ABSTRACT

Title of dissertation: ESSAYS ON FORCES UNDERLYING 2008 FINANCIAL CRISIS: CREDIT RATING AGENCIES AND INVESTOR SENTIMENT

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The roots of the 2008 financial crisis are often traced back to the collapse of the housing bubble. The factors that precipitated the crisis, and propagated its effects on firms and consumers to produce an economic contraction, are still the subject of ongoing debate among academics, policy makers, and practitioners. Macroeconomic factors, flawed government policies, and perverse incentives at financial institutions that lead to excessive risk taking are often cited as contributing forces to the crisis. In this dissertation, I investigate two forces that drove the 2008 financial crisis. One force is the credit rating agencies, whose excessively generous ratings lie at the root of the 2008 financial crisis. The popular claim is that the rating agencies have become too loose at their rating assignments, which led to overestimation of the creditworthiness of the companies by the public. In this dissertation, I examine the assertion that the rating companies have progressively relaxed their standards in recent decades for corporate credit ratings. Such relaxation seems to have lulled investors into a false sense of security about the safety of credit instruments whose

values collapsed abruptly. Next I examine the contagion effects of rating downgrades. I ask whether rating downgrade news have spill over effects on the rest of the industry. I then investigate a different force that has received less attention in the crisis; investor confidence. The third essay focuses explicitly on the period when the financial crisis was at its peak.

In Essay 1 titled, "Structural Shifts in Credit Rating Standards", I examine the time series variation in corporate credit rating standards for the period 1985-2007. I report two main findings: (i) There is a divergent pattern between investment grade and speculative grade rating standards during 1985-2002. Investment grade ratings tighten between 1985 and 2002. In contrast, the speculative grade rating standards loosen during the same period. Consistent with an agency explanation, rating companies assign more issuer friendly ratings to speculative grade credits, where there is substantial growth by the first-time entrants. The loose standards in speculative grade ratings are consistent with widespread criticism of the rating agencies during the Dot-Com crash. However, while the media focused on failure of rating agencies in high profile corporate debacles, the more serious problem was in the speculative grade rating assignments. (ii) There is a sharp structural break in both investment grade and speculative grade standards towards more stringent ratings around 2002. The change in rating levels due to the structural break is both economically and statistically significant. Holding firm characteristics constant, firms experience a drop of 1.5 notches in ratings due to tightening standards between 2002 and 2007. It appears that widespread criticism and threat of regulation led rating agencies to move towards more conservative ratings after the Dot-Com crash, Enron debacle and passage of Sarbanes-Oxley Act.

In Essay 2 titled "Contagion Effects of Rating Downgrade Announcements", we examine the intra-industry spill over effects of rating downgrade announcements based on abnormal returns for stock and CDS spreads of competitor industry portfolios. We find minor contagion effects for the equity prices of the industry portfolios for the entire sample. For the competitors of investment grade firms, we find significant contagion effects in the magnitude of -15 basis points for the window (0,1). For the speculative grade sample, we do not observe contagion or competition effects although this result can be due to cancellation of contagion and competition effects for the low rated firms. These results suggest that the net effect is dependent on the event firm's original rating. We find statistically significant CDS reaction of industry portfolios to downgrade news although in moderate magnitudes. The cross sectional tests show that the industry portfolio equity response and event firm equity response are positively correlated. This finding presents further evidence of contagion effects for rating downgrades.

Essay 3 discusses a different force that has received less attention in the financial crisis, investor sentiment, and focuses on data drawn from the crisis period. In Essay 3, titled "Confidence and the 2008 Financial Crisis", we examine the role of confidence in the 2007-2008 financial crisis using new high frequency data on daily closed-end fund discounts and novel measures of consumer sentiment from non-financial sources extracted at daily frequency. Empirically, there is some movement in sentiment through much of the crisis period but it is relatively moderate. However, tests detect a sharp structural break around the Lehman bankruptcy, after which there are breaks in both pricing across multiple asset classes and co-movement, especially in hard-to-arbitrage fund classes. Fund discounts also exhibit significantly increased co-movement with non-financial Gallup sentiment measures after the Lehman bankruptcy, and closed-end fund discount betas with respect to the market increase significantly during this period. While fund discounts may reflect liquidity issues in normal conditions, they seem to better reflect sentiment in stressed environments, so funds have undesirable conditional betas. The results are consistent with the view that the Lehman bankruptcy induced a negative shock to the supply of arbitrage capital, and as predicted by behavioral finance models of costly arbitrage, sentiment then matters more and is closely tied to returns. The results are also consistent with theories of financial crisis in which sentiment or confidence is an extra force that amplifies and transmits economic shocks that add to the usual credit and collateral mechanisms studied in the literature.

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Chapter 1

Structural Shifts in Credit Rating Standards

1.1 Introduction

Credit rating agencies face widespread criticism regarding the quality of their ratings. Questions about the role of rating agencies were raised around the Asian Financial Crisis in 1997, when the rating agencies appeared to lag the market rather than being pro-active (IMF (1999), Reisen and von Maltzan (1999)). Stronger criticisms regarding the "looseness" of ratings surfaced after the accounting scandals of Enron and WorldCom, when the rating agencies failed to foresee the deterioration of the company financials and the upcoming bankruptcies. Enron kept its investment grade long-term issuer rating until four days before its bankruptcy. The 2007-2008 financial crisis further elevated the criticism. Mortgage backed securities carrying investment grade ratings incurred large losses during the crisis, suggesting that the ratings of these securities were overstated. As a result, credit rating agencies face heavy scrutiny and popular wisdom generally dictates that rating agencies loosened their standards in the last decade.[1]

[1] "Triple-A-Failure," by Roger Lowenstein, New York Times Magazine, April 27, 2008. "Bringing Down Wall Street as Ratings Let Loose Subprime Scourge," by Elliot Blair Smith, www.bloomberg.com, Sept 24, 2008. "Berating the Raters", by Paul Krugman, New York Times Magazine, April 25, 2010. "Downgrade the Rating Agencies", by Kathleen Casey And Frank Partnoy, New York Times Magazine, June 04, 2010. "Rating The Raters: Enron And The Credit Rating Agencies", Congressional Hearing, March 20, 2002. "Credit Rating Agencies And The Financial Crisis", Congressional Hearing, October 22, 2008. "Reforming Credit Rating Agencies", Congressional Hearing, September 30, 2009.

Although the mass media has already sentenced the rating agencies for employing loose standards, a more formal investigation is necessary before drawing firm conclusions. More specifically, it is important to examine whether the rating agencies indeed relaxed their standards, particularly in the recent periods of interest such as the Dot-Com crash and the current subprime crisis. In this paper, I study whether the credit rating agencies tighten or loosen the corporate ratings during the period 1985 - 2007. I report two main findings: First, I find that between 1985-2002, there is a divergent pattern between investment grade and speculative grade rating standards. That is, the rating agencies tighten the standards for investment grade ratings, while relaxing the standards for speculative grade ratings. Second, I find that around 2002, there is a sharp structural break towards "more stringent" ratings in both investment grade and speculative grade rating categories.

My first major finding is a puzzling divergent pattern between investment grade and speculative grade standards during 1985-2002. As in Blume, Lim, and Mackinlay (1998) (henceforth BLM), I find that the investment grade ratings tighten during this period. Holding firm characteristics constant, the tightening amounts to an average of 1.1 notches for investment grade ratings. However, in contrast to investment grade ratings, speculative grade ratings loosen 0.6 notches during the same period. The loosening of standards in speculative grade ratings is consistent with the widespread criticism of agencies during the Dot-Com crash. Before 2002, the tightening trend in standards shown by BLM pertains only to the investment grade category, where the default rates are rare in any case. However, consistent with the popular wisdom, the rating agencies were indeed getting looser in their speculative grade rating assignments where the majority of the defaults occur.

These findings raise the question as to why rating agencies loosen the standards for speculative grade bonds while tightening the standards for investment grade bonds prior to 2002. I do not offer a full analysis of this question. However, the following explanation is plausible. I show that throughout 1985-2002, much of the growth in the universe of rated firms comes from the speculative grade first-time issuers. Rating agencies appear to assign more issuer friendly ratings to this asset class where there is substantial growth by the first-time entrants. The issuer-pays rating model can play a role here to attract further business. Indeed, such behavior also mirrors the failure of the rating agencies in the structured product finance products during the 2007-2008 financial crisis (Ashcraft, Goldsmith-Pinkham, and Vickery (2009)). Similar to the expansion in speculative credits prior to 2002, the mortgage backed securities of the subprime loans were newly rated instruments and experienced substantial growth during the post 2002 period.

My analysis also shows that there is a sharp structural break towards "more stringent" standards in both investment grade and speculative grade ratings around 2002. The structural break is both statistically and economically significant. Between 2002-2007, the investment grade ratings tighten sharply 1.3 notches, and the rate at which these ratings tighten is faster than 1985-2002 period. The speculative grade standards also tighten by an average of 1 notch after 2002. For the entire sample, the post 2002 drop in ratings amounts to 1.5 notches. The timing of the 2002 break coincides with the increased regulatory scrutiny and investor criticism beginning with high profile accounting scandals. The scandals and the subsequent passage of the Sarbanes-Oxley Act accelerated discussions regarding the quality of ratings, and the role of rating agencies in capital markets. It appears that widespread criticism, the regulatory threat to open up rating industry to competition coupled with reputational concerns of rating agencies led them to make structural changes to their rating standards.

