies' cash ratios are used in the following section, in order to examine whether there is a relationship between the internal cash holdings, the buyback announcement and the credit risk level.

Quantile	Nr. Obs	Mean	Std. Dev.	Min	Max
$P(X \geq q) \geq 0.75$	40	0.1728	0.0718	0.1120	0.4192
$P(X > q) > 0.25 \text{ \& } P(X < q) < 0.75$	80	0.0732	0.0201	0.0386	0.1099
$P(X \leq q) \leq 0.25$	40	0.0272	0.0088	0.0007	0.0377

Table 12: Descriptive statistics for the ratio of Cash & Equivalents to Total Assets

When the average of the cash holdings is taken across firms for each year, an increasing trend can be observed with a peak in the year 2010, the immediate aftermath of the financial crisis. Figure 15 indicates that the overall level of cash holdings within the companies analyzed in this sample increased over time.



Figure 15: Historical average cash holdings as percentages of total assets

2.5 Empirical Results

The market model, extended by a GARCH(1,1) process is estimated, as described in Section 2.3 and shown in Formula 16 to 20. For each single event, a multivariate regression is estimated over the

estimation period. There is some heteroskedasticity in the variance of the error terms, as can be seen from the ACF and PACF, or sample autocorrelation and partial autocorrelation functions, in Appendix 1. Only the ACF and PACF of the first 6 companies are reproduced for explanatory reasons. The figures on the left side in Appendix 1 show the autocorrelation functions of the CDS spread return series before the model estimation. On the ones on the right side, the ACF and PACF for the standardized squared residuals after the GARCH(1,1) market model estimation can be seen. For most of the companies, the autocorrelation is reduced substantially, and the blue bars stay within the two-standard error boundaries, shown in the figures. Hence, the model as in Formula 17 to 19 seems to be appropriate for this kind of data and this kind of analysis. Naturally, it would be better to fit a single model with an appropriate order of the GARCH process for each of the 428 events. But this is not done in this analysis, because the estimation errors do not add up that much over the 15 days period of the event window and the GARCH(1,1) process is also the best and most efficient alternative in most of the cases.

As explained in Section 2.3, the estimated parameters of the GARCH(1,1) process have to satisfy certain conditions. Among others, all the estimated coefficients for the GARCH and the ARCH term of the various events should be positive. Apart from one event, which is excluded, all the GARCH and ARCH terms are positive. 19 events are also excluded, because both the ARCH and the GARCH coefficients were not significant at the 10% confidence level.

CAR [-7,+7] for all events (428 events)	0.0219
T-statistic	13.2155

Table 13: T-statistic for the cumulative abnormal returns for all events

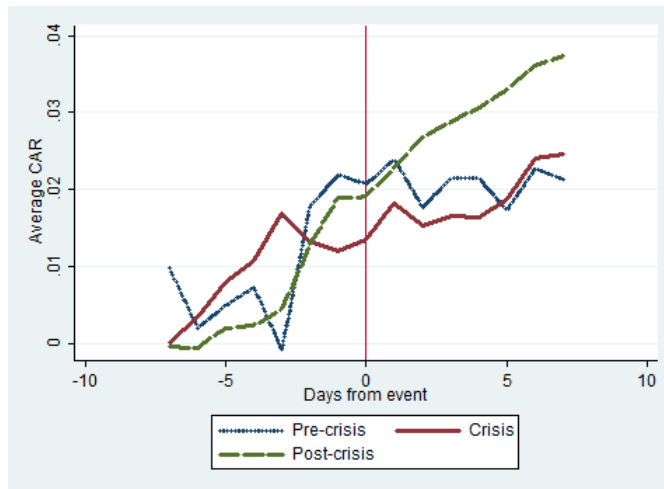
Overall, a general increase in the CDS spread returns can be observed after a share buyback announcement. Table 13 shows that the average CARs are roughly 2.2 percentage points higher than expected, and statistically significant at the 1% confidence level. These results are similar to the ones found by Niedermair (2013), differing only slightly, because for the analysis of this thesis no sectors are excluded, while in the previous work, firms belonging to the utilities and financial sector are not considered. These companies are excluded by Niedermair (2013), because the focus of her work is the relationship between cash holdings and repurchase announcements; and the level of cash for utilities and financial companies is sometimes affected by exogenous factors, such as capital regulations and laws. Meanwhile, the focus of this thesis is the interaction between market liquidity and share repurchases, and that is why no sectors are excluded and a bigger sample is kept.

In the following paragraphs, the results for each of the four hypotheses are presented and discussed.

Results H1: The financial crisis has a significant impact on how share buyback announcements affect the corporate risk profile.

Companies that announce a share buyback during the financial crisis are compared to those announcing a repurchase under normal market circumstances before and after the 2007 / 2008 crisis, in order to test

Hypothesis 1. Before the event, represented by the red vertical line in Figure 16, there seems to be some minor variation in the cumulative abnormal returns. This could be due to a partial leakage of information by some companies or certain corporate actions that allow the markets to conclude that a repurchase might be announced in the near future.



