BANK REGULATORY CERTIFICATION AND CAMEL FRAMEWORK-RELATED ACCOUNTING SIGNALS IN THE DEBT MARKET

Abstract

This study investigates whether and to which extent bond investors in the financial institution sector use accounting signals in their decision-making process during economic downturns. The recent bank crisis provides a perfect setting to test whether financial institutions' accounting ratios related to the CAMEL framework of the U.S. Federal Bank Regulatory Agencies – capital adequacy, asset quality, earnings ability, and liquidity - if at all, enter into the decision-making process of investors holding a portfolio of debt instruments in financial institutions. Applying a perfect foresight portfolio investment strategy (Abarbanell and Bushee 1998), I find evidence that cumulative monthly bond returns are associated with changes in "earning power" and changes in credit ratings only when financial markets are illiquid and not transparent. This is potentially attributable to the diverging interests of bank regulators and institutional bond investors during bank crisis periods with debtholders conceivably relying to a lesser extent on regulatory agencies' private information with regard to the supervision of the banking sector. Moreover, I provide insights on bond prices not fully anticipating accounting signals during periods of financial distress and illiquidity. To draw causal inferences, I also conduct an event study utilizing short-term windows centered on the U.S. Securities and Exchange Commission (SEC) EDGAR 10-K filings announcement dates and preliminary earnings announcement dates and report the value relevance of ratios related to changes in "earning power", liquidity, and capital adequacy for bond holders during the recent financial crisis period.

1.1 Introduction

This study examines whether and to which extent bond investors in the financial institution sector use accounting-based information signals related to the CAMEL[1] framework of the U.S. Federal Bank Regulatory Agencies – capital adequacy, asset quality, earnings ability, and liquidity - in their decision-making process during economic downturns. More specifically, I investigate whether debt market investors potentially free-ride on regulatory certification in 'good' times but not during periods of turmoil and distress (i.e., during the recent GFC). As bank regulatory information signals became less credible during the GFC, investors arguably had to turn to more fundamental information from the accounting system and other market-based signals (i.e., information in form of credit ratings). Although the focus of this paper is solely on the highly regulated banking sector, it addresses important implications attributable to this sectors' fundamental role for an economy's financial stability. Because exceedingly leveraged individual institutions access the capital markets to a greater extent through debt instruments than equity issues[2], taking on a bond investor perspective is appealing . According to the Financial Crisis Inquiry Report of the Financial Crisis Inquiry Commission (2011), "from 1978 to 2007 the amount of debt held by the financial sector soared from $3 trillion to $36 trillion", indicating the importance of debt financing for financial institutions in the United States.

Furthermore, international and U.S. accounting standard setters (International Accounting Standards Board, IASB and U.S. Financial Accounting Standards Board, FASB[3]) as well as capital markets and bank regulators (U.S. Securities and Exchange Commission, SEC and the Basle Committee on Banking Supervision) are currently deliberating whether information revealed through financial institutions' certified annual financial statements and mandated by the banking supervision framework has been informative and value relevant to both equity and debt investors during the recent financial crisis.

According to the Statement of Financial Accounting Concepts No. 1 Objectives of Financial Reporting by Business Enterprises (SFAC No. 1[4]), one objective of financial

[1] The acronym CAMEL refers to capital adequacy, asset quality, management capabilities, earnings ability, and liquidity. As bank regulatory agencies do not publish the results of their on-site CAMEL investigations, I use accounting-based information to obtain a proxy that captures each of the framework's main categories.

[2] Source: Securities Data Company and the Board of Governors of the Federal Reserve System (http://www.federalreserve.gov/econresdata/releases/corpsecure/current.htm).

[3] The report of the Financial Crisis Advisory Group (2009) presented to the IASB and FASB discusses among other things the limitations of financial reporting during financial crisis periods.

[4] SFAC No. 1 has been superseded by SFAC No. 8 (Conceptual Framework for Financial Reporting Chapter 1, The Objective of General Purpose Financial Reporting, and Chapter 3, Qualitative Characteristics of Useful Financial Information that includes the new conceptual framework. As the time period in this study includes the change from SFAC No. 1 to SFAC

reporting is to provide information that is relevant and useful to various stakeholders in making investment decisions. Stakeholders include both present and potential equity investors as well as creditors although these groups potentially assess the reported earnings and disclosures differently. Especially debt investors with their investments' limited upside potential, attributable to the instruments' inherent concave payoff function, conceivably only assess information signals capturing downside risks. As bank regulatory agencies have access to more timely and private information through their clients' IT-systems, and thus a more complete picture on an individual banks' financial health, investors probably free-ride on that information. If bank regulatory agencies detect discrepancies or threats in a bank's business model or risk management practices, stringent and frequent examinations (e.g., including cease-and-desist orders) ensure that the respective bank engages in activities to address these apparent weaknesses. As such, bond investors probably do not base their investment decisions on accounting information as these signals are not timely and do not reflect intra-period events. Bank regulatory agencies act as a safeguard and ensure that financial institutions' business models and risk appetite are appropriate, at least during periods without turmoil and distress.

Notwithstanding, bond investors potentially doubt bank regulators' examinations and assessments of individual financial institutions' going concern during severe bank crisis periods. As the stability of the financial sector is of utmost importance to bank regulatory agencies, the dissemination of information with regard to a bank's closeness to default could itself worsen the institutions' prospects. As such, bank failures often came as a surprise and pre-empted the announcements of bank regulatory agencies during the recent financial crisis. As a result, institutional bond holders in the financial sector could prefer accounting signals related to the CAMEL framework of the U.S. Federal Bank Regulatory Agencies – capital adequacy, asset quality, earnings ability, and liquidity – to other less credible information available in the capital markets during bank crisis periods. A possible explanation why bondholders rely more on accounting signals during financial crisis periods is also reflected in accounting standard setters' objectives that deviate from bank regulators' overall objectives. Standard setters are concerned with the true and fair view of financial statements, informing investors even in financial distress periods about the true financial position and performance at fiscal-year end, whereas bank regulators are especially interested in rules providing a sufficient cushion against unexpected losses, because the default of a major player could have

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No. 8, both concepts need to be mentioned. Nevertheless, there are no implications for the results of this study as both concepts basically incorporate the information approach to decision usefulness.

a negative impact on the overall financial stability of the capital market and the economy as a whole. During the pre-crisis period, an assessment of accounting-based information appears to be redundant, as bank regulatory agencies ensure the intactness of individual institutions through frequent and stringent on-site examinations.

Hence, whether bond holders in the banking sector potentially process accounting signals during non- and financial crisis periods because of the already stringent examination procedures of bank regulatory agencies is an empirical question.

In a first analysis, I investigate whether changes in financial indicators related to asset quality, liquidity, core business performance, and equity base are associated with cumulative monthly bond returns for both the recent financial crisis period (April 2007 – April 2009[5]) and the three years preceding the crisis (April 2004 – March 2007). Applying a perfect foresight portfolio strategy (Abarbanell and Bushee 1998), I provide evidence that neither ratio is associated with bond returns at conventional significance levels for the specified time period preceding the financial crisis. One possible explanation for the insignificant ratios is that investors rely on other information channels including bank regulators' access to private information and trust in the stringent supervision procedures applied and thus free ride on accounting information. Moreover, I test a different specification by including the average changes in the credit ratings of the financial institutions in the non-crisis period (provided by the credit rating agencies Moody's and Standard & Poor's) and conclude that this market-based signal is also not associated with annual bond returns. Applying the same analysis to the bank crisis period reveals interesting results. The changes in the core business performance ratio are positively associated with the annual bond returns. Furthermore, controlling for the average changes in credit ratings which itself is significant and negatively associated with bond returns, the changes in the core business performance ratio is still significant and positively associated with the annual bond returns. The results suggest that investors in the bond market of financial institutions prefer accounting signals related to earnings growth measures during financial crises, whereas these ratios seem to be irrelevant during periods where markets are liquid and active. These findings suggest that bond holders rely to a lesser extent on (and free-ride on) regulatory agencies' private information and stringent examination procedures during bank crisis periods. Furthermore, I find evidence

[5] According to the Business Cycle Dating Committee (2010) of the National Bureau of Economic Research (NBER), the recent financial crisis ("Great Recession") started in December 2007 and ended in June 2009 (http://www.nber.org/cycles/sept2010.html).

that bond prices during the recent financial crisis not fully anticipate the changes in the ratios related to asset quality, core business performance, equity base, and liquidity, because the hedge portfolio strategy (Ababarnell and Bushee 1998) provides investors with an increase in returns of 49,4% in the months the 10-K filings are announced.