Both findings are economically significant. For instance, S&P AA rated 10 year maturity bond yield index is on the average 24 basis points lower than the A rated index between 1996 and 2007. Based on this difference, 1.5 notches tightening in standards between 2002 and 2007 translate into 12 basis points higher cost of debt for issuers. Furthermore, the results survive a wide range of control variables and robustness tests. Alternative methods of measuring time trends in standards yield same patterns. The results also hold robustly in sample of first time issuers and sample of firms that existed in 1985.

Campbell, Lettau, Malkiel, and Xu (2001) demonstrate that idiosyncratic volatility of US firms trends upward between 1962-1997. In a related article, Campbell and Taksler (2003) show that increasing idiosyncratic volatility helps explain the widening of credit spreads between 1963 and 1999. In time series tests, additionally I investigate whether increasing idiosyncratic volatility can also account for the declining trend in ratings. I find that increase in idiosyncratic volatility can partially explain the change in rating standards until 2002. However, the aggregate idiosyncratic volatility comes down after 2002, while ratings continue to decline.[2] Therefore idiosyncratic volatility can not explain tightening rating trends after 2002.

[2]Brandt, Brav, Graham, and Kumar (2010) document idiosyncratic volatility trends until 2007.

The rest of the paper is organized as follows: I begin with a summary of credit rating literature in Section 2.2. Section 1.3 discusses the empirical strategy of measuring trends in rating standards, followed by the explanation of data used in this study in Section 2.3. Section 2.4 presents the results; the time series variation in rating standards. I conduct robustness tests and tests regarding idiosyncratic volatility in Section 1.6. Section 2.5 concludes.

1.2 Background

Credit ratings are ordinal rankings of credit risk across firms. At any point in time, a firm's credit rating is relative measure of creditworthiness, however, it does not correspond to absolute default probabilities over time. That is, the actual default probability implied by ratings may change over time. Issuer credit ratings provide "an opinion of the obligor's overall capacity and willingness to meet its financial obligations as they come due - whether rated or not" (Standard and Poor's (2008b)). S&P issuer ratings reflect only the risk of default and does not incorporate information about recovery rates.[3] In addition, they do not take into account any provisions of a particular debt issue. Failure to make payment on any debt obligation leads to "Default" status in the issuer ratings.

Ratings are intended to measure the creditworthiness of a corporation over long investment horizons. Short term fluctuations in the default risk due to business cycles do not trigger rating changes. Agencies take a rating action only if they perceive a permanent change in credit quality of a corporation. This method,

[3] On the other hand, Moody's issuer ratings reflect both default risk and loss given default.

known as "through-the-cycle" methodology, ensures that agencies maintain stability of ratings and avoid rating reversals.[4] Rating changes are triggered only when the difference between the rating-implied credit quality and the current credit quality is beyond some threshold. When triggered, ratings are adjusted partially i.e., there is a prudent migration policy (Loffler (2004), Altman and Rijken (2004), Altman and Rijken (2005)). The partial adjustment of ratings is believed to cause the serial dependency documented by Altman and Kao (1992) and Lando and Skodeberg (2002). In that sense, ratings do not posses Markovian properties. Both the path leading to the current rating and the duration spent at the current rating category is correlated with the subsequent upgrade or downgrade probability. This effect is particularly prominent for downgrades: a downgrade is mostly followed by a further downgrade.

Rating agencies are frequently criticized for being "too slow to update" their ratings as a consequence of the through-the-cycle and prudent migration methodologies. In response to this criticism, agencies frequently emphasize the trade off between rating stability and rating accuracy (Cantor and Mann (2006)). Beaver, Shakespeare, and Soliman (2006) argue that "*the properties of bond ratings are shaped by the institutional incentives placed on them by their clientele*". Because certified agency ratings are dominantly used by institutional investors in contracting and portfolio governance rules, frequent reversal of ratings would lead to costly portfolio re-balancing or other costly actions dictated by the contracts such as rat-

[4] Amato and Furfine (2004) examine the cyclical properties of ratings and find very little evidence for cyclicality.

ing triggers. As a result, agencies are conservative in updating ratings. For a broad review of other criticisms pertaining to the rating agencies, see Frost (2007).

The article most related to this study is BLM. Using S&P bond level ratings, BLM studies the investment grade rating standards between 1978 and 1995. They show that the apparent deterioration of credit quality of US firms seems to be driven at least partly by the stricter standards employed by the rating agencies. Moody's reports also show the dominance of downgrades over upgrades as early as Lucas and Lonski (1992), and Carty and Fons (1993). Lucas and Lonski document that the ratio of long term downgrades to upgrades deteriorated from a 1.17 average in the 1970s to 2.17 in the 1980s, reaching a record 4.93 in 1990. They also report that the declining trend in ratings is accompanied by an increased rating activity. While only 6% of the rated issuers ended the calendar year with a different rating during the 1970s, this ratio rose to 12% during the 1980s. S&P ratings follow similar trends as well. According to Standard and Poor's (2008a), the average downgrade to upgrade ratio between 1981 and 2008 is 1.58; an average of 1.66 in 1980s, 1.41 in 1990s and 1.71 between 2001 and 2008. The fact that the downgrades consistently outnumber upgrades indicates the decline in average rating over time.

In a study similar to BLM, Gonis and Taylor (2009) examine the S&P corporate ratings for 69 UK firms between 1999-2004. In line with BLM, they find that the increased number of downgrades relative to the upgrades is due to the increase in rating agencies' stringency. Doherty and Phillips (2002) analyze the reported decline in property-liability insurer ratings by the agency A.M. Best over the period 1988 to 1999 while Pottier and Sommer (2003) examine life insurer ratings issued by A.M. Best and S&P between 1987 to 1999. Using a similar method, they report findings which are consistent with BLM results. Becker and Milbourn (2009) analyze the effect of competition on rating standards. They document that the ratings slightly loosen in certain industries after Fitch increases its market share. They find that one standard deviation increase in Fitch's market share is associated with an increase in the average firm rating of 5-10% of one rating notch.

The failure of rating agencies to predict high profile corporate bankruptcies such as Enron (December 2, 2001), Worldcom (July 21, 2002), California Utilities and others, brought rating agencies under heavy scrutiny. The rating agencies maintained investment grade ratings for these firms until several days before they declared bankruptcy leading the mass media to question the quality and value of the ratings. Section 702 of Sarbanes-Oxley Act (July 25, 2002) requires SEC to "conduct a study of the role and function of credit rating agencies in the operation of the securities market".[5] The act also calls for examination of any barriers to entry into the credit rating industry, and any measures needed to increase competition as well as examination of any conflicts of interest in their operations.[6]

The increased regulatory pressure beginning with SOX resulted in the passage of Credit Rating Agency Reform Act of 2006. The main contribution of the act is to open the credit rating industry up to more competition by making it easier for rating companies to achieve Nationally Recognized Statistical Rating Organization status.

[5] In their model, Boot, Milbourn, and Schmeits (2006) show that rating agencies play an important role as a coordinating mechanism in the economy where multiple equilibria can exist. Sufi (2009) also provides evidence for real effects of debt certification.

[6] Bolton, Freixas, and Shapiro (2009) model and study the conflicts of interests in the credit rating agencies.

Only ratings of NRSRO's can be used for regulation purposes, creating a privilege for the agencies which obtain the status.[7] The act abolishes the SEC's authority to approve credit-rating agencies as NRSROs. Instead, it allows any agency with three years of experience that satisfies certain criteria to register with the SEC as a nationally recognized rating agency. With the new law, SEC is also granted the authority to inspect NRSRO internal operations such as record-keeping, financial reporting and managing conflicts of interest.[8]

Evidence complementary to my results is presented by Cheng and Neamtiu (2009), who examine the quality of ratings in terms of timeliness, accuracy and stability before and after the Sarbanes-Oxley Act. The authors define the window before SOX (1 January 1996 - 25 July 2002) as the pre-criticism period and the window after SOX (25 July 2002 - 31 Dec 2005) as the criticism period. They find that the average ratings of defaulted companies in the one year period leading to default are lower in the criticism period compared to pre-criticism period. They then conclude that the agencies did not adhere to the best possible rating practices in the pre-criticism period. The structural change in rating practices after high profile corporate debacles is also noted by industry specialists. A 2004 UBS Investment Bank Report (Pettit, Fitt, Orlov, and Kalsekar (2004)) notes that rating agencies enjoyed substantial profits from disintermediation, the shift from bank based lending

[7]Earlier, the SEC granted the NRSRO status through a complex process. During the infamous accounting scandals there were only 3 NRSRO's: S&P, Moody's and Fitch, whereas as of September 2009, there are 10 rating agencies qualifying for the status. (www.sec.gov)

[8]Frost (2007) states that "*The large CRAs also have been the focus of attention internationally. The International Organization of Securities Commissions (IOSCO) has been examining their role in capital markets (IOSCO 2003a) and the European Parliament recently called on the European Commission to assess the need for legislation to deal with the CRAs.*"

to capital market based lending, and the growth of speculative grade debt markets until the accounting scandals of 2000-2002.[9] However the scandals put them under fire and forced them to take actions to restore confidence. The rating agencies then made structural changes to their analytics, processes, personnel, and started employing more conservative standards. Issuers must now expect more skepticism, and more conservative ratings from the agencies.

1.3 Empirical Strategy

The goal of the analysis is to identify whether the ratings get more stringent or loose over time. For the purposes of this paper, I use a narrow definiton of stringency. If rating agencies used the model they used in 1985 to assign ratings after 1985, I ask whether a firm holding same risk characteristics receive a higher or lower rating. Higher ratings would imply loosening in standards, whereas lower ratings would mean stringency.