$\overline{CAR} [-7,+7]$ for events during the crisis (105 events)	0.0246
T-statistic	8.0758
$\overline{CAR} [-7,+7]$ for events before the crisis (37 events)	0.0214
T-statistic	2.7111
$\overline{CAR} [-7,+7]$ for events after the crisis (64 events)	0.0373
T-statistic	14.0278

Figure 16: Cumulative abnormal returns, comparing pre-crisis, crisis and post-crisis events

Repurchases announced before and during crisis times lead to cumulative abnormal returns higher than expected by around 2 percentage points, after the event. It becomes therefore more expensive for an investor to insure himself or herself against the risk of default of a certain company. Hence, the risk profile of the firms worsens in the immediate aftermath. This effect is statistically significant at the 1% confidence level. Figure 16 shows also that those companies that announce a share buyback in the post-crisis period suffer a substantially bigger deterioration of their risk profile. This can be derived from Figure 16, where the green line, which represents CARs for events in the post-crisis period, is substantially higher than the other two lines. The higher the CDS spread returns, the higher the costs for the insurance against the default risk of a company, and the higher therefore the firm's perceived credit risk. These CARs are nearly 4 percentage points higher than expected, and also statistically significant at the 1% level. A share repurchase announces a possible reduction in the internal cash resources of the company, which is a possible explanation for this increase of the credit risk. Hence, the results by Polak et al. (2011) can be confirmed, and cash management seems to play indeed an essential role in the aftermath of the financial crisis.

Given these results, Hypothesis 1 can be confirmed and the financial crisis seems to really have an impact on how share buybacks affect the credit risk of a company. It is however not possible to draw further conclusions on the causality and interrelation between market liquidity and share buyback announcements, based on Figure 16, because both the pre-crisis period and the post-crisis period show rather normal market circumstances with low bid-ask-spreads and high levels of market liquidity, but there are observed yet different CARs. With respect to causality, the event study allows to examine the causal relationship between the share buyback announcement and the credit risk, but on behalf of the influence of the financial crisis only univariate evidence can be shown.



Figure 17: CARs for events differentiated by sector affiliation

Fin refers to companies from the financial industry, Comm-Consum is communications & consumer discretionary, Uti-Ener is utilities & energy, Indu-Mat-Tech is Industrials & Materials & Technology.

In Figure 17, a differentiation by the sector affiliation of the companies is made. This allows to see whether the relationship between the financial crisis, share buyback announcements and credit risk varies for different sectors. This aspect has not been researched previously, based on the existing literature.

Figure 17 shows that for companies belonging to the financial, utilities and energy sector, the risk profile worsens the most after share buybacks in the period after the recent financial crisis. Thus, for these companies, cash and treasury management seems to have increased in priority within the manager's decisions, or at least the market perceives it like that. For firms from the communications and consumer discretionary sector the opposite seems to be the case, CARs in the pre-crisis period are significantly higher than in the post-crisis period. For other sectors, such as companies belonging to the industrials, materials or technology industry, it is not possible to interpret the findings any further, since the event study seems to not lead to well-defined results, as can be seen from the graph in the lower right corner of Figure 17. This might be due to a lack of enough data, since the sample decreases by virtue of the separation of the events and companies according to sector affiliation. Further results for the tests shown in Figure 17 are reported in Appendix 2, such as average cumulative abnormal returns, T-statistics and the number of events analyzed for each of the four graphs.

Results H2: The amount of shares bought back decreases during the financial crisis.

Only for 220 of the 428 events a buyback value could be obtained from Bloomberg. The values are converted into USD, in case the buybacks were announced in currencies different from the US dollar, as mentioned in Section 2.4. Figure 18 shows a scatter plot of the buyback values in million USD against time, and the average yearly values of the announced buybacks. The smallest announced amount is 11,000 USD, the highest 25 billion USD and the average is around 2.5 billion USD, hence, there are huge differences. Both graphs in Figure 18 indicate that it is rather difficult to evaluate whether the announced share buybacks increased or decreased during the financial crisis. Based on the graph on the right side, it seems that the average level of buybacks was rather high in the year 2007 and 2009. But these results have to be considered with caution, since these yearly arithmetic averages are subject to outliers, as can be deduced from the graph on the left side in Figure 18. The medians are therefore reported in Table 14. When comparing the median buyback values to the arithmetic averages, it can be seen that the former are always lower than the latter. Hence, the arithmetic averages are influenced by single, rather high buyback values. This is also confirmed by the scatter plot in Figure 18.

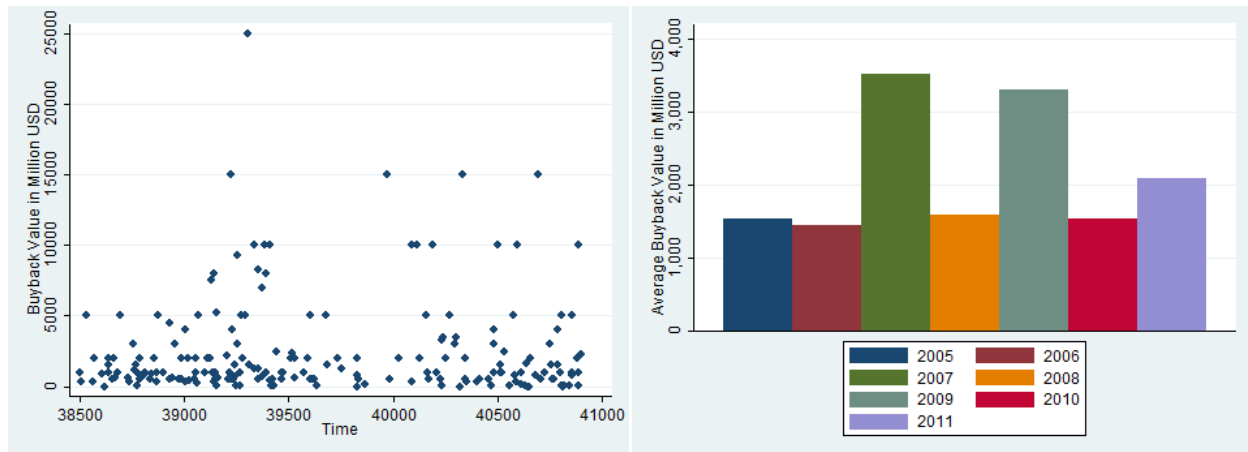


Figure 18: Historical buyback values in million USD

The numbers on the x-axis on the graph on the left side refer to the following dates: 38,500 is May 2005, 39,000 is Oct 2006, 39,500 is Feb 2008, 40,000 is July 2009, 40,500 is Nov 2010, 41,000 is April 2012.