After testing for associations between the accounting signals of interest and the cumulative bond returns, I conduct an event study utilizing short term windows centered on the 10-K filings announcement date and the four preliminary earnings announcement dates to draw causal inferences regarding the impact of signals related to core business performance, asset quality, liquidity, and capital adequacy on daily bond returns. Association studies only provide correlations which are measured over long time periods and hence, other more timely, and presumably value relevant, information potentially enters into the decision making process of bond investors. Thus, association studies do not allow for causal linkages between accounting signals and bond price movements (Kothari 2001). Applying event study methodologies, I regress daily bond returns on the changes in the liquidity, core business performance, equity base, and asset quality ratio, the event windows itself, and the interactions between the ratios and the window intervals. The results provide evidence that a substantial portion of the core business performance, equity base, and liquidity information gets incorporated into bond prices on the 10-K filings announcement window.

This study reveals three contributions to the literature. First, it sheds light on bond investors' different and dynamic informational needs during financial and non-financial crisis periods. Second, it provides evidence that accounting information signals related to the bank regulatory framework are not fully anticipated and incorporated into contemporaneous bond prices during the recent financial crisis. Third, accounting signals related to core business performance, liquidity, and equity base are value relevant to bond holders only during the recent financial crisis period stressing the importance of accounting signals to prevent mispricing especially during periods of financial distress and increased uncertainty (e.g., when efficiency in semi strong financial markets deteriorates even more).

1.2 Debt markets and accounting signals

1.2.1 Debt market characteristics

Financial institutions as well as corporates have to decide among different funding opportunities, including internal funding through cash flows and taking on additional debt or issuing equity securities, when investing in new projects with a positive net present value. Equity and institutional debt investors potentially have different informational needs attributable to their investments' different payoff functions. Given their convex payoff function, equity investors are willing to take on more risk than debtholders. Equity holders' claim to the company can be seen as holding a call option whereas the option is in the money when the value of the firm exceeds its debt (principal which has to be paid back to debt holders). In contrast, bond holders are faced with a concave payoff function giving them priority of payment when the firm value is equal to or smaller than the debt inherent in the respective company.

When analyzing annual financial statements, both equity and bond investors use accounting information from different sources, such as the statement of financial position, income statement, and cash flow statement. Investigating the relative usefulness of accounting signals from these different statements, prior research finds evidence that equity investors shift their focus from earnings as reported in the income statement to book values as reported in the statement of financial position when firms' financial health deteriorates (Barth et al. 1996, Collins et al. 1997). This is in line with accounting theory contemplating balance sheet net tangible assets as a proxy for a firms' liquidation value.

Given their concave payoff function, debt market investors in the primary and secondary bond market should potentially be interested in the liquidation value of their investment portfolio during non-financial crisis periods. Accounting signals about the future cash generating ability or "earning power" appear to be of secondary importance to debtholders, at least during periods in which there is no general doubt about banks' going concern. Thus, attributable to the asset substitution and underinvestment conflict (Myers 1977, Smith and Warner 1979), debt holders demand balance sheet information about the firm's net assets informatory about the liquidation value (Kothari et al. 2009). As firm values deteriorate during periods of severe financial crises, as witnessed during the "Great Recession", financial institutions' equity cushions to absorb unexpected losses declined significantly and were no longer regarded as sufficient. When firm values of financial institutions decline rapidly, debtholders potentially shift their focus from book values ratios related to liquidity, equity base, and asset quality to "earning power" related ratios because

these indicate whether the equity cushion to absorb losses can gradually be reinforced through internal financing capabilities.

According to research in finance, prices of debt instruments in the secondary bond market are mainly driven by market interest rates. As such, a decline in the market interest rates will lead to an increase of outstanding bond prices, and vice versa. In addition to market interest rates, bond prices are also determined by other variables including non-interest rate risk factors. Hull et al. (2004) investigate risk-neutral and real-world default probabilities of corporate bonds exhibiting different credit ratings and shed light on factors relevant to investors for estimating the extra risk premium. Technically, the extra risk premium measured in basis points is equal to the bond yield spread over the treasury rate minus the spread of the risk-free rate used by market participants above the treasury rate and the spread to adjust for the real world default. Hull et al. (2004) also provide explanations for the average risk premium required by bond holders. Factors examined by debt market investors include liquidity, market participants' expectations, non-diversifiable[6], and diversifiable risk factors. With regard to liquidity[7], Chen et al. (2007) provide evidence that this factor is priced in by investors for both investment grade and speculative grade bonds. Furthermore, other factors such as default risk, the risk of a downgrade, and reinvestment risk could potentially be relevant to bond holders. Credit risk is inherent in almost all forms of debt instruments and simply the threat to a borrower that the respective bond issuer is unable to fulfill its contractual obligations in form of future payments. Thus, bond investors require a higher rate of return for higher default risk levels in bond issuers. Longstaff et al. (2005) provide evidence that corporate bond spreads are to a large extent driven by credit risk information provided through the credit default swap (CDS) market.

To which extent bond holders use financial statement information of financial institutions related to changes in asset quality, liquidity, core business performance, and equity base to investigate the required average risk premium is an underexplored research area. Especially in situations where financial capital markets are illiquid and not transparent, as witnessed in the "Great Recession" (2008 – 2009), bond investors could potentially rely less on credit, liquidity, and market risk information signaled through channels other than annual certified financial statements, including press releases, prospectuses, credit ratings, CDS spreads, and market sentiment. In particular, credit rating agencies instead of reducing

[6] According to Amato and Remolona (2003), risks in a bond portfolio are problematic to diversify away because of the concave payoff function bond holders are exposed to.

[7] Liquidity risk mainly arises in a secondary bond market with only a few market participants (thin market).

information asymmetries between insiders and the capital markets seem to have impaired transparency and made markets even more opaque.

1.2.2 Accounting signals related to the CAMEL framework

Research in the debt market (Hull et al. 2004, Longstaff et al. 2005, and Chen et al. 2007) provides evidence that several factors determine bond prices including the issuers' sensitivity to market risks as well as liquidity, operational, and default risk of the issuer[8]. In capturing these different determinants of bond prices through accounting signals, I use four financial ratios related to four of the five categories from the CAMEL framework. The rational for using these categories relies on the intuition that bondholders potentially rely to a lesser extent on regulatory agencies' private information and stringent examination procedures during bank crisis periods and thus try to mimic bank regulators' CAMEL decision processes and estimate a banks' stability by utilizing accounting signals related to asset quality, liquidity, equity base, and core business performance from the certified annual financial statements.

CAMEL has been established by the Uniform Financial Institutions Rating System in the United States in 1979 and serves as a directive for federal bank regulatory agencies when evaluating the financial condition and performance of financial institutions (Putnam 1983, Cole and Gunther 1995). I use insights from this framework to investigate whether four accounting ratios related to the CAMEL framework - ratios related to capital adequacy (equity base), asset quality, earnings quality ("earning power"), and liquidity[9] – are value relevant to investors in the financial institutions' bond market during periods with and without transparent and liquid markets. Furthermore, I shed light on whether bond prices anticipate these ratios before the accounting signals are published on the fourth quarter preliminary earnings announcement date and the 10-K filings announcement date during financial crisis periods.

According to the Federal Deposit Insurance Company (FDIC) [10], asset quality is an important indicator for investors evaluating the overall condition and robustness of a financial institution against an existing and potential decline of value in the financial assets, especially the quality of the performing and non-performing part of the loan portfolio. In this study I

[8] Information in terms of sensitivity to market risks as well as liquidity, operational, and default risk of the issuer is reflected in the individual credit ratings, as credit rating agencies incorporate idiosyncratic private issuer and market-based information in their stringent rating approval process.

[9] This study ignores management quality which is also used by Federal Bank Regulatory Agencies when examining financial institutions. Management quality refers to a set of managers' abilities including technical competence, leadership qualities, and flexibility to respond to a changing environment.

[10] http://www.fdic.gov/regulations/safety/manual/section3-1.html

measure the asset quality of the financial institutions in the sample through the annual changes in the ratio of loan loss reserves to gross loans *(*Δ*AQuality*). This ratio measures the quality of a banks' individually and collectively assessed loan portfolio. An increase in the ratio signals a deterioration in the performing part of the financial assets included in the overall loan portfolio.

The capital adequacy (equity base) ratio measures a financial institutions' leverage and the ability to absorb expected and unexpected losses. To get a measure which informs about the equity cushion available to absorb losses in the individually and collectively assessed loan portfolio books, I use the changes in the ratio of equity to net loans *(*Δ*CAdequacy*) in this study. Whereas tier-1 and tier-2 capital ratios, as required by bank regulatory agencies, are a more narrow measure, equity available to absorb overall loan book losses used in this study includes total equity reserves, total share capital, and treasury shares. Net loans comprise net loans to banks, credit unions, private customers, small businesses and multinational corporations. Overall, a decline in the equity to net loans ratio informs investors about a lower protection available to financial institutions to cover loan losses.