In order to analyze the trends in rating standards, BLM estimate a panel of ordered probit model, where they model ratings as a function of firm characteristics and year indicator variables. Year indicators are then used to capture the stringency/loosening in the rating standards relative to the left out year, i.e. first year in the sample. I follow this approach. If the coefficient estimates are stable over time, this method would measure the trends in standards correctly. However, if the coefficients are changing, the year dummies might be misleading. In order to address this problem, I also measure the trend using an alternative approach used by Fama

[9]See Rajan (2005) for further discussion about disintermediation.

and French (2001) in their study of disappearing dividends (see also Hoberg and Prabhala (2009)). I estimate the model coefficients using year 1985 only, and then predict the ratings for the whole sample using these coefficient estimates. For each observation, I calculate the residual, viz., actual rating minus predicted rating, and then average the residuals over each year. The average residual of a particular year then tells us, on the average, how many notches a firm's actual rating differs from its hypothetical rating calculated using 1985 standards. Since both methods provide reasonably close results, I continue with the year dummy approach used by BLM. I therefore estimate an ordered probit model where I model the ratings as a function of BLM firm characteristics, additional control variables and year indicators. The model I estimate is:

$$R_{it} = \begin{cases} 17 & \text{if } Z_{it} \in [\ \mu_{16},\ \infty) \\ 16 & \text{if } Z_{it} \in [\ \mu_{15},\ \mu_{16}) \\ \vdots & \\ 2 & \text{if } Z_{it} \in [\ \mu_{1},\ \mu_{2}) \\ 1 & \text{if } Z_{it} \in (-\infty,\ \mu_{1}) \end{cases} \tag{1.1}$$

$$Z_{it} = \alpha_t + \beta' X_{it} + \epsilon_{it} \tag{1.2}$$

$$E[\epsilon_{it}|X_{it}] = 0 \tag{1.3}$$

where R_{it} denotes the long term issuer rating of firm i at year t, α_t the intercept for year t, β the vector of slope coefficients and Z_{it} the latent variable linking firm characteristics to the rating categories R_{it} according to partition points μ_i. X_{it} is a matrix whose columns are variables Size, Operating Margin, Long Term Debt Leverage, Total Debt Leverage, Idiosyncratic Risk, Systematic Risk, Interest Coverage, Tangibility, Cash Balances, Retained Earnings, R&D, Capital Expenditures, Dividend Payer, M/B.

In an ordered probit model, the magnitude of the coefficients is not economically meaningful. For instance, the year dummy coefficient estimates, α_t, are in units of the latent variable Z_{it}, making it difficult to interpret their economic significance. In order to assess the economic value, I convert the year indicator coefficients α_t to units of rating notches. I first calculate the average distance between adjacent rating categories, i.e. average distance for one notch, by averaging the difference between cut points, i.e. $(\mu_{16} - \mu_1)/15$. Then I report the year dummy coefficients as multiples of this average distance. For the remaining explanatory variables, I follow the common procedure to assess economic significance in discrete choice models. I calculate the number of rating notches a firm would improve its rating given one standard deviation increase in the relevant explanatory variable.

The firm characteristics I use in the study are listed below. Size, operating margin, long term debt leverage, total debt leverage, idiosyncratic risk, systematic risk and interest coverage variables follow BLM. BLM uses the three year averages of the variables interest coverage, operating margin, LT debt leverage and total debt leverage and I follow their practice. Based on the S&P reports (Standard and Poor's (2007), Standard and Poor's (2008b)) and literature, I include the remaining variables. Compustat item codes are given in parentheses.

- **Size:** NYSE market capitalization percentile, i.e., the fraction of NYSE firms having equal or smaller capitalization than firm i in year t.[10]

- **Operating Margin:** Operating income before depreciation (oibdp) to sales (sale)

- **LT Debt Leverage:** Long term debt (dltt) to assets (at)

- **Total Debt Leverage:** Long term debt (dltt) plus short term debt (dlc), divided by assets (at)

- **Idiosyncratic Risk:** A firms idiosyncratic risk is the root mean squared error from a regression of its daily stock returns on the CRSP value-weighted index return. One firm-year observation of idiosyncratic risk is computed using firm-specific daily stock returns from one calendar year. A minimum of 50 observations in a calendar year are required to calculate idiosyncratic risk.[11]

- **Systematic Risk:** A firms systematic risk is market model beta estimated from the above regression used to define idiosyncratic risk.

[10] BLM's size measure is log of market capitalization deflated by cpi. This choice is criticized by Cantor (2004) who claims that any trend in the market capitalization may lead to overstatement of the decline in ratings. Following Fama and French (2001), I use NYSE market capitalization percentile as a proxy for size to eliminate this problem.

[11] Although BLM control for idiosyncratic volatility, they standardize the variable before using it. That is, they divide each idiosyncratic volatility observation by that year's average value, creating a variable with a mean of 1 in each year. Because it is de-trended, their idiosyncratic volatility measure acts as a pure cross sectional variable and can not capture any decline in the ratings due to rising idiosyncratic volatility. In order to control for the trends in idiosyncratic volatility, I do not standardize it in my analysis.

- **Interest Coverage:** Operating income after depreciation (oiadp) plus interest expense (xint) divided by interest expense (xint). I modify the functional form of the interest coverage in line with BLM. First, before taking the three year averages, the ratio is set to zero for negative values. Any three-year average which is greater than 100, is bounded at 100. Then, to address the non-linearity of the relation between interest coverage and credit risk, I break the variable into four continuous variables, interest coverage-a to interest coverage-d, which capture the incremental value of the interest coverage in intervals of (0-5), (5-10), (10-20) and (20-100).

- **Tangibility:** Property plant and equipment - total (ppent) to assets (at)

- **Cash Balances:** Cash and short-term investments (che) to assets (at)

- **Retained Earnings:** Retained earnings (re) to assets (at)

- **R&D:** Research and development expense (xrd) to assets (at). If data item xrd is missing, it is set to zero.

- **Capital Expenditures:** Capital expenditures (capx) to assets (at)

- **Dividend Payer:** A firm is a dividend payer in calendar year t if it has positive dividends per share by the ex date (dvpsx_f) in the fiscal year that ends in year t.

- **Market-to-Book:** Book assets (at) minus book equity plus market equity all divided by book assets (at). Market equity is calculated as fiscal year closing price (prcc_f) times shares outstanding (csho). Book equity is defined as stockholder's equity (seq) minus preferred stock plus balance sheet deferred taxes and investment tax credit (txditc). If data item txditc is missing it is set to zero. If data item seq is not available, it is replaced by either common equity (ceq) plus preferred stock par value (pstk), or assets (at) - liabilities (lt). Preferred Stock is preferred stock liquidating value (pstkl) [or preferred stock redemption value (pstkrv), or preferred stock par value (pstk)].

Campbell, Lettau, Malkiel, and Xu (2001), henceforth CLMX, document that idiosyncratic volatility of US stocks increases dramatically between 1962 and 1997. Campbell and Taksler (2003) demonstrate a strong link between idiosyncratic volatility and corporate bond yield spreads both in cross section and over time. They show that rising idiosyncratic volatility helps to explain part of the increase in corporate bond spreads between 1963 and 1999. Given the strong relevance of idiosyncratic risk to credit risk, the increasing trend in idiosyncratic volatility can be connected to the decline in credit ratings as well.

I add the additional control variables to the model for various reasons. The relation of tangibility to credit risk and credit constraints is frequently demonstrated in the literature (Rampini and Viswanathan (2010)). Cash holdings play a major role to insulate companies from profitability shocks which might negatively affect debt payment. Bates, Kahle, and Stulz (2009) show that the cash holdings of the US corporations have increased dramatically between 1980 and 2006. They present evidence that the increasing cash trend is driven by precautionary motives to hold cash. Fama and French (2001) show that the propensity to pay dividends decline between 1978 and 1999. Fama and French (2001) show that part of the decline is explained by the changes in the firm characteristics but even after controlling for firm characteristics the propensity to pay dividends decreases. Following Hoberg and Prabhala (2009), it is possible that, some unobserved common source of risk that drives the precautionary cash savings or dividend cuts, might also contribute to the deterioration of credit risk of the firms. Therefore I include these variables in the study.

DeAngelo, DeAngelo, and Stulz (2006) argue that the earned/contributed capital mix, measured as retained earnings to total assets (RE/TA), is a proxy for a firm's stage in its life cycle, i.e. maturity, because it shows a firm's ability to self finance versus dependence on external finance. For the same reason, retained earnings to assets is a credit risk factor. The firms in early stages of their life cycle (low RE/TA) with high growth opportunities might finance them aggressively though capital infusion, whereas more mature firms (high RE/TA) with abundant cumulative profits may rely on internal capital. I therefore include this variable in the analysis. Additionally I use the variables market to book, research and development, and capital expenditures to proxy for investment and growth opportunities.

1.4 Data

My measure of credit rating is the S&P Long Term Issuer Level rating obtained from the ADSPRATE database. This database contains monthly firm level rating data starting 1985. I convert the letter ratings into numerical equivalents using an ordinal scale ranging from 1 for the lowest rated firms (CCC) to 17 for the highest rated firms (AAA). Because I have very few observations with CCC rating, I pool them together (CCC-, CCC, CCC+) to form the lowest ordinal category. I exclude the observations with credit ratings indicating default from the analysis. I gather firm level accounting data from the CRSP/Compustat Merged Fundamentals Annual database. I exclude financial firms (SIC codes 6000-6999). If any missing data item has a datacode 8 (insignificant), I set that item to zero. I obtain the daily stock price data from the CRSP database. I use the calendar year end (December 31) values for the ratings. I match a rating observation to the latest Compustat entry available before the year end. To minimize the effect of outliers, I winsorize all continuous variables (except for the interest coverage which is modified on the lines of BLM) at 1% and 99%.