Year	2005	2006	2007	2008	2009	2010	2011
Median	1000	1000	1250	1142.75	1000	1500	1000

Table 14: Median buyback values in million USD

In any case, it is possible to conclude that there seems to be no break in the pattern of the announced share buyback values through time, not even during the financial crisis. This is somewhat contradicting to the findings by Finn et al. (2009) and Grace et al. (2009), claiming that repurchases dropped during the crisis for UK firms and those belonging to the S&P 500, respectively. Hypothesis 3 will provide more detailed results on the buyback values.

Results H3: The size of a share repurchase is significant. The higher the communicated amount of shares intended to buy back, the bigger the risk deterioration.

When analyzing the influence of the absolute amount of the buyback value on credit risk, the pattern seems to be non-linear. Figure 19 shows that for both the highest and the lowest quantile, the effect of the share buyback announcements on the default risk of a company is similar and CARs are equal to 5 percentage points. The lowest and highest quantile of the buyback sizes are the dark blue and light blue lines in the graph and refer to repurchase values below 500 million USD or above 4 billion USD. The detailed quantile distributions can be seen in Table 11 in Section 2.4.

The T-statistic in Figure 19 compares the highest quantile to the lowest quantile, in order to examine whether these two extreme buyback sizes have significantly different impacts on the credit risk. But this is not the case, and the null hypothesis, that both categories of events have the same influence, cannot be rejected.

For buyback values in the range between 1 – 4 billion USD, the CARs are 3 percentage points higher, and statistically significant at the 1% confidence level. This can be seen based on the green and orange lines in the graph, representing the middle and second highest quantile. The lowest impact have buyback values between 600 million USD and 1 billion USD, illustrated by the red line in Figure 19, with CARs higher than expected by only 1 percentage point. Hence, there seems to be a U-shaped relationship between the announced buyback values and the impact on the risk level of a company.

Additional details on the CARs and T-statistics for the five quantile groups are reported in Appendix 3.

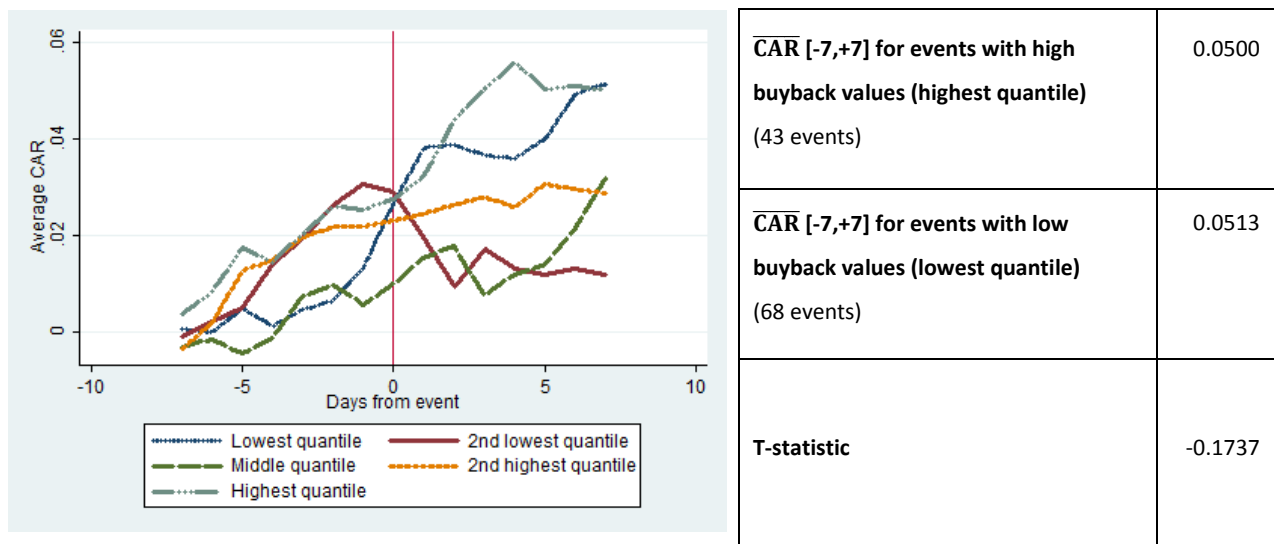


Figure 19: CARs for events with relatively high buyback values versus events with low buyback values

Hypothesis 3 can definitely be confirmed, since the events have different impacts on the credit risk of a company for changing buyback values. It is however not possible to observe a linear incidence of the buyback size on the default risk. In any case, the effect of the share buyback announcements is for all the

announced repurchase values negative with respect to the credit risk of a company. The influence of the announced amount has not been analyzed by the existing literature and is innovative as such.