A financial institution is considered "liquid" if its asset and liability management strategy achieves a term structure match between the entity's assets and liabilities. In other words, illiquidity refers to a situation in which financial institutions are not able to obtain additional funding either by taking on more debt or transforming financial assets into cash and cash equivalents. During severe financial crises, a bank run for example would lead to a situation where deposit withdrawals by customers and corporate clients translate into large cash outflows leaving the bank unable to service its debt. The FDIC[11] released a financial institutions letter in August 2008 stressing the importance of liquidity management especially during disruptions as seen in the recent credit and capital markets crisis. In this study, I capture the extent to which financial institutions are liquid through the changes in the ratio of net loans to total assets *(*Δ*Liquidity*). This ratio measures the extent to which the assets of a bank are bound to the individually and collectively assessed loan portfolio. An annual increase in this ratio informs investors about a financial institution having proportionately less short-term assets and cash and cash equivalents available to service its debt.

Most stakeholders in financial institutions and corporates focus on the core business performance when evaluating their individual investments and rebalancing their security portfolio. Core business performance ratios measure a bank's profitability and show how effectively a bank carries out its asset and liability management strategy in form of how

[11] http://www.fdic.gov/news/news/financial/2008/fil08084.html

efficiently financial assets have been used to generate net income. In this study, I use the changes in the ratio of return to average asset *(*Δ*EAbility*) as comprehensive measure of core business performance. Based on the assumption that a financial institution keeps a similar risk appetite and strategy from year to year, an increase in this ratio informs about banks being more profitable in the core business lines.

1.2.3 Transparency-stability vs. transparency-fragility view

Transparency of and mandated disclosures in the banking sector have been widely discussed among bank regulatory bodies and academics. Proponents of the so-called transparency-stability view (Cordella and Yeyati 1998; Nier 2005; Tadesse 2006) argue that enhanced disclosure requirements contribute to the stability of the banking system. Conversely, discovery of an individual bank's financial weakness may infect the entire banking system (Calomiris and Mason 1997; Chen and Hasan 2006; Gilbert and Vaughan 1998; Goldstein and Sapra 2012; Kaufman 1994), and probably jeopardizes overall economic stability. For example, Goldstein and Sapra (2012) argue that "disclosure of stress test results may actually create more panic, thereby lowering confidence in the banking sector". From a bank regulatory standpoint and according to the transparency-fragility view, greater transparency in terms of greater disclosure and more precise information signals may be seen as a threat to the entire banking system, especially during financial crisis periods. In this study I argue that the bank regulatory certification process probably detected financial weaknesses in individual banks during the recent financial crisis, but has been aware of the negative consequences if these weaknesses were disclosed to the financial market. Press releases on individual banks could have caused contagion and spillover effects within the banking sector. Hence, bond investors may consider information revealed through bank regulatory agencies to be less credible, especially during the recent financial crisis. Thus, institutional bond holders in the financial sector probably prefer accounting signals related to the CAMEL framework of the U.S. Federal Bank Regulatory Agencies to supplement other, arguably less credible, information during bank crisis periods.

1.3 Literature review

Prior research on the importance of 'earning power' and book value related accounting signals focuses primarily on the equity market. Regarding different information needs of investors, Barth et al. (1998) provide evidence that a shift in investors' focus from earnings information to book values is observable for firms that are deteriorating in financial health. With regard to research on the value relevance of accounting signals, especially in the banking sector, Venkatachalam (1996) examines fair value disclosures for derivatives mandated by SFAS No. 119, and provides evidence that such information impacts stock prices of financial institutions. Barth et al. (1996) also shed light on the value relevance of financial instrument fair values for equity investors disclosed under SFAS No. 107. Through examining loan loss provisions of financial institutions, Ahmed et al. (1999) find a negative effect of such provisions' discretionary component on equity returns. Furthermore, Ahmed et al. (2006) investigate banks' recognized and disclosed SFAS 133 derivatives information. They show that recognized derivatives are relevant in explaining firm value. Hatfield and Lancaster (2000) focus on the signaling effects of bank loan-loss reserve additions, and find equity market reactions to the announcements of such additions. They conclude that increases in loan loss reserves are associated with negative equity price movements before the announcement, which reverse a few days after the news release. Additionally, Wahlen (1994) examines disclosures related to non-performing loans, loan loss provisions, and loan charge-offs. He presents evidence that managers intentionally inflate the discretionary component of loan loss provisions when they anticipate increased future cash flows.

Prior research in finance provides inconclusive evidence on the determinants of bond prices. Hull et al. (2004) present explanations to explain the average risk premium required by bond holders. Factors examined by debt market investors include liquidity, market participants' expectations, non-diversifiable, and diversifiable risk factors. With regard to liquidity, Chen et al. (2007) provide evidence that this factor is priced in by investors for both investment grade and speculative grade bonds. Furthermore, other factors such as default risk, risk of a downgrade, and reinvestment risk could potentially be relevant to bond holders. Credit risk is inherent in almost all forms of debt instruments, and simply the threat to a borrower that the respective bond issuer is unable to fulfill its contractual obligations in the form of future payments. Thus, bond investors require a higher rate of return for higher default risk levels in bond issuers. Longstaff et al. (2005) provide evidence that corporate bond spreads are to a large extent driven by credit risk information provided through the credit default swap (CDS) market.

Research literature on the value relevance of accounting signals for debt market investors in both the primary and secondary bond market is growing rapidly (i.e. Khurana and Raman 2003, Easton et al. 2009, DeFond and Zhang 2011, Amiram and Owens 2011). However, whether the impact of accounting ratios related to 'earning power' and book value on bond returns differs during financial crisis and non-financial crisis periods is still an under-explored research area. Khurana and Raman (2003) present evidence that fundamentals are value relevant to investors in the primary bond market, and thus provide information not captured in published bond ratings. Further, Easton et al. (2009) provide initial evidence on the value relevance of accounting earnings in the bond market. They conclude that bond prices react to the announcement of earnings, and find that annual bond returns are positively associated with annual changes in earnings and earnings components.

1.4 Hypothesis development

1.4.1 Cumulative monthly bond return analysis

1.4.1.1 Association between cumulative monthly bond returns and ratios related to the CAMEL framework

Addressing differential information needs of investors, prior research in the corporate equity market provides evidence that a shift from earnings information to book values is observable for firms deteriorating in financial health (Barth et al. 1998). Although research literature on the value relevance of accounting signals for debt market investors in both the primary and secondary bond market is growing rapidly (i.e. Khurana and Raman 2003; Easton et al. 2009; DeFond and Zhang 2011; Amiram and Owens 2011), whether the impact of accounting ratios related to 'earning power' and book value on bond returns differs during financial crisis and non-financial crisis periods is still an under-explored research area.

As such, I investigate whether accounting information related to a bank's performance and financial position is associated with bond returns during the GFC period. Bond investors may free-ride on regulatory certification in 'good' times but prefer accounting signals related to the CAMEL framework of the U.S. Federal Bank Regulatory Agencies, that is, capital adequacy, asset quality, earnings ability, and liquidity, to other less credible information during bank crisis periods (including credit ratings).

More specifically, I examine whether changes in financial indicators related to asset

quality *(*Δ*AQuality*), core business performance (Δ*EAbility*), liquidity (Δ*Liquidity*), and equity base (Δ*CAdequacy*) are associated with annual cumulative bond returns in a GFC and non-GFC setting. I test the following hypothesis:

Hypothesis 1a: *Banks' annual bond returns are associated with annual changes in ratios related to 'earning power' (Core performance ratio: Δ*EAbility)* during the recent financial crisis period (April 2007 – March 2009).*

Hypothesis 1b: *Banks' annual bond returns are associated with annual changes in ratios related to 'book values' (Equity base: Δ*CAdequacy / Liquidity: Δ*Liquidity / Asset quality: (Δ*AQuality) during the recent financial crisis period (April 2007 – March 2009).*

1.4.1.2 Anticipation of financial indicators related to the CAMEL framework

In addition to assessing accounting signals from quarterly and certified annual financial statements, bond investors may use several other sources of timely information including but not limited to prospectuses, derivative markets, press releases, and credit ratings. These information channels could provide relevant and timely information to bond investors, and mitigate the importance of accounting variables in the investment evaluation process. Thus, in addition to analyzing the association between ratios related to the CAMEL framework and bond returns, I investigate whether bond prices lead/anticipate the annual changes in the ratios related to asset quality *(*Δ*AQuality*), core business performance (Δ*EAbility*), liquidity (Δ*Liquidity*), and equity base (Δ*CAdequacy*) during non-bank and bank crisis periods. I test the following hypothesis:

Hypothesis 2: *During the recent bank crisis period (April 2007 – March 2009), banks' cumulative monthly bond returns are more strongly associated with annual changes in ratios related to the CAMEL framework in the month of the financial statements' public release than in previous months.*