The merger of all files and elimination of observations with missing values in the variables result in a sample of 23,152 firm years. Roughly one fifth of the firms in Compustat are rated. The rated percentage has increased to approximately 30% in the recent years. Table 1.1 documents the number of firms in each rating category between the years 1985 - 2002. The table shows that, despite the increase in the sample size, the number of firms in A, AA, and AAA rating categories is steadily decreasing over the years, whereas the number of firms in B, BB, BBB rating categories is increasing. That is, rating agencies tend to assign top ratings less frequently compared to earlier years. The percentage of speculative grade firms in the sample is progressively increasing: It is 37.3% in 1985, 47.8% in 2002 and in

53.2% in 2007.

Table 1.2 displays the rating distribution of the firms that are rated for the first time; the first time issuers. I identify the first time issuers as they first appear in the ADSPRATE database.[12] Table 1.2 shows that the majority of the increase in the sample is caused by entry of speculative grade first time issuers. The speculative grade first time issuers outnumber the investment grade first time issuers in the majority of the study period. In particular, the bulk of the entry to the pool of rated firms happens at B and BB categories. The number of first time issuers appears to decline after 2001.

Table 1.3 documents the annual downgrade versus upgrade statistics. The table shows that the number of downgrades consistently exceeds the number of upgrades. In fact, the mean downgrade to upgrade ratio is 1.48 between 1986 and 2007. This number is comparable to 1.58, the ratio stated by S&P in their 2008 Default Study Report for the period 1981-2008 (Standard and Poor's (2008a)). The dominance of downgrades over upgrades is consistent with the decline in average ratings. Notably, the downgrade to upgrade ratio peaks in year 2002 reaching the level 4.02.

Table 2.9 presents the summary statistics for all variables. The average leverage ratios, viz., long term debt to assets and total debt to assets, are 31% and 36% respectively. Consistent with Faulkender and Peterson (2006), these ratios are higher compared to average Compustat firms. Figure 1.1 displays the sample medi-

[12]Because the ADSPRATE database starts in 1985, I can identify the first time issuers beginning 1986.

ans of select variables for rating categories BBB, A and AA and over time. There are interesting trends. The medians of interest coverage, operating margin and size steadily increase over the study period. Notably, the median interest coverage ratio improves even more sharply after 2002. Similarly, the leverage ratios given rating categories tend to decrease over the study period. Furthermore, the decrease is more prominent in the post 2002 period. Idiosyncratic volatility trends upward, peaks around 2000-2001 and then decline sharply afterwards. Retained earnings to assets ratio also appears to increase after 2000. The figure is consistent with the argument that the rating agencies required investment grade firms to have better characteristics in 2007 compared to 1985 to achieve the same rating.

1.5 Empirical Results

1.5.1 Coefficient Estimates for Control Variables

In this section, I estimate the ordered probit model given in Equations 1.1, 1.2, and 1.3 for period 1985 - 2007. Table 1.5 presents the coefficient estimates for the entire sample. Except for M/B, the coefficients of all firm characteristics are statistically significant. The signs of BLM variables are consistent with their results. Interest coverage, operating margin, size (NYSE%) have positive signs. Systematic risk, idiosyncratic risk and long term debt leverage enters with a negative sign. As in BLM, the estimated coefficient of total debt leverage variable has the opposite of its predicted sign. This observation suggests that on the average, controlling for long term debt, firms with higher short term debt have higher ratings. The majority of the remaining variables have the expected signs. Dividend payers have higher credit ratings, as they are generally less volatile firms with steady income streams. Maturity, proxied by higher retained earnings is associated with higher credit ratings. Firms with more tangible assets and firms with higher growth opportunities measured by R&D expenditures have lower credit risk. However, the coefficient of cash balances variable is inconsistent with the expectations. Intuition suggests that firms with higher cash balances should have lower credit risk and higher credit ratings but empirically we observe the opposite. This empirical irregularity is studied in Acharya, Davydenko, and Strebulaev (2008). The authors argue that the precautionary cash holdings can explain the observed pattern. In their model, endogenously determined optimal cash balances are positively related to credit risk, while exogenous components of cash balances are negatively related.

In an ordered probit model, the coefficient estimates are in units of the latent variable and hence it is difficult to interpret their economic significance. One approach to assess the economic significance is to calculate the product of the estimated coefficient and the standard deviation of the relevant independent variable. This product measures the change in conditional expectation in the latent variable given one standard deviation increase in the explanatory variable. One can then compare this product to the size of the partitions to interpret economic importance. Dividing this product by the average distance between the rating categories (i.e. average rating notch length is calculated as $(\mu_{16} - \mu_1)/15$) represents the number of rating notches a firm would improve its rating given one standard deviation increase in the relevant explanatory variable. The third column in Table 1.5 presents this measure for each explanatory variable.[13] Table 1.5 shows that size is one of the most important variables in determining ratings. A one standard deviation increase in NYSE% increases the credit rating by 1.30 notches. Notably, idiosyncratic volatility also has a substantial effect on ratings. A one standard deviation increase in idiosyncratic volatility decreases the firm rating by 0.83 notches. Surprisingly, according to this measure, idiosyncratic volatility has a larger economic importance than long term debt leverage. A one standard deviation increase in long term debt reduces the rating by 0.78 notches.

Table 1.6 presents the results of the ordered probit model estimated separately for the investment grade and speculative grade subsamples. The majority of the variables have the same signs for these two samples. There are, however, a few exceptions. In the investment grade sample, long term debt leverage and total debt leverage have signs consistent with the whole sample but these signs are reversed for speculative grade firms. More specifically, for the speculative grade firms, total debt has a negative sign, while long term debt has a positive sign (insignificant). This observation suggests that, unlike the investment grade sample, what matters for speculative firms is the total debt leverage. The insignificance of long term debt leverage can be due to inability of speculative grade firms to issue substantial amount of long term debt. Another difference is that, systematic risk is insignificant for speculative grade firms. It suggests that idiosyncratic volatility is more relevant in measuring risk for these firms. Market-to-book enters with a positive sign for

[13] An example clarifies the calculation: For the entire sample, rating notch length is $(\mu_{16}-\mu_1)/15 = 0.555$. The coefficient of variable size (NYSE%) is 0.125 and standard deviation of size from Table 2.9 is 5.788. Therefore, one standard deviation increase in size increases the credit rating by $0.125 \times 5.788/0.555 = 1.303$ notches.

investment grade, while it has negative sign for speculative grade. As a result, the variable is insignificant in the entire sample. Similarly, R&D is positive for investment grade firms but negative (insignificant) for speculative grade firms. These observations suggest that the apparent growth opportunities do not improve credit risk for speculative firms. It is possible that excessive risk taking in speculative grade firms increases the value of equity, and hence M/B, but hurts the bond holders. This risk shifting behavior may be responsible for the observed negative correlation. Table 1.6 shows that the negative sign of cash balances for the entire sample is driven by the speculative grade firms. Consistent with intuition, cash holdings improve ratings for investment grade firms. The sign of cash holdings, however, is negative for speculative grade sample. Endogenously determined high cash holdings may be a symptom of other problems such as credit constraints for speculative grade firms.

1.5.2 Time Trends

The main focus of this study is the time series variation in rating standards, which is proxied by the pattern of year indicator variables relative to the omitted year 1985. Table 1.5 presents the coefficient estimates of year indicator variables for the entire sample. The majority of the year indicators 1986-2002 have coefficient estimates close to 0. An examination of the year indicators 1986-2002 suggests that there is no clear trend in the magnitude of year indicators. The majority of these variables are also not statistically different from 0. These observations are consistent with stable standards between 1985 and 2002 for the whole sample. However, the year indicators 2003 - 2007 have negative signs and they are statistically significant at 1% level. This observation suggests that the standards have tightened for the entire sample after 2002.

To describe the time trend, I convert the year indicator variables to units of rating notches. I compare the coefficient of the year indicators to the size of the partitions. That is, I divide the coefficient estimates by the rating notch length. This ratio measures the size of year dummies in terms of the number of rating notches. The fourth column in Table 1.5 displays this measure of year indicators. Figure 1.2 plots the same column. Figure 1.2 clearly shows that year indicators are generally stable until 2002, after which they display a steady downward trend. This pattern suggests that rating agencies applied stable standards for the entire sample until 2002. However, after a sharp structural break at 2002, they gradually move towards stringent standards. If a firm keeps all characteristics constant between 1985 and 2007, it preserves its rating until 2002, however its rating declines 1.5 notches between 2002 and 2007.[14] The structural break is also economically significant. A firm's AAA rating would slide to AA or AA+ between 2002 and 2007 given constant firm characteristics.

Next I examine the rating standards for investment grade and speculative grade subsamples. Panel B of Table 1.6 displays the year indicator coefficients for speculative and investment grade subsamples. The results are striking. The table shows that there is a stark difference in the evolution of rating standards for

[14]For year 2007, the coefficient estimate is -0.903. I calculate the rating notch length as $\mu_{16} - \mu_1/15 = 0.555$. Therefore the coefficient is equal to -0.903/0.5555 = -1.626 rating notches. This measure is the drop in rating between years 1985 and 2007. In year 2002, the year dummy variable is at -0.105 notches. Hence, the drop between 2002 and 2007 is about 1.5 notches.

investment grade ratings and speculative grade ratings. The year indicator variables have consistently negative sign for investment grade firms. However, in contrast to investment grade results, the majority of year indicator variables have positive sign in the speculative grade sample. Furthermore, most of these coefficients are statistically significant at the 1% level. These observations suggests that the rating agencies tightened the standards for the investment grade ratings while relaxing them in the speculative grade ratings.