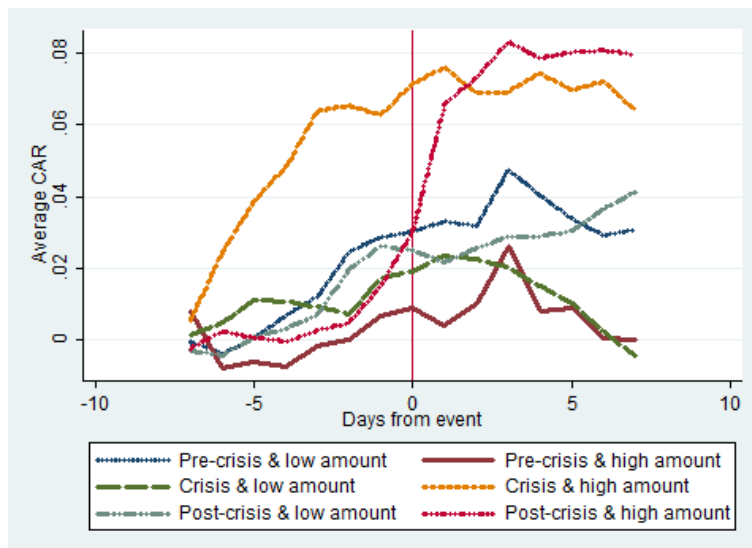


Figure 20: Plot of CARs for low vs high buyback amounts, differentiating by the time periods pre-crisis, crisis and post-crisis

In addition, the influence of the buyback values is also analyzed with respect to market liquidity, namely in the pre-crisis, crisis and post-crisis period. With respect to the level of the buyback sizes, only the lowest and highest quantile are considered, representing extreme repurchase amounts. Figure 20 shows the results, while the T-statistics are reported in Appendix 4.

The worst reactions to the buyback announcements have those events that happened in the post-crisis period and gave notice of a rather high repurchase value. The cumulative abnormal returns are by 8 percentage points higher than expected, as can be seen from the pink line in Figure 20. These findings confirm the results from Hypothesis 1 that internal cash buffers increased in importance after the financial crisis of 2007 – 2008.

Announcing a high buyback value during the crisis period leads to 7 percentage points higher than anticipated returns. This is opposed to cumulative abnormal returns equal to 0 for those with a relatively elevated buyback value in the pre-crisis period. Announcing a low buyback value has a comparatively minor impact on the risk profile, being around 0 percentage points during the crisis period and between 3 and 4 percentage points during the pre-crisis and post-crisis period. This aspect of share buyback announcements has not been researched previously, and it therefore complements the existing literature on behalf of when and how much cash is optimal to pay out to the shareholders.

Results H4: During and after the financial crisis, companies with ex-ante high cash holdings are announcing to buy back relatively more stocks than others.

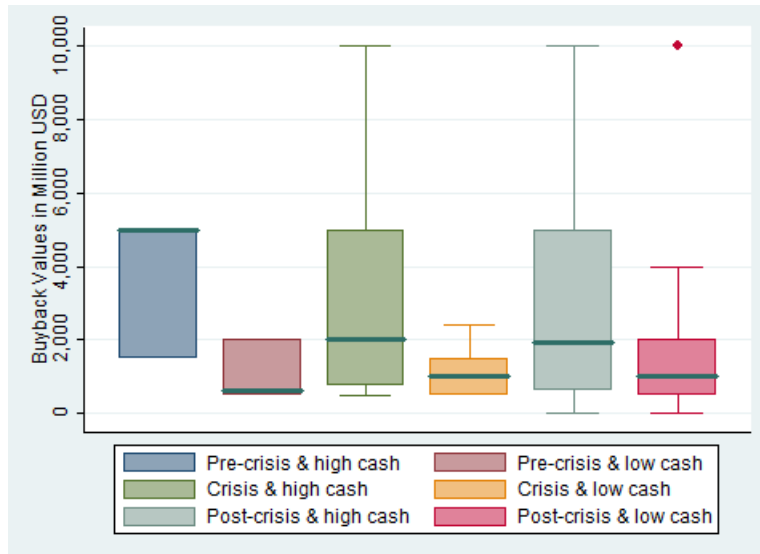


Figure 21: Box plot of buyback values, differentiating by time period and amount of corporate cash holdings

The thick lines inside the boxes represent the median, the outer borders of the boxes show the 25th and 75th quantile and the whiskers represent values outside the inter-quantile range, or the middle 50%.

Cash-rich companies have more resources on hand to be able to buy back shares. Hence, the findings in Figure 21 seem reasonable. For all three time periods analyzed, the pre-crisis, crisis and post-crisis period, cash-rich companies announced on average higher buyback values than companies with relatively lower internal savings. Also the median is always higher for cash-rich firms, compared to cash-poor firms, indicated by the thick lines inside of the boxes in Figure 21. It seems intuitive that cash-poor companies buy back fewer stocks, due to their restricted internal resources. Still, they could request a loan in order to finance the corporate payout.

It seems that companies with high cash holdings do not only use repurchases to differentiate themselves during a crisis, but also in periods of relatively high market liquidity when companies do not expect any crisis to happen in the near future. Then again, the findings could also imply that cash-rich companies simply do not have any positive net present value projects on hand and repurchase shares because of that. The motivations for share buybacks can be many, as was outlined also in the literature survey in Section 2.2.