1.4.2 Relative importance of preliminary earnings and 10-K filing announcements for investors in the debt market

Although the association studies provide evidence on the correlation between annual cumulative bond returns and accounting signals related to liquidity, asset quality, core business performance, and equity base in the month of the 10-K filing public release, one cannot draw causal inferences over such a long time period because other timely and relevant information potentially enters into the decision-making process. Other information channels include but are not limited to prospectuses, derivative markets, press releases, conference calls, and credit ratings. These information channels could provide relevant and timely information to bond investors, mitigating the importance of accounting variables in the investment evaluation process. In a first step to address causal inferences, I examine the relative importance of preliminary earnings and 10-K filing announcements for investors in the debt market by regressing each individual event window return on the annual bond return (similar to Ball and Shivakumar 2008). I test the following hypothesis:

Hypothesis 3: *Short-window bond returns centered on the 10-K filing announcement dates are more strongly associated with banks' annual bond returns than short-window bond returns centered on the preliminary earnings announcement dates during the recent financial crisis (April 2007 – March 2009).*

1.4.3 Daily bond return analysis

In addition to testing the association of event window bond returns with annual bond returns, I conduct a daily bond return analysis to investigate the importance of accounting signals. The return-on-return regression design (borrowed from Ball and Shivakumar, 2008) addresses the relevance of the individual event windows for the daily bond returns, but does not specifically test the value relevance of changes in financial indicators related to asset quality, liquidity, equity base, and core business performance for bond holders. The recent financial crisis from April 2007 to March 2009, known as the 'Great Recession', provides a perfect setting to test whether accounting information related to the CAMEL framework enters, if at all, into the decision-making process of investors holding a portfolio of debt instruments in financial institutions. Thus, to draw causal inferences, I test the following hypothesis:

Hypothesis 4: *Changes in banks' financial indicators related to the CAMEL framework are value relevant for bond holders only during the recent financial crisis period (April 2007 – March 2009).*

1.5 Methodology, research design, and sample selection

1.5.1 Perfect foresight portfolio strategy

This section derives the regression approach for constructing the zero investment portfolio bond returns (Fama and McBeth 1973; Bernard and Thomas 1990)[12]. We start with the linear function of the expected abnormal bond return (BR) of a given reference firm i and the decile ranked accounting information signals (AS1 and AS2), beta risk (β) and intercept:

$$E(BR_i) = \gamma_1 + \gamma_2 AS1_i + \gamma_3 AS2_i + \gamma_4 \beta_i \quad (1)$$

To derive the return to any bond investment portfolio (p) of n firms, a firm-specific portfolio weight (wjp) needs to be introduced:

$$E(BR_p) = \sum_{i=1}^{n} w_{ip}\, E(BR_i) \quad (2)$$

$$= \gamma_1 \sum_{i=1}^{n} w_{ip} + \gamma_2 \sum_{i=1}^{n} w_{ip}\, AS1_i + \gamma_3 \sum_{i=1}^{n} w_{ip}\, AS2_i + \gamma_4 \sum_{i=1}^{n} w_{ip}\, \beta_i$$

Portfolio weights need to be chosen so that the following constraints are in place when testing whether accounting information signal 1 and 2 can earn abnormal returns:

Accounting signal 1 portfolio (AS1) Accounting signal 2 portfolio (AS2)

[12] This derivation is based on the discussion and notes from the capital markets course delivered by Wayne Landsman at the University of North Carolina at Chapel Hill in 2011.

$$\sum w_{i2} = 0 \qquad \sum w_{i3} = 0 \tag{3a}$$

$$\sum w_{i2}\, AS_1 = 1 \qquad \sum w_{i3}\, AS_1 = 0 \tag{3b}$$

$$\sum w_{i2}\, AS_2 = 0 \qquad \sum w_{i3}\, AS_2 = 1 \tag{3c}$$

$$\sum w_{i2}\, \beta_i = 0 \qquad \sum w_{i3}\, \beta_i = 0 \tag{3d}$$

results in: $E(BR_2) = \gamma_2$ results in: $E(BR_3) = \gamma_3$ (4)

Constructing portfolio weights under these constraints results in a zero-investment portfolio as the long positions (purchases) and short positions (sales) balance. Furthermore, the zero-investment portfolio has a beta risk of zero which implies that the portfolio does not include systematic risk. Finally, under the above constraints the abnormal bond returns only reflect information of one of the two accounting signals.

Using ordinary least square (OLS) portfolio weights to test the perfect foresight portfolio strategy results in:

$$BR_i = \gamma_1 + \gamma_2 AS1_i + \gamma_3 AS2_i + \gamma_4 \beta_i + \varepsilon \qquad , i = 1,2, \ldots\ldots, n \tag{5}$$

Equation 5 expressed in vector notation gives:

$$\begin{bmatrix} BR_1 \\ \vdots \\ \vdots \\ \vdots \\ \vdots \\ BR_n \end{bmatrix} = \begin{bmatrix} 1 & AS1_1 & AS2_1 & \beta_1 \\ \vdots & \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots & \vdots \\ 1 & AS_n & AS2_n & \beta_n \end{bmatrix} * \begin{bmatrix} \gamma_1 \\ \gamma_2 \\ \gamma_3 \\ \gamma_4 \end{bmatrix} + \begin{bmatrix} \epsilon_1 \\ \vdots \\ \vdots \\ \vdots \\ \epsilon_n \end{bmatrix} \quad \text{or} \quad \mathbf{R} = \mathbf{X}\gamma + \varepsilon \tag{6}$$

γ can be further written as (under OLS assumptions): $\gamma = (X'X)^{-1}X'(BR)$ (7)

Defining $\mathbf{W = (X'X)^{-1}X'}$ results in $\gamma = W(BR)$ (8)

Thus, we can equate:

$$\gamma_p = \sum_{i=1}^{n} w_{ip} BR_i \qquad , p = 1,2,3,4 \tag{9}$$

w_{ip} equals firm's i portfolio weight and coincides with the estimated coefficient from the OLS regression.

As a result, the regression of bond returns on accounting information signals provides coefficients which reflect the contribution of each single independent variable to the overall return of the zero investment portfolio strategy. Attributable to the portfolio constructions the individual return contribution of each regressor is not biased by the existence of other accounting information signals in the regression.

1.5.2 Research design

For the cumulative monthly bond return analysis, I use a perfect foresight investment strategy (Fama and Macbeth 1973, Abarbanell and Bushee 1998) constructing zero-investment portfolios. Cumulative monthly bond returns[13] are calculated for the 9 months leading and the 3 months following the fiscal-year end of the respective financial institution, and are regressed on the decile-ranked changes in the ratios related to asset quality, liquidity, equity base, and core business performance. The research design provides insights into the extent to which bond prices lead (anticipate) these fundamental accounting signals. As mentioned earlier, the application of the above described zero-investment hedge strategy provides the researcher with regression coefficients that can be interpreted as each regressor's contribution to the total bond return of the hedge portfolio. To test hypotheses 1a, 1b and 2, I estimate the following regression equation for the two non-financial crisis periods and the financial crisis period (see Figure 2.1):

$$\begin{aligned} Cumret_{Nt} = {} & \beta_0 + \beta_1 \Delta CAdequacy + \beta_2 \Delta Liquidity + \beta_3 \Delta EAbility + \beta_4 \Delta AQuality \\ & + \beta_5 \Delta CRating + \varepsilon \end{aligned} \tag{10}$$

where, $Cumret_{N,t}$ is the cumulative monthly bond return for the 9 month leading to the 3 months following the fiscal-year end, $\Delta CAdequacy$ is the decile-ranked change in the equity

[13] Monthly and daily realized bond returns are calculated as the change in bond price (cum accrued interest) plus coupon payments made during the return interval, scaled by the bond price at the start of the return interval. Using risk-adjusted returns instead of raw returns provides similar results (Easton et al. 2009).

to net loans ration, $\Delta Liquidity$ is the change in the net loans to total assets ratio, $\Delta EAbility$ is the change in return on average assets, $\Delta AQuality$ is the change in the loan loss reserves to gross loans ratio, and $\Delta CRating$ is the change in the weighted-average credit rating provided by Standard and Poor's, Fitch, and Moody's.

Instead of running analyses for the separate individual periods, the following regressions reveals the same results[14] using the pooled dataset and including an option-adjusted spread that identifies the period of the recent recession in the U.S and is interacted with the main effects:

$$\begin{aligned} Cumret_{Nt} = {} & \beta_0 + \beta_1 \Delta CAdequacy + \beta_2 \Delta Liquidity + \beta_3 \Delta EAbility + \beta_4 \Delta AQuality \\ & + \beta_5 \Delta CRating + \beta_6 OAS + \beta_7 \Delta CAdequacy^{*} OAS + \beta_8 \Delta Liquidity^{*} OAS \\ & + \beta_9 \Delta EAbility^{*} OAS + \beta_{10} \Delta AQuality^{*} OAS + \beta_{11} \Delta CRating^{*} OAS + \varepsilon \end{aligned} \tag{11}$$

OAS is an indicator variable that equals one if the Bank of America (BofA) Merill Lynch Option-Adjusted Spread (OAS) is above 2 percentage points for at least 6 months per specific firm-year observations (FED St. Louis 2013)[15]. Considering the annual cumulative bond return construction, Figure 2.1 shows that *OAS* equals one for firm-year observations during the recent GFC and zero in the period preceding the GFC.