Again, I convert the coefficient estimates to units of rating notches by dividing them with the rating notch length estimated from each sample. This measure of year indicators is given in columns 3 and 6 of Panel B in Table 1.6.[15] Figure 1.3 provides the plot of column 3. Figure 1.4 displays the plot of column 6. Figure 1.3 shows that, for investment grade sample, intercepts display a declining trend throughout 1985-2007 (except for the period 1997-2002). More specifically, holding firm characteristics constant, the standards tighten by 1.1. notches between 1985-2002. However, Figure 1.4 documents that the time trends in speculative grade sample is in stark contrast to investment grade sample during this period. For the speculative grade firms, the year dummies display an increasing trend. Namely, the standards get relaxed by 0.6 notches between 1985-2002. This divergent pattern in the standards of investment grade and speculative grade firms is puzzling. Particularly, the loosening in speculative grade can have important implications. In Section 1.5.3, I discuss in detail the significance of this finding and my interpretations.

[15]An example clarifies the calculation: For the investment grade sample, the year indicator coefficient for 2007 is -1.280. The rating notch length is $\mu_9 - \mu_1/8 = 0.532$, where $\mu_1 - \mu_9$ are estimated using the investment grade sample. Therefore the coefficient is equal to -1.280/0.532 = -2.403 rating notches.

Figures 1.3 and 1.4 also show that consistent with the entire sample, there is an apparent structural break towards more stringent standards around 2002, in both investment grade and speculative grade samples. For the speculative grade, the year indicators stop increasing and reverse direction. That is, around 2002 the standards cease to loosen and begin tightening. For the investment grade, after 2002, the year indicators decline at a steeper rate compared to 1985-2002 period. In other words, the standards begin tightening at an accelerated rate. The results are also economically significant. For investment grade sample, holding firm characteristics constant, a firm's rating declines 1.3 notches between 2002 and 2007. For speculative grade sample, the decline in rating amounts to 1 notch.

The Figures 1.2, 1.3 and 1.4 indicate a structural break at 2002, which is robustly observed in entire sample, investment grade sample and speculative grade sample. To verify the patterns suggested in these figures, I conduct statistical tests for a structural break in the level and slope of year indicators of the ordered probit model given in Section 1.3. Panel A of Table 1.7 tests whether the intercepts before and after 2002 are equal. For this test, I replace Equation 1.2 with Equation 1.4 and re-estimate the model given in Section 1.3.

$$Z_{it} = b_0 D + \beta' X_{it} + \epsilon_{it} \tag{1.4}$$

That is, the year indicators are removed from Equation 1.2 and replaced with a single dummy variable D, which takes value 1 for years 2003-2007 and 0 otherwise. Panel A reports the coefficient estimate b_0 of dummy variable D, the coefficient estimate in units of rating step length i.e. $\frac{b_0}{(\mu_{16}-\mu_1)\backslash 15}$, and the P-value for Wald test for the hypothesis that b_0 is equal to 0. The Wald test rejects null of equal intercepts at p-levels indistinguishable from 0 for whole sample, investment grade sample and speculative grade sample. Hence, I conclude that the level of intercepts before and after 2002 are different.

Panel B of Table 1.7 presents tests for the structural break in the slopes of the year indicators. Here I test whether the rate of change in rating standards is different between 1985-2002 and 2002-2007. For instance, Figure 1.3 suggests that, for the investment grade sample, the rate at which ratings tighten is higher post 2002 compared to 1985-2002 period. However, it is not clear whether this difference is statistically significant. For this test, I replace Equation 1.2 with Equation 1.5 and re-estimate the model given in Section 1.3.

$$Z_{it} = b_0 D + b_1 t D + b_2 t(1-D) + \beta' X_{it} + \epsilon_{it} \tag{1.5}$$

where D is a dummy variable that takes 1 for 2003-2007 and 0 otherwise, and t takes values 1 to 23 for years 1985 to 2007. Namely, the year indicators in Equation 1.2 are replaced with two trend variables to proxy for the slope of the year indicators for periods 1985-2002 and 2003-2007. The dummy variable D is also included to allow different intercepts before and after 2002. The coefficients estimates b_1 and b_2 measure the rate at which rating standards change. For instance, for investment grade sample, I expect to find that b_2 is significantly greater than b_1. Panel B displays coefficient estimates for b_1 and b_2, and Wald Test P-Values for the equality of the slopes b_1 and b_2. The Wald test again strongly rejects the equality of the slopes b_1 and b_2 for whole sample, investment grade sample and speculative grade sample. For the whole sample b_1 is 0 and b_2 is negative consistent with stable standards until 2002 and a shift to stricter ratings after 2002. For speculative grade sample b_1 is positive and b_2 is negative indicating the loosening in ratings until the break and the reversal to stringency afterwards. For the investment grade sample, both b_1 and b_2 are negative however b_2 is bigger in absolute value. This result shows that the rate of decline in investment grade ratings is greater post 2002 compared to 1985-2002 period. These results suggest that the apparent structural break in 2002 is also statistically significant.

1.5.3 Discussion

The analysis shows a puzzling divergent pattern in investment grade and speculative grade standards between 1985-2002. During this period, rating agencies tighten the standards in investment grade, while relaxing the standards in speculative grade. The loose standards in speculative grade are consistent with the widely criticized performance of rating agencies during the Dot-Com crash. The default rates rise to record levels in 2000 (2.42%), 2001 (3.74%) and in 2002 (3.51%) (Standard and Poor's (2008a)). Notably, the standards for speculative grade ratings became the most loose between 2000 and 2002. The loose standards could play a role in the high default rates observed during this period. One channel for this role is, the loose standards can attract further entry to the universe of rated firms by the high credit risk issuers. If this is the case, the loose standards can contribute to the excessive defaults rates by making debt markets more accessible to low credit quality firms. Consistent with this argument, the speculative grade first time issuers consistently outnumber the investment grade first time issuers in the majority of the study period.

The loosening standards in speculative grade credits can also reconcile the apparent puzzle between the heavy criticism for rating agencies and the BLM stringency trends. Before 2002, the tightening in standards is limited to the investment grade firms where the default rates are extremely rare in any case. However, historically, the majority of the corporate defaults is observed in speculative grade category. These standards were indeed loosened. These findings yield another interesting observation. While the media focused on failure of rating agencies in high profile corporate debacles, the more serious problem was in the speculative grade rating assignments.

One explanation for the loosening standards in speculative grade debt is the unintentional systematic error in rating agency practices. The explanation I find most plausible is that, the loose standards may be the result of the agency problems induced by the issuer-pays rating model. The disintermediation, viz., the shift from bank based lending to capital market based lending, increased the role of rating agencies in the economy (Rajan (2005)). Particularly the rapid growth in speculative grade debt created substantial business opportunity for the rating agencies (Pettit, Fitt, Orlov, and Kalsekar (2004)). Table 1.1 shows the universe of rated speculative grade firms expands throughout the study period. The percentage of speculative grade firms in the sample increases from 37.3% in 1985, to 47.8% in 2002 and to 53.2% in 2007. Table 1.2 documents that the majority of the increase is due to speculative grade first time issuers. The agency problems caused by the issuer-pays rating model could play a role here. Fist time issuers create a flow of revenues for rating agencies. Hence, rating agencies have incentives to provide more issuer-friendly ratings in order to attract further business in this fast growing asset class. The same forces appear to be at play before the 2007-2008 financial crisis. Similar to the growth in speculative credits, asset backed securities of subprime loans were newly rated instruments which experienced a rapid expansion post 2002. The rating agencies substantially benefited from the revenues of the new deal flows in these securities. Parallel to the speculative grade ratings, the ratings on these instruments also appear loose ex-post.

The analysis also shows that there is a structural break in the rating standards in 2002, after which the rating agencies act stricter in assigning ratings. This result is striking given the recent mass criticism towards rating agencies for employing loose standards. What could be potential factors that led the rating agencies to tighten their standards post 2002? The increased regulatory scrutiny beginning with SOX could be one driving factor that forced the rating agencies to move towards stricter ratings. It is possible that tighter ratings could prevent regulation in rating industry (Cheng and Neamtiu (2009)). The SOX also opens up discussions about the lack competition in the rating industry. The threat to the rating agencies' oligopoly could also affect agencies' incentives for tighter ratings (Cheng and Neamtiu (2009)). Reputation concerns could also achieve the same outcome.

Rating agencies view their reputation as absolutely critical for their business. As Becker and Milbourn (2009) note, S&P claims that "Reputation is more important than revenues". When faced with widespread criticism, concern for their reputation might lead the rating agencies to act more conservatively in their rating process. Another possible explanation is that, after the infamous accounting scandals, the rating agencies might view the financial reports and forecasts of companies more skeptically (Pettit, Fitt, Orlov, and Kalsekar (2004)). Skepticism might lead agencies to discount favorable information while incorporating it into ratings.

As an alternative explanation of the tightening standards, it is possible that today's economic environment is riskier than it was in the past (Rajan (2005)). In other words, the meaning of the variables might have changed over time. In that case, the firms might need to maintain better characteristics to achieve same credit quality in today's environment compared to earlier years. However, this alternative explanation necessitates a structural shift in the riskiness of economic environment around 2002 to reconcile the findings of this paper. It is also difficult to reconcile this explanation with the divergent pattern between investment grade and speculative grade standards before 2002.