2.5.1 Implications and Limitations

The above results make it evident that the financial crisis had a major impact on cash and treasury management for companies. It seems that it increased in weight and became an essential strategic component managers have to consider. When companies announce a share buyback in the post-crisis period, the increase in credit risk is substantially higher, compared to before the crisis. Thereby, this is especially the case for companies belonging to the financial, utilities or energy sector. Hence, companies

should either choose a different way to transfer cash from the firm to the shareholders, such as through dividends or a corporate loan extended to the shareholders, or not buy out the resources at all. In any case it is essential, that executives know about the increased importance of internal cash holdings and what a reduction of them implies for the perceived risk level of a company.

In light of the corporate risk management, companies should be aware of the negative effect share buyback announcements have on the perceived default risk of a company. Given the essential role of treasury management, especially after the 2007 – 2008 financial crisis, as is confirmed also by Polak et al. (2011), companies should consider including cash management as an important component of their business model and strategy, if they do not already do so. It is vital to actively manage a company's cash resources. No previous study analyzed the link between share buyback announcements and credit risk, investigating thereby the influence of the financial crisis. The findings from this analysis should be applied by companies in real world situations, in order to improve cash management and the buyback of shares.

Another concluding remark is that companies seem not to adjust the buyback level to market liquidity. There cannot be found any significant difference across the years of 2005 until 2011, even though the degree of market liquidity varied heavily during this time period. Hence, the findings by Chay et al. (2009) that share buybacks decrease during crisis times cannot be confirmed. Whether this behavior by companies is ideal or not is questionable. Profits on buybacks announced during less liquid markets are lower (De Cesari et al., 2012). Moreover, the risk profile worsens in any case after a share buyback announcement. Especially during a financial crisis however, the default risk as perceived by the markets is better be kept at lower levels. Hence, firms should evaluate the decision to repurchase shares in light of their corporate risk level. They should take into consideration also the degree of liquidity in the financial markets.

Further research could investigate how corporate risk management can be optimized by linking buyback actions to market liquidity. In periods of illiquid markets, repurchase values should be decreased, and in periods of liquid markets the sizes can be raised. Another possible explanation why share buyback values remain rather constant across the years is that these payout measures can also act as substitutes for dividends. Hence, it would be interesting to analyze repurchase values and dividends together, to see whether companies, for instance, switch from one payout mean to another during the crisis.

In addition, it is analyzed what incidence the buyback amount has on the credit risk. When looking at the whole 7 year time period, it seems that in general both a low buyback value and a high repurchase value have a similar effect on the credit risk. So it is more the announcement itself than the buyback amount that is perceived by the markets and has a negative influence on the corporate risk. There is no linear relationship, but somehow a U-shaped connection between repurchase value and credit risk. When differentiating however by pre-crisis, crisis and post-crisis period, the findings bring forth that the markets dislike big repurchases especially after the years of 2007 – 2008. Cumulative abnormal returns are by 8 percentage points higher than expected for these kinds of events. This is a rather elevated amount and the CDS spreads increase substantially. Hence, again the essential role of internal cash resources in the post-crisis period is highlighted.

In addition, cash-rich companies buy back more shares than cash-poor companies. They have more resources on hand and can, as a consequence, better afford such corporate actions. They enjoy an increased flexibility in their movements. Thus, this implies that the financing possibilities for the buybacks have an influence on the repurchase decision itself. Indeed, most repurchases are financed internally, as claims also Lasfer et al. (2011). This in turn allows to draw some further conclusions on why shares are bought back, namely, because there are internal unused cash resources that are not invested in positive net present value projects or other investment opportunities. Companies that do not possess such cash buffers, engage less in repurchase activities compared to cash-rich firms, both in absolute terms and numerically. This complements the work by Niedermair (2013) who observes that the risk profile worsens less for companies with rather high cash holdings compared to those with lower internal savings, when a share buyback is announced.

The above empirical findings should however be considered with caution, since CDS spreads do not only price the credit risk of a company, but include also a liquidity component (Tang et al., 2011). The spreads might be higher, especially during a crisis and in the immediate aftermath, because of illiquid markets, where trading occurs only occasionally. In this thesis, the whole change in the CDS spreads is related to changes in the credit risk of a company. Further analysis could try to differentiate the two pricing components, credit risk and liquidity, in order to obtain more accurate results.

Another possible limitation of this thesis is that I do not control for the size of the companies, when analyzing the amount of the repurchases. All of the firms analyzed are rather big and international companies, quoted on the stock market. But still the firms differ in size among each other. Possibly, more detailed results can be obtained when ratios are considered instead of absolute amounts of the share buyback values. Such a ratio could be, for instance, the amount of repurchased shares to the overall outstanding shares. This can be addressed by further studies.

Moreover, this study does not control for country fixed effects. Corporate cultures and the environment in which companies are embedded in, is sometimes fairly different from one country to another. But these business models and structures persist over time for companies belonging to the same country. Hence, future research could try to obtain a bigger sample and then control also for country specific effects. The countries analyzed in this study are taken as such, because of a data availability issue. Therefore, companies from the United States are also slightly overrepresented in the sample.

Also time fixed effects have been considered only partially in the analysis. The market return is included in the linear regression functions as explanatory variable, accounting thereby for common trends in the markets such as macroeconomic shocks, elections or terrorist activities. Still, there might be some additional heterogeneity in the CDS spread returns that remains constant across time. The market model, which is applied in this study, could be amplified and a difference-in-difference approach or an additional dummy variable could be used in Formula 17.

Finally, the event study is an ideal method to analyze how an event impacts a certain outcome measure, when there are no information leakages beforehand. In this case the influence of share buyback announcements on corporate risk is examined. Sporadically on the figures above, there can be seen

some variations already before the event, indicating that the estimation of the cumulative abnormal returns might not be completely exact. In addition, the sample size decreases for certain sub-analyses by quite a lot. Hence, a bigger sample would be advantageous for further research.