In addition to testing associations between bond returns and ratios related to the CAMEL framework, I conduct an analysis addressing the relative importance of preliminary earnings and 10-K filing announcements for investors in the debt market, and the value relevance of ratios related to asset quality, liquidity, core business performance, and equity base using event study methodologies.

First, I test the relative importance of preliminary earnings and 10-K filing announcements for investors in the debt market by regressing the annual bond returns on short

[14] The drawback of using regression equation (2) that includes the interaction terms is the impracticality to interpret the relative contribution of the individual financial ratios related to the CAMEL framework to the overall return of the zero investment hedge strategy. Running separate regressions for the GFC and non-financial crisis period using equation (10) provides this information which is used to construct the overall cumulative bond return contribution (see section 2.5.1 perfect foresight portfolio strategy).

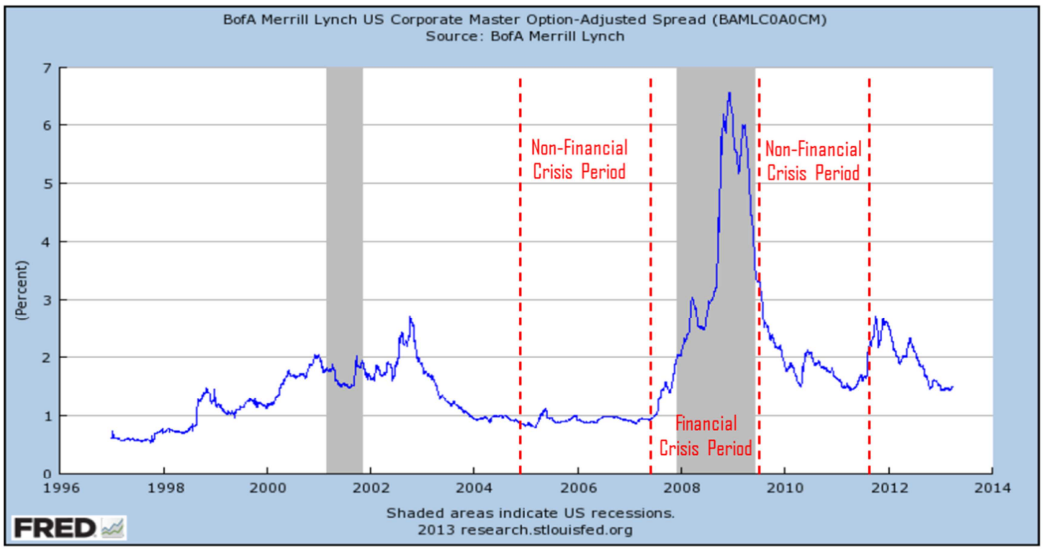
[15] Option-adjusted spreads are based on economic research of the Federal Reserve Bank of St. Louis (2013) and are constructed using an investment-grade bond index that is corrected for market capitalization and the corresponding treasury rate. Premiums above 2 percentage points reflect financial distress and liquidity in the underlying financial market.

event window returns centered on the preliminary earnings announcement and 10-K filing dates:

$$ABR = \gamma_0 + \gamma_1 Rq_1q_3 + \gamma_3 Rq_4 + \gamma_4 R\text{sec} + \varepsilon \quad (12)$$

where, *ABR* denotes the annual bond return of the respective sample (i.e., bank crisis vs. non-bank crisis), Rq_1q_3 the short event window return centered on the preliminary earnings announcement of quarter 1 to quarter 3, Rq_4 the short event window return centered on the preliminary earnings announcement of quarter 4, and *Rsec* the short event window return centered on the 10-K filing dates.

FIGURE 2.1: Bank of America (BofA) Merill Lynch Option-Adjusted Spreads (OAS) from January 1996 to March 2013 (Source: Federal Reserve Bank St. Louis).



Second, I conduct an event study utilizing short-term windows centered on the 10-K filing announcement date and the four preliminary earnings announcement dates. This is done to draw causal inferences regarding the impact of signals related to core business performance, asset quality, liquidity, and capital adequacy on daily bond returns. More specifically, I regress daily bond returns on the changes in the liquidity, core business performance, equity base, and asset quality ratio, the event windows itself, and the interactions between the ratios and the window intervals:

$$DBR = \delta_0 + \delta_1 \Delta EAbility + \delta_2 \Delta AQuality + \delta_3 \Delta Liquidity + \delta_4 \Delta CAdequacy \quad (13)$$
$$\delta_5 q1q3\_win15 + \delta_6 q4\_win15 + \delta_6 \text{sec}\_win15$$
$$\delta_{11} q1q3\_win15 \times \Delta EAbility + \delta_{12} q4\_win15 \times \Delta EAbility + \delta_{13} \text{sec}\_win15 \times \Delta EAbility$$
$$\delta_{21} q1q3\_win15 \times \Delta\Delta AQuality + \delta_{22} q4\_win15 \times \Delta AQuality + \delta_{23} \text{sec}\_win15 \times \Delta AQuality$$
$$\delta_{31} q1q3\_win15 \times \Delta Liquidity + \delta_{32} q4\_win15 \times \Delta Liquidity + \delta_{33} \text{sec}\_win15 \times \Delta Liquidity$$
$$\delta_{41} q1q3\_win15 \times \Delta CAdequacy + \delta_{42} q4\_win15 \times \Delta CAdequacy + \delta_{43} \text{sec}\_win15 \times \Delta CAdequacy + \varepsilon$$

1.5.3 Sample selection

This study investigates whether and to what extent bond investors in the financial institution sector use accounting signals related to the CAMEL framework of the Federal Bank Regulatory Agencies in their decision-making process during economic downturns. For the construction of monthly cumulative and daily bond returns, data are retrieved from the Trade Reporting and Compliance Engine (TRACE) and Mergent Fixed Investment Securities Database (FISD) database. FISD comprises information on pricing and trade terms of debt instrument starting in 1995. TRACE was established by the National Association of Securities Dealers (NASD) in 2002 and provides data on financial institution and corporate bonds in the U.S. secondary bond market. I use information from both TRACE and FISD database to construct the cumulative monthly and daily bond returns using trade prices (flat price) and accrued interest scaled by the respective bond price at the beginning of the return interval. The focus of this study is on bonds that are non-redeemable, non-callable, and do not have other step-up clauses or embedded derivatives. If a financial institution placed multiple bond issues, the average bond return reflects the weighted par values of the multiple issues. Data related to the CAMEL framework of Federal Bank Regulatory Agencies in the U.S. is retrieved from the Federal Reserve database and Thomson One Banker. The preliminary earnings announcement dates for the daily bond return analysis come from the Thomson One Banker database, and the SEC filing dates are manually collected from the (SEC) EDGAR 10-K website. Merging all databases provides a sample of 272 firm-year observations for the period 2004 through 2011 and includes both two non-bank crisis windows with 183 bank-year observations and the recent bank crisis period, including 89 bank-year observations.

1.6 Empirical results

1.6.1 Descriptive analysis

Table 2.1 presents the descriptives for the first-order-differences in the regressors related to equity base (Δ*CAdequacy),* assets quality *(*Δ*AQuality),* core business performance (Δ*EAbility*), and liquidity (Δ*Liquidity*) for the period spanning 2004 through 2011. Table 2.2 illustrates the distribution of the annual cumulative bond return for the different time periods representing both bank and non-bank crisis periods in the form of quantiles. Furthermore, the full sample of annual cumulative bond returns is also provided.

TABLE 2.1: Descriptive statistics of the differences in the financial ratios related to the CAMEL framework

Variable	N	Mean	Median	Max	Min	Standard Deviation
Δ*AQuality (not ranked)*	272	0.0022	0.0001	0.065	-0.0230	0.0083
Δ*Liquidity (not ranked)*	272	-0.0035	0.0000	0.1518	-0.1878	0.0418
Δ*CAdequacy (not ranked)*	272	0.0078	0.0027	1.5963	-1.0481	0.1289
Δ*EAbility (not ranked)*	272	-0.0234	-0.0005	0.5013	-0.2092	0.0043

This table reports the descriptive statistics for the changes in the regressors where Δ*AQuality* refers to the changes in the loan loss reserves to gross loans ratio, Δ*Liquidity* to the changes in the net loans to total assets ratio, Δ*CAdequacy* to the changes in the equity to net loans ratio, Δ*EAbility* for the changes in the return on average assets ratio. The capital adequacy (Δ*CAdequacy*) ratio measures a financial institutions' leverage and the ability to absorb expected and unexpected losses. The core business performance ratio (Δ*EAbility)* measures a bank's profitability and shows how effectively a bank carries out its asset and liability management strategy in form of how efficiently financial assets have been used to generate net income. The asset quality ratio (Δ*AQuality*) measures the quality of a banks' individually and collectively assessed loan portfolio. The liquidity ratio (Δ*Liquidity)* measures the extent to which the assets of a bank are bound to the individually and collectively assessed loan portfolio.