The structural shift towards strict standards post 2002 can have several implications. The tightening standards can affect a firm's cost of debt, capital ratios, the nature of clientele holding the firm's bonds and make it harder for a firm to achieve its target rating. Credit ratings are a gateway to access debt markets.[16] It

[16]Faulkender and Peterson (2006) document that 78% of the bonds outstanding are issued by rated firms. Also, stock and bond prices move in expected directions in response to rating changes (Hand, Holthausen, and Leftwich (1992a)).

is well known that credit spreads are positively related to credit ratings (Kao and Wu (1990)). Therefore, stricter ratings might lead to higher cost of debt for firms if the markets do not recognize the change in standards. Credit ratings play a substantial role in capital market regulations such as determining capital requirements, disclosure requirement and investment prohibitions.[17] More stringent standards may cause the firms' rating to fall below the boundary rating required by some regulations and affect capital ratio requirements and nature of clientele buying the bonds of a firm. There is ample evidence to suggest that managers target credit ratings due to the advantages of high ratings. According to Graham and Harvey (2001) survey, maintaining a credit rating is the second most important factor for managers in choosing the degree of leverage, ranking immediately after financial flexibility. Kisgen (2006) shows that credit rating targets directly affect capital structure decisions. Hovakimian, Kayhan, and Titman (2009) show that rating targets influence other corporate financial policies as well. The findings in this paper suggest that, especially after 2002 managers are now faced with tougher requirements to achieve their target ratings.

[17] Cantor and Packer (1997) provides a summary of the ratings based regulation rules. Banks are prohibited from purchasing speculative grade securities since 1936. Insurers are obliged to hold a higher capital requirement on low rated bonds beginning 1951. Since 1989, pension funds are allowed to invest in asset backed securities rated A and higher and S&Ls are prohibited from investing in speculative grade bonds. In 1991, SEC brought limits to low rated bond holdings of money market mutual funds.

1.6 Robustness Tests

In this section, I address the robustness of the findings. I first consider additional variables in the model to alleviate the concerns that missing variables might be driving the results. Then I establish robustness to the year dummy approach I utilize to measure the time series variation in rating standards. Next, I show that the results apply similarly to sample of first time issuers and the sample of firms that existed in 1985.

1.6.1 Robustness to Additional Variables

One criticism that could invalidate the findings of this paper is that the year indicators might be merely capturing the time trend in an omitted variable. This criticism can never be fully addressed, however demonstrating the robustness of the results to further variables that are potentially related to credit risk can mitigate the concern. I consider several variables, which I list below. I show that the addition of these variables causes only minor changes in the plots and has practically no effect on the results . Figure 1.5, Figure 1.6, and Figure 1.7 show the pattern of year indicators for the entire sample, investment grade sample and speculative grade sample after controlling for these variables.

- **Industry Dummies:** I control for Fama-French 49 Industry dummies to account for changing industry characteristics.

- **Net Working Capital:** I calculate net working capital as current assets (act) - current liabilities (lct) scaled by assets.

- **Debt Maturity:** I control for the debt maturity. From the balance sheets, I do not observe the exact maturity of a firm's debt however I do know the amount of debt payable in 1 through 5 years. I control for debt payable in each of the next five years (dd1 through dd5 scaled by assets).

- **Pension Funding Status:** Following Rauh (2009), I calculate the pension funding status as pension assets (pplao + pplau) - pension liabilities (pbpro - pbpru) scaled by pension liabilities. Alternatively I scale the variable by firm assets rather than pension liabilities. Additionally I experiment with an alternative pension funding status variable (pcppao) scaled by firm assets.

- **Firm Age:** I calculate firm age as the number of years since the first time the firm has positive assets and sales in Compustat.

- **Firm Fixed Effects:** I control for firm fixed effects in order to account for the change in composition of firms in the sample.[18]

- **Discretionary Accruals:** Jorion, Shi, and Zhang (2009) argue that earning management activities by the firms can explain the tightening in rating standards. Gu and Zhao (2006) present opposing findings and show that accrual management can not be responsible for the over-time downward trend in bond ratings. As in Gu and Zhao (2007), I calculate discretionary accruals based on Jones (1991) model to proxy for the earnings management activities. Addition of this variable to the model causes only minor changes in the pattern of year dummy variables, as Figure 1.5, Figure 1.6 and Figure 1.7 demonstrate.

[18]For this estimation, I use OLS estimator instead of ordered probit.

1.6.2 Robustness of Year Indicator Approach

The year dummy approach requires a strong underlying assumption that the slope coefficients of the model are constant through time. This assumption is restrictive and probably not correct. If the slope coefficients are changing over time, intercepts can be misleading as measure of rating standards. In this section I utilize alternative methods to measure trends in rating standards. I establish the robustness of entire sample, investment grade sample and speculative grade results.

First, I present the robustness of year indicator approach in the entire sample results. I re-estimate the model given in Equations 1.1, 1.2, 1.3 year by year in the spirit of Fama and MacBeth (1973) after dropping year indicators, α_t, from Equation 1.2. I then use the method outlined in Fama and French (2001) to measure trends in ratings. I first average the annual coefficients and partition points to arrive at the Fama-Machbeth model. Next I predict the fitted ratings based on this model. Later I calculate the residual rating as the difference between the actual and fitted ratings. The annual averages of the residuals provide me with the changes in standards compared to the average standards between 1985-2007. For the entire sample, the trend obtained using this method is plotted in Panel D of Figure 1.8. The pattern is almost identical to the trend given by year indicators.

The Fama-Macbeth approach given in the previous paragraph, calculates the trend in ratings compared to average standards between 1985-2007. Next I measure the trends directly according to the standards employed in 1985. If a firm maintained firm characteristics that it had in 1985 throughout 1985-2007, would its rating be higher or lower in the following years? Lower ratings would mean tightening, whereas higher ratings would mean loosening in standards. To answer this question, I first estimate the 1985 standards; I estimate the ordered probit model using data in 1985 only. I then use the coefficients obtained from this model to predict fitted ratings. Again, the annual averages of the residuals provide me with the changes in standards relative to the 1985 standards. For the entire sample, the result is illustrated in Panel A of Figure 1.8. The trend is virtually identical to the year indicator approach given in Figure 1.2. To further verify the robustness of the results, I repeat the same analysis for 1996 standards and 2007 standards. I plot the trend with respect to 1996 standards and 2007 standards in Panel B and C of Figure 1.8. It is interesting to note that, when measured according to 2007 standards, the decline in ratings after 2002 is about 2 rating notches, which is higher than the 1.5 notches estimated using year indicator approach. This observation suggests that the estimate of 1.5 notches in Section 1.5.2 is possibly a conservative measure of post 2002 tightening in ratings.

Next, I present the robustness of year indicator approach in the investment grade sample and speculative grade sample. I repeat the same methods described above for these subsamples. Figure 1.9 presents the robustness results for investment grade firms. Figure 1.10 presents the robustness results for speculative grade firms. It is evident from these figures that there are only minor differences in the results when I use alternative methods to measure time series variation in rating standards.

When I divide the sample into investment grade and speculative grade subsamples and estimate the respective trends using year dummy approach as in Section

1.5.2, I restrict the model to fit ratings only within that relevant sample. For instance, when I estimate the model for investment grade sample, the model can not fit speculative grade ratings to the observations. This problem might induce a bias in the estimation of stringency/looseness. To eliminate any bias induced by this truncation of sample, I utilize an alternative approach. I estimate the model for the entire sample year-by-year using the Fama-Macbeth approach. I average the annual coefficients and partition points to arrive at the Fama-Machbeth model. Next I predict the fitted ratings based on this model. Then I calculate the residual rating as the difference between the actual and fitted ratings. Finally, I average the residuals for each year over investment grade (speculative grade) category ratings to calculate the trend for investment grade (speculative grade) sample. This method yields results very similar to the year dummy approach. The trend for investment grade category is almost identical to the year dummy approach given in Figure 1.3. The trend calculated for speculative grade is similar to the year dummy trend given in Figure 1.4 with one difference. The pattern is amplified: The loosening in ratings until 2002 is 1 notch with this specification. Also, loosening in ratings by 2000 amounts to 1.5 notches. Hence it is possible that the year dummy estimates provide conservative estimates of loosening in speculative grade ratings. The drop in speculative grade after 2002 is about 1.7 notches, which is also higher from year dummy estimates given in Figure 1.4.

1.6.3 First Time Issuers

It is possible that the first time issuers have different risk characteristics than the existing firms and the observed patterns in rating standards are driven solely by the first time issuers entering the sample. Therefore, it is important to establish the robustness of the the results to these new entrants. First, I conduct tests which exclude first time issuers. I calculate time series variation in credit rating standards for entire sample, investment grade sample and speculative grade sample using only the firms that existed in 1985. Because there is exit from the sample but no entry, for the entire sample, the sample size decreases steadily from 724 in 1985 to 254 in 2007, resulting in a total of 9,101 firm-years. Figure 1.11 plots the year indicator variables for 1985 firms and compares them to results obtained using all firms. Panel A displays the results for entire sample, panel B for investment grade sample and panel C for speculative grade sample. It is evident from the figure that the results are robust to exclusion of first time issuers.

Next, I explore the trends in rating standards using first time issuers only. For this test, in each year I keep only the firms that appear in the ADSPRATE database for the first time. For the entire sample, the restriction yields 1786 firm-year observations ranging from 20 observations in 1990 to 207 firms in 1998. The results for this experiment is given in Figure 1.12. Panel A displays the results for entire sample, panel B for investment grade sample and panel C for speculative grade sample. The result is striking. Despite the small sample size, these newly rated firms closely follow the pattern identified using all firms. Notably, the first time issuers sample and the 1985 sample are mutually exclusive, yet, they display consistent trends. Overall, I conclude that the results robustly hold for first time issuers and the firms that exist in 1985.