2.6 Conclusion

The relationship between share buyback announcements and market liquidity is not straight-forward and seems to be rather non-linear. Managers seem not to adjust the amounts of buybacks to changing market liquidity levels. The financial crisis of 2007 – 2008 did however lead to radical changes concerning the effect of share buyback announcements on the credit risk of a company.

In this thesis 160 companies and 428 events are analyzed, over the time period 01/01/2005 until 12/31/2011. These companies are components of either the CDX North America Investment Grade Index or the Markit iTraxx Europe and are headquartered in Europe or North America. An event study is used, which is based on the comparison of the behavior of an outcome measure around the event date, to the normal pattern prior to the event. For this analysis, the outcome measures are daily credit default swap spreads of 5 year contracts, as proxy for the credit risk; while the events are share buyback announcements. A market model extended by a generalized autoregressive conditional heteroskedasticity process of order 1 is employed, which captures both the persistency and time-variance of the volatility. This panel data analysis helps to answer the following research question: How varies the effect of share buyback announcements on the risk profile of a company with respect to market liquidity, comparing the financial crisis to normal market conditions? As to my knowledge, this issue has not been researched previously and provides substantial new evidence on how share buybacks can be optimized.

The existing literature does not present enough evidence and theories, based on which this research question could be answered. According to Modigliani and Miller (1958), the value of a firm should not be influenced at all by share buybacks. Others claim that both uncertainty and the marginal value of an extra dollar of internal cash, have an impact on whether companies engage in such payout measures or not (Faulkender et al., 2006; Chan et al., 2013).

As a matter of facts, the general credit risk level of a company worsens after a share buyback announcement and CDS spread returns are higher than expected by around 2.2 percentage points. When comparing the repurchase events that have been announced during the crisis to those communicated before and after the financial crisis, companies suffer the biggest deterioration of their risk profile in the post-crisis period. The abnormal returns amount to considerable 4 percentage points. Thereby, the risk profile worsens the most for companies belonging to the financial, utilities and energy sector.

Moreover, companies that announce a buyback in the post-crisis period and communicate rather high repurchase values, present cumulative abnormal returns that are higher than expected by astonishingly 8 percentage points. After the financial crisis of 2007 – 2008, the role of liquidity and cash management

increased in importance and the markets react highly negatively when companies decide to reduce their internal corporate savings, for instance by announcing a share buyback. Also Polak et al. (2011) confirm the broader and more strategic role of the corporate treasurer after this recent financial crisis. Hence, companies should consider cash management as a vital component of their business model and their strategy.

Still, companies seem to not significantly decrease the buyback values during the crisis, even though the marginal dollar of cash would be higher during these times and profits from repurchases lower. Hence, it seems not optimal to engage in such actions during times of decreased market liquidity. Firms should evaluate the decision to repurchase shares in light of their current risk level and take also the degree of liquidity in the financial markets into consideration. Cash-rich companies announce higher buyback values compared to cash-poor firms. The former either do not have any investment opportunities on hand, or are able to enjoy a rather big degree of flexibility due to their internal cash buffers. Hence, cash holdings are kept because of precautionary reasons and are used to eventually smoothen out changing market conditions.

Further research can analyze the use of share buybacks as substitutes for dividends during crisis times, try to differentiate the credit risk component from the liquidity component in CDS spreads, and analyze the announced buyback values as ratios of the total shares outstanding to obtain more accurate results.