Justifying the split into crisis and non-crisis periods, the impact of the GFC on the banking sector is also reflected in the cumulative bond returns. Cumulative bond returns in the period from April 2004 to March 2007 show that bonds are indeed a rather secure investment in comparison to stocks, with a maximum return of 12.55%, median return of 4.23%, and a negative return only for 1% of the debt investment portfolio. This is in contrast to the cumulative bond return distribution during the bank-crisis period from April 2007 to March 2009. Although a maximum return of 17.69% is achieved, the median return is already 1% lower compared to the preceding non-bank crisis period. Furthermore, one quarter of the cumulative bond returns in the sample is negative and the lower decile of the distribution experiences a significant negative cumulative return of more than 10%. With regard to the period from April 2009 to March 2011, one can clearly argue that it is a non-bank crisis

period; nevertheless, the distribution of the cumulative bond returns presumably outlines a soaring debt market achieving a maximum cumulative return of 125%. In addition, the median cumulative return of 9.13% is twice as high as the return of the 'normal' period from 2004 to 2006. In addition to the CDX distribution and the NBER definition of the GFC period, the distribution of the annual cumulative bond returns in Table 2.2 supports the decision to define the bank crisis timeframe as a period starting in April 2007 and ending in March 2009.

TABLE 2.2: Annual Bond Return Distribution

Quantile	Period preceding GFC (n=95)	GFC period (n=89)	Period following GFC (n=88)	Full Sample Period (n=272)
100% Max	0.1255	0.1769	1.2553	1.2553
99%	0.0979	0.1769	1.2553	0.6541
95%	0.0788	0.0773	0.4958	0.3231
90%	0.0692	0.0699	0.3231	0.1918
75% Q3	0.0610	0.0551	0.1572	0.0948
50% Median	0.0423	0.0321	0.0913	0.0594
25% Q1	0.0226	-0.0159	0.0693	0.0306
10%	0.0088	-0.1379	0.0506	-0.0649
5%	0.0067	-0.1849	0.0364	-0.1379
1%	-0.0063	-0.3822	-0.0096	-0.2621
0% Min	-0.0489	-0.3822	-0.0096	-0.3822

This table reports the distribution of the annual bond returns for the period preceding the GFC (April 2004 – March 2007), GFC (April 2007 – March 2009), and the period following the GFC (April 2009 - March 2011). Bond returns are calculated as the change in bond price (cum accrued interest) plus coupon payments made during the return interval, scaled by the bond price at the start of the return interval. ($AnnRet_{ijt} = \frac{BP_{ijt}+AI_{ijt}-BP_{ijt-1}}{BP_{ijt-1}}$) BP_{ijt} is the flat price of bond i of firm j at time t. AI_{ijt} denotes the accrued interest for the respective bond issue. Annual bond returns are calculated for a period that starts nine month before the fiscal year-end of the respective firm and ends three months after the fiscal year-end. Using this time frame ensures that the annual bond returns relate to the respective annual disclosures published in the certified annual reports. Individual bond issues are aggregated to firm-level bond returns by taking a value weighted-average of the bond returns. In our analysis, I use these raw returns in all of our specifications. Easton et al. (2009) report that their results are not altered if raw returns are adjusted for contemporaneous U.S. treasury rates that are subtracted from the respective raw returns.

Tables 2.3a and 2.3b address multicollinearity issues among the regressors. Table 3a presents the correlations among the cumulative monthly bond returns (*Cumret*), differences in credit ratings (Δ*Rating)* and differences in the ratios related to asset quality *(*Δ*AQuality*), core business performance (Δ*EAbility*), equity base (Δ*CAdequacy*), and liquidity (Δ*Liquidity*). A correlation coefficient of -0.44 between the changes in the liquidity ratio and the changes in the equity base ratio attributable to the net loans component of both ratios seems to be

acceptable. To mitigate concerns that the decile-ranked regressors artificially increase the correlations and could possibly lead to multicollinearity issues, Table 2.3b shows the variance Inflation Factors (VIF) for both the ranked and non-ranked independent variables. These factors present the extent to which the variance of the coefficient estimates is inflated by multicollinearity. As can be seen, multicollinearity among the regressors is not of concern in this study.

TABLE 2.3a: Correlations among Dependent Variable and the Differences in the Regressors

Variables	*Cumret*	Δ*Rating*	Δ*AQuality*	Δ*CAdequacy*	Δ*Liquidity*	Δ*EAbility*
Cumret	1.0000					
Δ*Rating (not ranked)*	-0.0171	1.0000				
Δ*AQuality (not ranked)*	0.0259	0.1462	1.0000			
Δ*CAdequacy (not ranked)*	0.0679	0.0339	0.1370	1.0000		
Δ*Liquidity (not ranked)*	-0.0927	-0.0451	-0.2808	-0.4771	1.0000	
Δ*EAbility (not ranked)*	0.1588	-0.0567	-0.3917	0.1916	0.0267	1.0000

This table reports the Pearson correlation statistics among the cumulative monthly bond returns (Cumret), differences in credit ratings (Δ*Rating)* and differences in the ratios related to asset quality *(*Δ*AQuality*), core business performance (Δ*EAbility*), equity base (Δ*CAdequacy*), and liquidity (Δ*Liquidity*). ΔAQuality refers to the changes in the loan loss reserves to gross loans ratio, ΔLiquidity to the changes in the net loans to total assets ratio, ΔCAdequacy to the changes in the equity to net loans ratio, ΔEAbility for the changes in the return on average assets ratio. The capital adequacy (Δ*CAdequacy*) ratio measures a financial institutions' leverage and the ability to absorb expected and unexpected losses. The core business performance ratio (Δ*EAbility)* measures a bank's profitability and shows how effectively a bank carries out its asset and liability management strategy in form of how efficiently financial assets have been used to generate net income. The asset quality ratio (Δ*AQuality*) measures the quality of a banks' individually and collectively assessed loan portfolio. The liquidity ratio (Δ*Liquidity)* measures the extent to which the assets of a bank are bound to the individually and collectively assessed loan portfolio.

TABLE 2.3b: Variance inflation factor (VIF) among (ranked) independent variables

Variable	Variance Inflation (VIF) Not Ranked	Variance Inflation (VIF) Ranked
Intercept	0.0000	0.0000
Δ*Rating*	1.0274	1.0053
Δ*AQuality*	1.3519	1.0732
Δ*Liquidity*	1.1348	1.2390
Δ*CAdequacy*	1.0951	1.2783
Δ*EAbility*	1.2803	1.0922

This table reports the variance inflation parameter for the ranked and raw differences in credit ratings (Δ*Rating)* and the ratios related to asset quality *(*Δ*AQuality*), core business performance (Δ*EAbility*), equity base (Δ*CAdequacy*), and liquidity (Δ*Liquidity*). The capital adequacy (Δ*CAdequacy*) ratio measures a financial institutions' leverage and the ability to absorb expected and unexpected losses. The core business performance ratio (Δ*EAbility)* measures a bank's profitability and shows how effectively a bank carries out its asset and liability management strategy in form of how efficiently financial assets have been used to generate net income. The asset quality ratio (Δ*AQuality*) measures the quality of a banks' individually and collectively assessed loan

portfolio. The liquidity ratio (Δ*Liquidity)* measures the extent to which the assets of a bank are bound to the individually and collectively assessed loan portfolio.

1.6.2 Association of CAMEL ratios with annual bond returns

Table 2.4 reports the results of the hedge portfolio investment strategy in terms of the cumulative annual bond returns. The regressions coefficients reflect the association of the cumulative annual bond return with the decile-ranked changes in the ratios related to asset quality, liquidity, core business performance, and equity base. The returns examined in Table 2.4 are bond returns cumulated over a period of 12 months, ending three months after the fiscal year end. The results illustrate that financial institutions' changes in the ratios related to the CAMEL framework of the U.S. Federal Bank Regulatory Agencies in the non-bank crisis periods cannot explain the variation in the dependent variable, and are thus not associated with cumulative annual bond returns. On the contrary, the changes in core business performance ratio (ΔEAbility) appear to be significantly and positively associated with the annual cumulative bond returns during the bank-crisis period. The results are robust even after the inclusion of the changes in the average credit ratings (ΔRating) as an additional independent variable. Furthermore, ΔRating itself is significant and as expected negatively associated with annual bond returns.

As mentioned earlier, research literature provides evidence that equity investors are more interested in 'earning power' information than book values (liquidation value), and vice versa for firms deteriorating in financial health (Barth et al. 1998). With regard to debt investors, then, the opposite should be expected. Bond holders with their investments' limited upside potential, attributable to the instruments' inherent concave payoff function, conceivably limit their risk assessment to certified annual disclosures related to liquidity and equity base, and are less concerned with the 'earning power' and future growth opportunities in the respective investee during non-financial crisis periods. When firm values of financial institutions decline rapidly, debt holders potentially shift their focus from book values ratios related to liquidity, equity base, and asset quality to 'earning power' related ratios because these indicate whether the equity cushion to absorb losses can gradually be reinforced through internal financing capabilities.