1.6.4 Idiosyncratic Volatility and Trends in Ratings

Campbell, Lettau, Malkiel, and Xu (2001) demonstrates that idiosyncratic risk of US stocks increase substantially between 1962 and 1997. Brandt, Brav, Graham, and Kumar (2010) find that idiosyncratic risk peaks around 2000 and then trends downward, falling below 1990 levels by 2007. Campbell and Taksler (2003) document that, cross sectionally, idiosyncratic volatility is as important a determinant of bond spreads as credit ratings. Campbell and Taksler (2003) also provide evidence to link idiosyncratic volatility to credit risk in time series. They find that increasing idiosyncratic volatility partially explains the widening of credit spreads between 1963 and 1999. Because BLM standardize idiosyncratic volatility, they do not allow for this variable to explain the time trends in ratings. By not standardizing idiosyncratic risk, I test whether the trend in idiosyncratic risk might be a contributing factor to the decline in ratings. In this section, I formally test the conjecture that the increasing idiosyncratic volatility explains downward trend in ratings. Because my model already controls for both the trend and cross sectional components of idiosyncratic volatility, I regress the year indicators obtained from BLM model on aggregate idiosyncratic volatility to test this conjecture. I calculate the aggregate idiosyncratic volatility using CLMX methodology described in Brandt, Brav, Graham, and Kumar (2010).

Table 1.8 presents the result of this regression for periods of 1985 - 2002 and 1985 - 2007, for all samples. For the period 1985-2002, I find that idiosyncratic volatility is significantly related to decline in ratings for all samples; whole sample, investment grade sample and speculative grade sample. The year dummies estimated from BLM model for speculative grade sample display mildly increasing trend until 1992 and then trend downwards. Due to this change in direction around 1992, I test the speculative grade sample against idiosyncratic volatility for the periods 1992-2002 and 1992-2007. In spite of having only 11 observations, idiosyncratic volatility significantly explains part of the trend in ratings for speculative grade sample as well.

It is evident from Table 1.8 that, for the whole period 1985-2007, idiosyncratic volatility is not significant and R^2's indicate that the variable has no explanatory power. This result is probably due to the reversal in idiosyncratic volatility trend after 2000. Intuitively one would expect ratings to improve after the idiosyncratic volatility comes down, however ratings continue to decrease even after the turnaround in idiosyncratic volatility. Overall, the tests suggest that trends in idiosyncratic volatility can partially explain declining trends in ratings before 2002 but not between 2002 and 2007. This finding is consistent with the notion of structural break at year 2002.

1.7 Conclusion

The credit rating agencies are under intense scrutiny following the high profile corporate debacles of Dot-Com crash. The mass media and the regulatory agencies frequently criticize rating agencies for employing loose standards. In this paper, I examine the time series variation in credit rating standards for the period 1985-2007, to investigate whether the criticism of relaxed standards is empirically supported, particularly in light of BLM's findings that the ratings are indeed tightening.

I find that, the investment grade ratings tighten between 1985-2002. However, in contrast to investment grade ratings, the speculative grade ratings loosen during the same period. The loose standards in speculative grade is consistent with the widespread criticism for rating agencies during the Dot-Com crash. Additionally, I find that there is a structural break towards "more stringent" standards around 2002, in both investment grade and speculative grade ratings. The structural break is both statistically and economically significant. Following the structural break, I find that the ratings tighten 1.5 notches between 2002 and 2007 holding firm characteristics constant. The 1.5 notches tightening in standards translates into 12 basis points higher cost of debt for firms in 2007 relative to 2002. The structural break corresponds with the intense scrutiny beginning with the high profile corporate failures such as Enron and the subsequent passage of SOX. This is consistent with the argument that rating agencies began employing more conservative rating practices following SOX.

The divergent pattern in investment and speculative grade standards prior to

2002 is puzzling. One explanation is that, the root cause of the loose standards in speculative grade is the agency problems due to issuer-pays rating model. I show that, the universe of rated speculative credits go through an expansion phase between 1985-2002 and majority of the growth is due to the speculative grade first time issuers. Loose standards can be due to the incentives of rating agencies to encourage further entry by the speculative grade first time issuers. Such process can also be supported by the loose ratings on structured finance products during the 2007/2008 crisis. Similar to the expansion in speculative credits, the mortgage backed securities of the subprime loans were new entrants and the rating agencies enjoyed the rapid growth of this asset class post 2002. Further research is needed to sort out whether this problem is indeed caused by agency issues or merely due to systematic error by the rating agencies.

Table 1.1: Rating Distribution in the Sample

This table displays the S&P Long Term Issuer credit rating distribution across the entire sample. The sample includes non-financial rated public firms with non-missing observations on the variables used in the analysis; interest coverage, operating margin, long term debt leverage, total debt leverage, NYSE %, market model beta, idiosyncratic risk, dividend payer, M/B, R&D, retained earnings, capital expenditures, cash flow, cash balances, tangible assets. Panel A presents number of firms with given rating category, while Panel B shows the percentages.

	Panel A: Number								**Panel B: Percentage**							
Year	CCC	B	BB	BBB	A	AA	AAA	Total	CCC	B	BB	BBB	A	AA	AAA	Total
1985	7	139	124	129	216	91	18	724	1.0	19.2	17.1	17.8	29.8	12.6	2.5	100.0
1986	35	181	132	149	198	88	20	803	4.4	22.5	16.4	18.6	24.7	11.0	2.5	100.0
1987	25	202	146	153	190	89	20	825	3.0	24.5	17.7	18.5	23.0	10.8	2.4	100.0
1988	19	168	139	152	197	82	22	779	2.4	21.6	17.8	19.5	25.3	10.5	2.8	100.0
1989	15	137	127	158	188	80	22	727	2.1	18.8	17.5	21.7	25.9	11.0	3.0	100.0
1990	17	104	110	163	182	86	21	683	2.5	15.2	16.1	23.9	26.6	12.6	3.1	100.0
1991	13	92	109	175	197	85	19	690	1.9	13.3	15.8	25.4	28.6	12.3	2.8	100.0
1992	12	103	145	193	204	87	19	763	1.6	13.5	19.0	25.3	26.7	11.4	2.5	100.0
1993	8	123	188	203	222	80	19	843	0.9	14.6	22.3	24.1	26.3	9.5	2.3	100.0
1994	9	144	199	227	216	78	17	890	1.0	16.2	22.4	25.5	24.3	8.8	1.9	100.0
1995	10	165	215	239	239	73	16	957	1.0	17.2	22.5	25.0	25.0	7.6	1.7	100.0
1996	12	194	251	278	255	73	17	1080	1.1	18.0	23.2	25.7	23.6	6.8	1.6	100.0
1997	15	233	268	322	263	65	16	1182	1.3	19.7	22.7	27.2	22.3	5.5	1.4	100.0
1998	17	250	319	348	265	69	15	1283	1.3	19.5	24.9	27.1	20.7	5.4	1.2	100.0
1999	19	239	313	365	252	58	12	1258	1.5	19.0	24.9	29.0	20.0	4.6	1.0	100.0
2000	28	250	315	380	230	46	13	1262	2.2	19.8	25.0	30.1	18.2	3.6	1.0	100.0
2001	28	228	310	383	221	41	13	1224	2.3	18.6	25.3	31.3	18.1	3.3	1.1	100.0
2002	36	209	340	375	214	38	11	1223	2.9	17.1	27.8	30.7	17.5	3.1	0.9	100.0
2003	24	224	356	366	208	36	11	1225	2.0	18.3	29.1	29.9	17.0	2.9	0.9	100.0
2004	21	238	360	381	203	33	10	1246	1.7	19.1	28.9	30.6	16.3	2.6	0.8	100.0
2005	18	232	360	354	209	33	10	1216	1.5	19.1	29.6	29.1	17.2	2.7	0.8	100.0
2006	18	245	357	341	182	34	10	1187	1.5	20.6	30.1	28.7	15.3	2.9	0.8	100.0
2007	13	241	322	302	162	32	10	1082	1.2	22.3	29.8	27.9	15.0	3.0	0.9	100.0
Total	419	4341	5505	6136	4913	1477	361	23152	1.8	18.8	23.8	26.5	21.2	6.4	1.6	100.0

Table 1.2: Rating Distribution of First Time Issuers

This table displays the rating distribution of the first time issuers in the entire sample. The sample includes non-financial public firms with a Long Term Issuer Credit Rating and non-missing observations on the variables used in the analysis. I identify the first time issuers as they first appear in the ADSPRATE database.