2.7 Sources

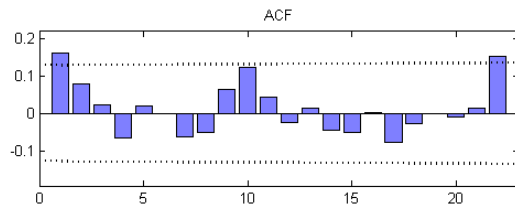
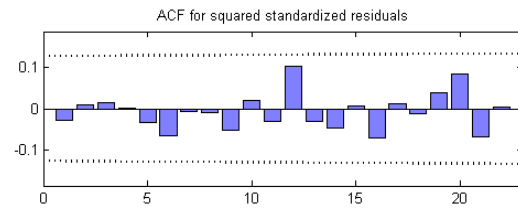
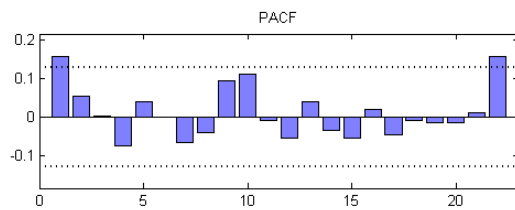
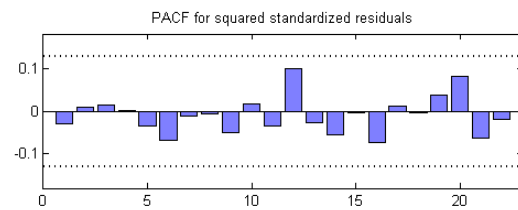
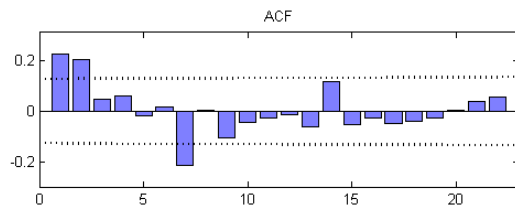
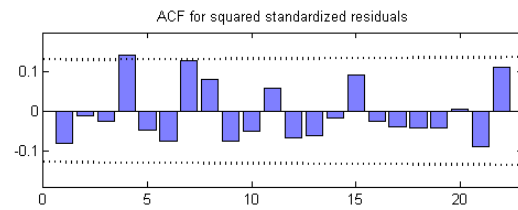
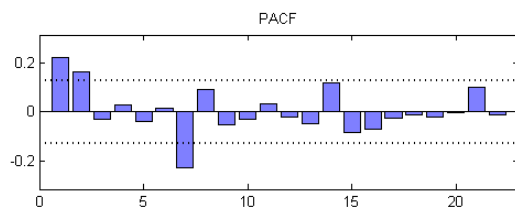
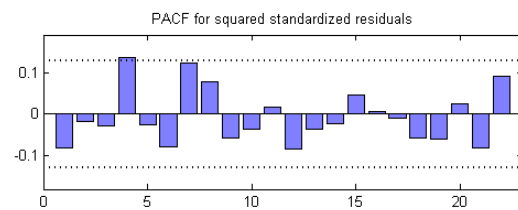
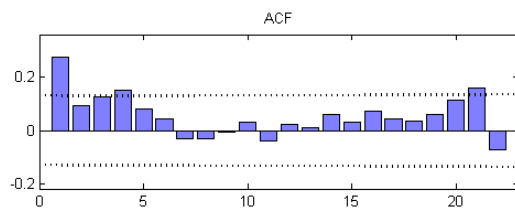
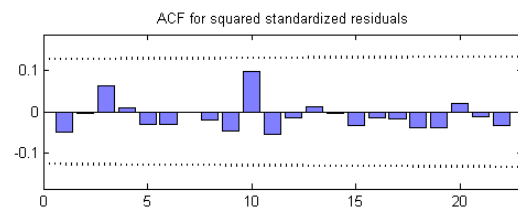
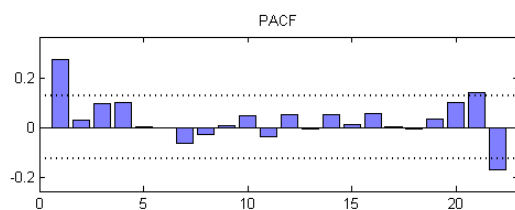
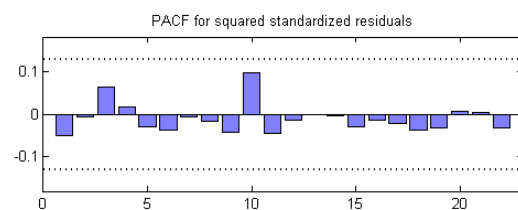
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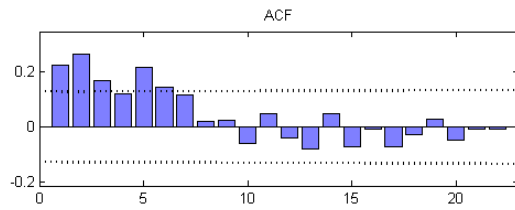
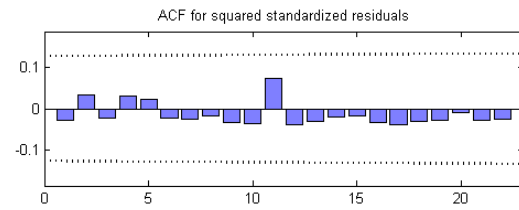
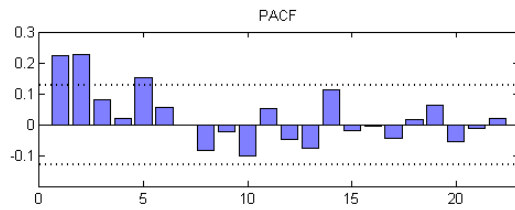
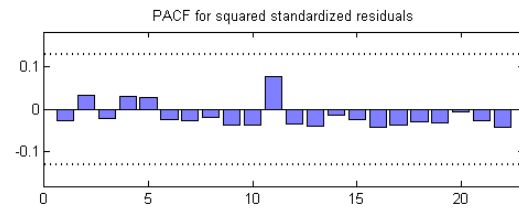
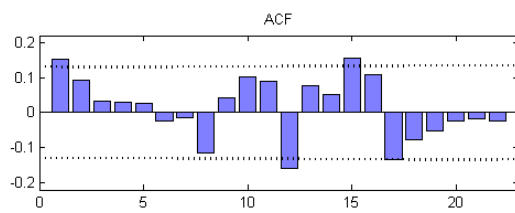
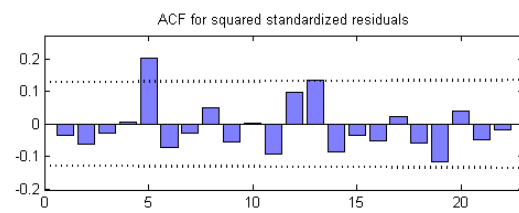
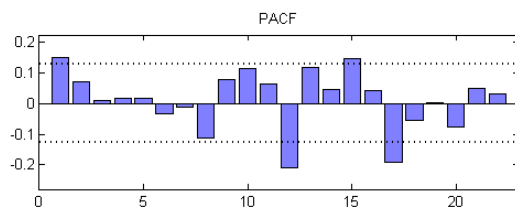
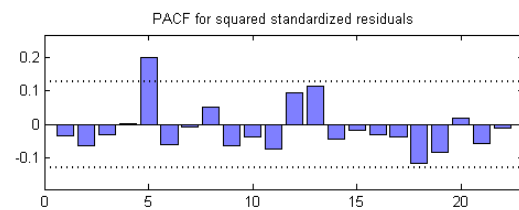
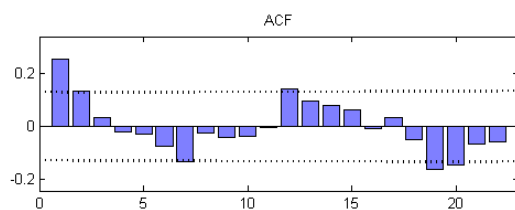
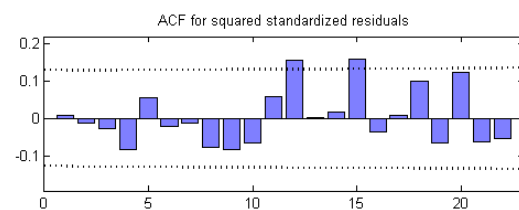
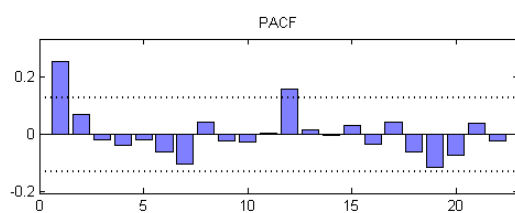
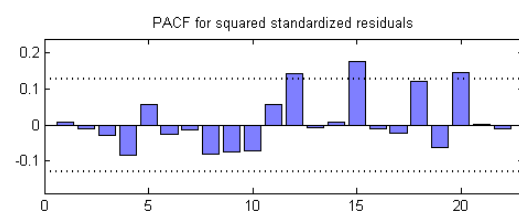
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2.8 Appendix