The results in Table 2.4 support hypothesis 1a by showing that banks' annual cumulative bond returns are associated with annual changes in ratios related to 'earning

power' (ΔEAbility) during bank crisis periods (April 2007 – March 2009). Furthermore, banks' annual cumulative bond returns are not associated with ΔEAbility during non-bank crisis periods. With regard to hypothesis 1b, the null hypothesis that banks' annual cumulative bond returns are not associated with annual changes in ratios related to book values (Equity base: ΔCAdequacy / Liquidity: ΔLiquidity / Asset quality: ΔAQuality) during non-bank crisis periods cannot be rejected. These initial results of the association study suggest that bond investors favor information related to 'earning power' during financial crisis periods.

TABLE 2.4: Association of Annual Bond Returns with CAMEL Ratios

Model: $Cumret_{Nt} = \beta_0 + \beta_1 \Delta CAdequacy + \beta_2 \Delta Liquidity + \beta_3 \Delta EAbility + \beta_4 \Delta AQuality + \beta_5 \Delta CRating + \varepsilon$

Variables	Period preceding GFC	Period preceding GFC	GFC	GFC	Period following GFC	Period following GFC
Intercept	0.0508***	0.0090***	-0.0273	-0.0323	0.1989***	0.2157***
(t-stat)	(5.69)	(6.07)	(-0.66)	(-0.84)	(2.72)	(2.78)
Δ*EAbility*	-0.0086	-0.0107	0.1006**	0.1087***	0.0254	0.0115
(t-stat)	(-1.03)	(-1.28)	(2.42)	(2.75)	(0.34)	(0.15)
Δ*AQuality*	-0.0013	-0.0049	-0.0039	0.0288	0.0594	0.0662
(t-stat)	(-0.16)	(-0.59)	(-0.09)	(0.73)	(0.87)	(0.91)
Δ*Liquidity*	-0.0038	-0.0061	-0.0566	-0.0550	-0.0772	-0.0990
(t-stat)	(-0.41)	(-0.66)	(-1.52)	(-1.53)	(-1.09)	(-1.32)
Δ*CAdequacy*	0.0081	-0.0111	0.0154	-0.0059	-0.1157	-0.1123
(t-stat)	(-0.85)	(-1.18)	(0.40)	(-0.16)	(-1.53)	(-1.42)
Δ*Rating*	-	-0.0098	-	-0.1357***	-	-0.0783
(t-stat)	-	(-1.34)	-	(-4.13)	-	(-0.21)

This table reports the individual coefficients and the annual cumulative bond return of the perfect foresight portfolio strategy (Abarbanell and Bushee 1998) based on the changes in the four financial ratios related to CAMEL. Δ*AQuality* refers to the changes in the loan loss reserves to gross loans ratio, Δ*Liquidity* to the changes in the net loans to total assets ratio, Δ*CAdequacy* to the changes in the equity to net loans ratio, Δ*EAbility* for the changes in the return on average assets ratio. Δ*Rating* refers to the average-weighted credit ratings change provided by Standard and Poor's, Fitch, and Moody's. Δ*Liquidity* measures the extent to which the assets of a bank are bound to the individually and collectively assessed loan portfolio. An annual increase in this ratio informs investors about a financial institution having proportionately less short-term assets and cash and cash equivalents available to service its debt. Δ*AQuality* measures the quality of a banks' individually and collectively assessed loan portfolio. An increase in the ratio signals a deterioration in the performing part of the financial assets included in the overall loan portfolio. Δ*CAdequacy* measures a financial institutions' leverage and the ability to absorb expected and unexpected losses. A decline informs investors about a lower protection available to financial institutions to cover loan losses. Δ*EAbility* measures a bank's profitability and show how effectively a bank carries out its asset and liability management strategy in form of how efficiently financial assets have been used to generate net income. An increase in this ratio informs about banks being more profitable in the core business lines. The time periods are defined as the period preceding the GFC (April 2004 – March 2007), GFC (April 2007 – March 2009), and the period following the GFC (April 2009 - March 2011). P-values in parentheses are based on heteroskedasticity-robust, firm-level clustered standard errors. ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

1.6.3 Value relevance of ratios related to the CAMEL framework for bond holders

Although association studies provide evidence on the correlation between annual cumulative bond returns and accounting signals related to liquidity, asset quality, core business performance, and equity base in the month of the 10-K filing public release, one cannot draw causal inferences over such a long time period because other timely and relevant information potentially enters into the decision-making process. Other information channels include but are not limited to prospectuses, derivative markets, press releases, conference calls, and credit ratings. These information channels could provide relevant and timely information to bond investors mitigating the importance of accounting variables in the investment evaluation process.

In a first step to examine the value relevance of ratios related to the CAMEL framework, I investigate whether the perfect foresight hedge portfolio strategy provides significant contributions to the overall return in the months the 10-K filings are announced. Figure 2.1 illustrates that for the bank-crisis period the hedge portfolio strategy under perfect foresight achieves significant return contributions of 49.4% in the months the 10-K filings are announced. Furthermore, Figure 1 illustrates that even in the case of perfect foresight of the ratios related to liquidity, asset quality, core business performance, and equity base, bond holders seem not to incorporate accounting information in their investment decisions process during non-bank crisis periods. Overall, these findings seem to support hypothesis 2, that during the 2007-2009 bank crisis period banks' cumulative monthly bond returns were more strongly associated with annual changes in ratios related to the CAMEL framework in the month of the financial statements' public release than in previous months.

FIGURE 2.1 Perfect foresight investment portfolio returns

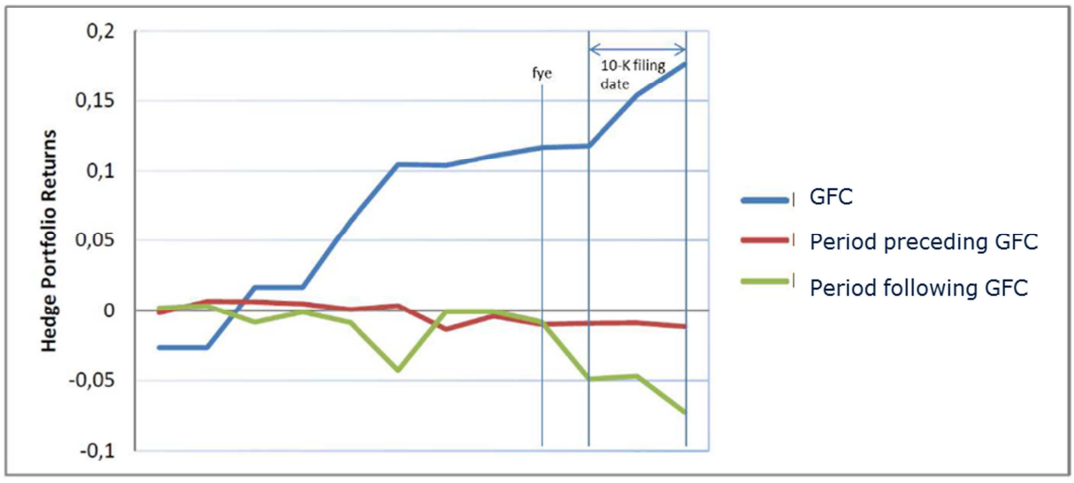


TABLE 2.5: Importance of Ratios related to the CAMEL framework around the SEC Filing Date

Model: $ABR = \gamma_0 + \gamma_1 Rq1q3 + \gamma_3 Rq4 + \gamma_4 R\text{sec} + \varepsilon$

Variables	± 7 Day window for period 2007 – 2008 (t-stat)
Intercept	-0.0002
	(-0.02)
Rq1q3	0.2018
	(0.71)
Rq4	1.0192**
	(2.26)
Rsec	1.3352***
	(5.10)

This table reports the relative importance of the cumulative bond returns of the 15 days centered on the respective preliminary earnings announcement date of quarter 1 to quarter 3 (Rq1q3), quarter 4 (Rq4), and the U.S. Securities and Exchange Commission (SEC) EDGAR 10-K filings announcement dates (Rsec) in explaining the cumulative annual bond return (Ball and Shivakumar 2008). Bond returns are calculated as the change in bond price (cum accrued interest) plus coupon payments made during the return interval, scaled by the bond price at the start of the return interval. ($AnnRet_{ijt} = \frac{BP_{ijt}+AI_{ijt}-BP_{ijt-1}}{BP_{ijt-1}}$) BP_{ijt} is the flat price of bond i of firm j at time t. AI_{ijt} denotes the accrued interest for the respective bond issue. On average, significant coefficients exceeding 1 are indicative of investors' under-reaction to the information disclosed in the certified annual financial statements (Ball and Shivakumar 2008). P-values in parentheses are based on heteroskedasticity-robust, firm-level clustered standard errors. ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

To provide evidence that the significant return contribution in the months the 10-K filings are announced is indeed attributable to the 10-K filing announcement dates, I examine the relative importance of preliminary earnings and 10-K filing announcements for investors in the debt market by regressing each individual event window bond return on the annual bond return (Ball and Shivakumar 2008) (Table 2.5). The regression coefficients on the cumulative bond return during the 15-day period around the 10K-filing date is positive and significant at the 1% confidence level, signaling the relevance of the 10-K filing for bond holders' investment valuation. Ball and Shivakumar (2008) provide evidence that on average coefficients exceeding 1 are indicative of investors' under-reaction to the information disclosed in the certified annual financial statements. The findings support hypothesis 3, which states that short-window cumulative bond returns centered on the 10-K filings announcement dates are more strongly associated with banks' cumulative annual bond returns than short-window cumulative bond returns centered on the preliminary earnings announcement dates during the recent financial crisis period.