Appendix 1: ACF and PACF





The dotted lines in each plot indicate the two standard error boundaries of the ACF and PACF.

Appendix 2: T-statistics for companies differentiated by sector affiliation (H1)

CAR [-7,+7] for events during the crisis, FINANCIAL SECTOR (8 events) T-statistic	0.1303 9.2159
CAR [-7,+7] for events before the crisis, FINANCIAL SECTOR (2 events) T-statistic	-0.0248 -1.8714
CAR [-7,+7] for events after the crisis, FINANCIAL SECTOR (4 events) T-statistic	0.1787 12.9147
CAR [-7,+7] for events during the crisis, COMMUNICATIONS & CONSUMER DISCRETIONARY (35 events) T-statistic	0.0318 6.3777
CAR [-7,+7] for events before the crisis, COMMUNICATIONS & CONSUMER DISCRETIONARY (8 events) T-statistic	0.0624 10.1765
CAR [-7,+7] for events after the crisis, COMMUNICATIONS & CONSUMER DISCRETIONARY (24 events) T-statistic	0.0331 8.8818
CAR [-7,+7] for events during the crisis, UTILITIES & ENERGY SECTOR (13 events) T-statistic	0.0117 1.4271
CAR [-7,+7] for events before the crisis, UTILITIES & ENERGY SECTOR (5 events) T-statistic	0.0107 1.7713

CAR [-7,+7] for events after the crisis, UTILITIES & ENERGY SECTOR (8 events)	0.0269
T-statistic	3.9377

CAR [-7,+7] for events during the crisis, INDUSTRIALS & MATERIALS & TECHNOLOGY SECTOR (27 events)	0.0275
T-statistic	4.2315
CAR [-7,+7] for events before the crisis, INDUSTRIALS & MATERIALS & TECHNOLOGY SECTOR (14 events)	-0.0070
T-statistic	-0.3561
CAR [-7,+7] for events after the crisis, INDUSTRIALS & MATERIALS & TECHNOLOGY SECTOR (13 events)	-0.0093
T-statistic	-2.0989

Appendix 3: T-statistics for buyback values (H3)

Average CAR [-7,7] for events with high buyback values (highest quantile) (43 events)	0.0500
T-statistic – highest quantile	8.5729
Average CAR [-7,7] for events with rather high buyback values (2nd highest quantile) (45 events)	0.0287
T-statistic – 2 nd highest quantile	6.7734
Average CAR [-7,7] for events with medium buyback values (middle quantile) (14 events)	0.0318
T-statistic – middle quantile	4.9423
Average CAR [-7,7] for events with rather low buyback values (2nd lowest quantile) (50 events)	0.0117
T-statistic – 2 nd lowest quantile	2.9319
Average CAR [-7,7] for events with low buyback values (lowest quantile) (68 events)	0.0513
T-statistic – lowest quantile	10.7370

Appendix 4: T-statistics for buyback values and the time periods pre-crisis, crisis and post-crisis (H3)

Average CAR [-7,7] for events with high buyback values in pre-crisis period (5 events)	-0.0000
T-statistic	-0.0021
Average CAR [-7,7] for events with low buyback values in pre-crisis period (9 events)	-0.0042
T-statistic	-0.7702
Average CAR [-7,7] for events with high buyback values in crisis period (22 events)	8.2243
T-statistic	0.0642
Average CAR [-7,7] for events with low buyback values in crisis period (24 events)	-0.0042
T-statistic	-0.7702
Average CAR [-7,7] for events with high buyback values in post-crisis period (12 events)	0.0794
T-statistic	9.2250
Average CAR [-7,7] for events with low buyback values in post-crisis period (23 events)	0.0415
T-statistic	9.7412

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