In addition to addressing causal inferences through the relative importance of preliminary earnings and 10-K filing announcements for investors in the debt market, I

conduct a daily bond returns analysis that includes accounting information signals related to the CAMEL framework. The Ball and Shivakumar (2008) regressions explained above address the relevance of the individual event windows, but do not specifically test the value relevance of changes in ratios related to asset quality, liquidity, equity base, and core business performance for bond holders. Table 2.6 reports the results of the regression analysis of equation (3) and presents the individual coefficients for the main effects ($\Delta EAbility$, $\Delta AQuality$, $\Delta Liquidity$, and $\Delta CAdequacy$), the indicator variables for the different event windows (preliminary earnings announcement and SEC filing date windows), and the interaction terms of the main effects with the indicator variables with respect to the daily bond return analysis for the financial crisis (April 2007 – March 2009) and the non-financial crisis period (April 2004 – March 2007). The result supports hypothesis 4 which states that changes in banks' financial ratios related to the CAMEL framework are value relevant for bond holders only during the recent financial crisis. The significant and positive coefficients on the interaction terms of $\Delta EAbility$ and $\Delta CAdequacy$ with the 10-K filing announcement date window suggest that indicators related to 'earning power' and capital adequacy are value relevant for bond holders. Additionally, the negative and significant coefficient on the interaction term of $\Delta Liquidity$ with the 10-K filing announcement date window provides evidence that the liquidity position of financial institutions is value relevant for investors during periods of turmoil and distress.

TABLE 2.6: Daily Bond Return Analysis for Non-Financial Crisis (April 2004 – March 2006) and Financial Crisis Period (April 2007 – March 2009)

Model:

$$DBR = \delta_0 + \delta_1 \Delta EAbility + \delta_2 \Delta AQuality + \delta_3 \Delta Liquidity + \delta_4 \Delta CAdequacy$$
$$\delta_5 q1q3\_win15 + \delta_6 q4\_win15 + \delta_6 \text{sec}\_win15$$
$$\delta_{11} q1q3\_win15 \times \Delta EAbility + \delta_{12} q4\_win15 \times \Delta EAbility + \delta_{13} \text{sec}\_win15 \times \Delta EAbility$$
$$\delta_{21} q1q3\_win15 \times \Delta AQuality + \delta_{22} q4\_win15 \times \Delta AQuality + \delta_{23} \text{sec}\_win15 \times \Delta AQuality$$
$$\delta_{31} q1q3\_win15 \times \Delta Liquidity + \delta_{32} q4\_win15 \times \Delta Liquidity + \delta_{33} \text{sec}\_win15 \times \Delta Liquidity$$
$$\delta_{41} q1q3\_win15 \times \Delta CAdequacy + \delta_{42} q4\_win15 \times \Delta CAdequacy + \delta_{43} \text{sec}\_win15 \times \Delta CAdequacy + \varepsilon$$

Variables	± 7 Day window for period preceding GFC	(t-stat)	± 7 Day window for GFC period	(t-stat)
Intercept	0.0003***	(3.11)	-0.0000	(-0.04)
Δ*EAbility*	-0.0000	(-0.25)	0.0002	(0.79)
Δ*AQuality*	-0.0001	(-0.70)	0.0001	(0.36)
Δ*Liquidity*	-0.0000	(-0.02)	0.0002	(1.22)
Δ*CAdequacy*	0.0000	(0.03)	-0.0001	(-0.44)
q1q3_win15	-0.0002	(-0.43)	0.0003	(0.45)
q4_win15	-0.0002	(-0.66)	-0.0004	(-0.29)
sec_win15	0.0002	(0.34)	-0.0020*	(-1.65)
Δ*EAbility * q1q3_win15*	0.0004	(1.04)	-0.0006	(-0.85)
Δ*EAbility * q4_win15*	0.0002	(0.34)	0.0019	(1.61)
Δ*EAbility * sec_win15*	0.0001	(0.22)	0.0021*	(1.88)
Δ*AQuality * q1q3_win15*	0.0002	(0.45)	-0.0009	(-1.40)
Δ*AQuality * q4_win15*	0.0004	(0.76)	0.0001	(0.12)
Δ*AQuality * sec_win15*	0.0001	(0.19)	0.0010	(-0.96)
Δ*Liquidity * q1q3_win15*	-0.0001	(-0.25)	0.0000	(0.06)
Δ*Liquidity * q4_win15*	-0.0003	(-0.51)	-0.0008	(-0.72)
Δ*Liquidity * sec_win15*	-0.0002	(-0.33)	-0.0027**	(-2.44)
Δ*CAdequacy * q1q3_win15*	-0.0003	(-0.65)	0.0008	(1.22)
Δ*CAdequacy * q4_win15*	-0.0004	(-0.65)	-0.0003	(-0.31)
Δ*CAdequacy * sec_win15*	-0.0004	(-0.60)	0.0024**	(2.32)

This table reports the individual coefficients for the main effects (Δ*EAbility*, Δ*AQuality*, Δ*Liquidity*, and Δ*CAdequacy*), the dummy variables indicating the different ± seven day event windows (preliminary earnings announcement and SEC filing date windows), and the interaction terms of the main effects with the dummy variables with respect to the daily bond return analysis for the financial crisis (April 2007 – March 2009) vs. non-financial crisis period (April 2004 – March 2007). Daily bond returns are calculated as the change in bond price (cum accrued interest) plus coupon payments made during the return interval, scaled by the bond price at the start of the return interval. Δ*AQuality* refers to the changes in the loan loss reserves to gross loans ratio, ΔLiquidity to the changes in the net loans to total assets ratio, ΔCAdequacy to the changes in the equity to net loans ratio, Δ*EAbility* for the changes in the return on average assets ratio. ΔRating refers to the average-weighted credit ratings change provided by Standard and Poor's, Fitch, and Moody's. Δ*AQuality* measures the quality of a banks' individually and collectively assessed loan portfolio. An increase in the ratio signals a deterioration in the performing part of the financial assets included in the overall loan portfolio. Δ*CAdequacy* measures a financial institutions' leverage and the ability to absorb expected and unexpected losses. A decline informs investors about a lower protection available to financial institutions to cover loan losses. Δ*EAbility* measures a bank's profitability and show how effectively a bank carries out its asset and liability management strategy in form of how efficiently financial assets have been used to generate net income. An increase in this ratio informs about banks being more profitable in the core business lines. P-values in parentheses are based on heteroskedasticity-robust, firm-level clustered standard errors. ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

1.7 Concluding remarks

This study investigates whether and to what extent bond investors in the financial institution sector free-ride on regulatory certification in non-financial crisis periods, and whether they use accounting signals in their decision-making process only during economic downturns. The 2007-2009 bank crisis period provides a perfect setting to test whether financial institutions' financial accounting indicators related to the CAMEL framework of the U.S. Federal Bank Regulatory Agencies — capital adequacy, asset quality, earnings ability, and liquidity — enter, if at all, into the decision-making process of investors holding a portfolio of debt instruments in financial institutions. Applying a perfect foresight portfolio investment strategy (Abarbanell and Bushee, 1998), I find evidence that cumulative monthly bond returns are associated with changes in 'earning power' and changes in credit ratings only when financial markets are illiquid and not transparent. This is potentially attributable to diverging interests of bank regulators and institutional bond investors during bank crisis periods, with debt holders conceivably relying to a lesser extent on regulatory agencies' private information and certification. Moreover, I provide insight in terms of bond prices that have not fully anticipated accounting signals during periods of financial distress and illiquidity. To draw causal inferences, I also conduct an event study utilizing short-term windows centered on the U.S. Securities and Exchange Commission (SEC) EDGAR 10-K filing announcement dates and preliminary earnings announcement dates, and report the value relevance of ratios related to changes in 'earning power', liquidity, and capital adequacy for bond holders during the recent financial crisis period (April 2007-March 2009).

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