Year	CCC	B	BB	BBB	A	AA	AAA	Speculative Gr. Total	Investment Gr. Total	Total
1986	7	75	27	19	17	3	1	109	40	149
1987	3	54	34	14	9	5	1	91	29	120
1988	2	13	14	8	4	1	0	29	13	42
1989	1	10	14	4	5	1	0	25	10	35
1990	0	2	4	5	4	5	0	6	14	20
1991	0	1	10	8	10	5	0	11	23	34
1992	0	18	23	15	6	1	1	41	23	64
1993	1	34	30	16	14	2	0	65	32	97
1994	2	27	20	14	7	1	0	49	22	71
1995	2	31	19	24	13	1	0	52	38	90
1996	1	44	40	28	18	4	0	85	50	135
1997	1	63	49	26	11	2	0	113	39	152
1998	2	74	73	32	20	5	1	149	58	207
1999	1	34	33	22	8	1	0	68	31	99
2000	3	40	31	20	8	1	0	74	29	103
2001	1	18	24	28	5	3	0	43	36	79
2002	0	17	29	10	5	0	0	46	15	61
2003	0	18	24	8	4	0	0	42	12	54
2004	0	21	12	7	3	0	0	33	10	43
2005	3	23	20	2	4	0	0	46	6	52
2006	0	24	12	5	1	0	0	36	6	42
2007	0	22	11	3	1	0	0	33	4	37
Total	30	663	553	318	177	41	4	1246	540	1786

Table 1.3: Summary of Annual Rating Changes

This table displays the annual rating changes for the entire sample; number and percentages of downgrades and upgrades, as well as the annual downgrade to upgrade ratio. Rating changes are calculated as the difference in ratings from the first to the last day of each year. All intermediate ratings are disregarded. The sample includes non-financial public firms with a Long Term Issuer Credit Rating and non-missing observations on the variables used in the analysis. The sample does not include withdrawn ratings or issuers in default.

Year	Issuers (As of Jan 1)	Downgrade	Upgrade	Downgrade%	Upgrade%	Down/Up
1986	724	123	54	16.99	7.46	2.28
1987	803	93	61	11.58	7.60	1.52
1988	825	79	74	9.58	8.97	1.07
1989	779	80	83	10.27	10.65	0.96
1990	727	100	56	13.76	7.70	1.79
1991	683	81	64	11.86	9.37	1.27
1992	690	86	87	12.46	12.61	0.99
1993	763	84	89	11.01	11.66	0.94
1994	843	76	72	9.02	8.54	1.06
1995	890	93	107	10.45	12.02	0.87
1996	957	80	111	8.36	11.60	0.72
1997	1080	101	135	9.35	12.50	0.75
1998	1182	135	125	11.42	10.58	1.08
1999	1283	164	95	12.78	7.40	1.73
2000	1258	178	82	14.15	6.52	2.17
2001	1262	237	76	18.78	6.02	3.12
2002	1224	265	66	21.65	5.39	4.02
2003	1223	218	109	17.83	8.91	2.00
2004	1225	129	120	10.53	9.80	1.08
2005	1246	156	149	12.52	11.96	1.05
2006	1216	158	124	12.99	10.20	1.27
2007	1187	143	151	12.05	12.72	0.95
Mean	-	-	-	12.70	9.55	1.48

Table 1.4: Summary Statistics

This table displays sample summary statistics for the entire sample. The sample includes non-financial public firms with a Long Term Issuer Credit Rating and non-missing observations on the variables used in the analysis. NYSE% is NYSE market capitalization percentile, Operating Margin is operating income before depreciation (oibdp) to sales (sale), LT Debt is long term debt (dltt) to assets (at). Total Debt is long term debt (dltt) plus short term debt (dlc), divided by assets (at). Id. Risk is the RMSE from a regression of the firm's daily stock returns on the CRSP value-weighted index return. Beta is market model beta estimated from the same regression used to define idiosyncratic risk. Interest Coverage is operating income after depreciation (oiadp) plus interest expense (xint) divided by interest expense (xint). Tangibility is property plant and equipment - total (ppent) to assets (at). Cash Balances is cash and short-term investments (che) to assets (at). RETA is Retained earnings (re) to assets (at). R&D is research and development expense (xrd) to assets (at). Capex is capital expenditures (capx) to assets (at). Dividend Payeris a dummy variable equal to 1 in calendar year t if the firm has positive dividends per share by the ex date (dvpsx_f) in the fiscal year that ends in year t. M/B is Book assets (at) minus book equity plus market equity all divided by book assets (at).

	Mean	25 %	Median	75 %	Std. Dev.
Interest Coverage	7.226	2.494	4.102	7.112	11.526
Operating Margin	0.174	0.091	0.149	0.241	0.147
LT Debt	0.310	0.181	0.283	0.400	0.189
Total Debt	0.357	0.228	0.332	0.449	0.192
NYSE %	11.926	7.000	13.000	17.000	5.788
Beta	0.891	0.529	0.837	1.180	0.506
Idiosyncratic Risk	0.024	0.015	0.020	0.028	0.013
Dividend Payer	0.607	0.000	1.000	1.000	0.489
M/B	1.563	1.062	1.296	1.750	0.819
R&D	0.015	0.000	0.000	0.014	0.032
RETA	0.123	0.021	0.148	0.300	0.323
Capex	0.070	0.031	0.054	0.088	0.058
Cash Balances	0.078	0.013	0.039	0.101	0.100
Tangibility	0.401	0.197	0.361	0.601	0.243

Table 1.5: Estimation Results - Entire Sample

This table displays estimation results for the ordered probit model from 1985 through 2007 for the entire sample. The sample includes non-financial public firms with a Long Term Issuer Credit Rating and non-missing observations on the variables used in the analysis. Dependent variable is S&P LT Issuer Rating converted into numerical identifiers 1-17 (AAA is 17). NYSE% is NYSE market capitalization percentile, Operating Margin is operating income before depreciation (oibdp) to sales (sale), LT Debt is long term debt (dltt) to assets (at). Total Debt is long term debt (dltt) plus short term debt (dlc), divided by assets (at). Id. Risk is the RMSE from a regression of the firm's daily stock returns on the CRSP value-weighted index return. Beta is market model beta estimated from the same regression used to define idiosyncratic risk. Interest Coverage is operating income after depreciation (oiadp) plus interest expense (xint) divided by interest expense (xint). Tangibility is property plant and equipment - total (ppent) to assets (at). Cash Balances is cash and short-term investments (che) to assets (at). RETA is Retained earnings (re) to assets (at). R&D is research and development expense (xrd) to assets (at). Capex is capital expenditures (capx) to assets (at). Dividend Payeris a dummy variable equal to 1 in calendar year t if the firm has positive dividends per share by the ex date (dvpsx_f) in the fiscal year that ends in year t. M/B is Book assets (at) minus book equity plus market equity all divided by book assets (at). The standard errors are calculated using the Huber-White robust estimator clustered at the firm level.

	Coefficient	Z - Stat	$\frac{\text{Coefficient} \times \text{Variable Std.Dev}}{\text{Rating Notch Length}}$	$\frac{\text{Coefficient}}{\text{Rating Notch Length}}$
Interest Coverage A	0.223***	14.333	0.578	
Interest Coverage B	0.028***	2.624	0.100	
Interest Coverage C	0.030***	4.193	0.150	
Interest Coverage D	-0.003*	-1.941	-0.060	
Operating Margin	0.345**	2.356	0.091	
LT Debt	-2.278***	-6.824	-0.777	
Total Debt	1.210***	3.689	0.419	
NYSE%	0.125***	20.940	1.303	
Beta	-0.208***	-6.813	-0.190	
Idiosyncratic Risk	-0.351***	-20.759	-0.830	
Dividend Payer	0.773***	16.449	0.681	
M/B	0.012	0.460	0.018	
R&D	1.528**	2.213	0.087	
RETA	0.687***	10.512	0.400	
Capex	-1.976***	-6.008	-0.208	
Cash Balances	-1.103***	-5.788	-0.199	
Tangibility	0.722***	6.269	0.316	
Year Indicators				
1986	-0.147***	-4.339		-0.265
1987	0.007	0.163		0.013
1988	-0.089*	-1.959		-0.160
1989	-0.082*	-1.751		-0.148
1990	0.089*	1.825		0.161
1991	0.165***	3.385		0.297
1992	0.148***	3.046		0.266
1993	0.075	1.576		0.136
1994	-0.049	-0.984		-0.087
1995	-0.106**	-2.119		-0.190
1996	-0.145***	-2.893		-0.262
1997	-0.128**	-2.542		-0.231
1998	0.076	1.494		0.138
1999	0.020	0.366		0.036
2000	0.223***	3.807		0.401
2001	0.050	0.907		0.089
2002	-0.058	-1.081		-0.105
2003	-0.381***	-7.352		-0.687
2004	-0.582***	-11.117		-1.048
2005	-0.716***	-13.455		-1.291
2006	-0.849***	-15.742		-1.529
2007	-0.903***	-16.418		-1.626
N	23152			
Pseudo R2	0.263			

Table 1.6: Estimation Results - Investment Grade and Speculative Grade Subsamples

This table displays estimation results for the ordered probit model from 1985 through 2007 for the investment grade and speculative grade subsamples. The sample includes non-financial public firms with a Long Term Issuer Credit Rating and non-missing observations on the variables used in the analysis. Dependent variable is S&P LT Issuer Rating converted into numerical identifiers 1-17 (AAA is 17). NYSE% is NYSE market capitalization percentile, Operating Margin is operating income before depreciation (oibdp) to sales (sale), LT Debt is long term debt (dltt) to assets (at). Total Debt is long term debt (dltt) plus short term debt (dlc), divided by assets (at). Id. Risk is the RMSE from a regression of the firm's daily stock returns on the CRSP value-weighted index return. Beta is market model beta estimated from the same regression used to define idiosyncratic risk. Interest Coverage is operating income after depreciation (oiadp) plus interest expense (xint) divided by interest expense (xint). Tangibility is property plant and equipment - total (ppent) to assets (at). Cash Balances is cash and short-term investments (che) to assets (at). RETA is Retained earnings (re) to assets (at). R&D is research and development expense (xrd) to assets (at). Capex is capital expenditures (capx) to assets (at). Dividend Payeris a dummy variable equal to 1 in calendar year t if the firm has positive dividends per share by the ex date (dvpsx_f) in the fiscal year that ends in year t. M/B is Book assets (at) minus book equity plus market equity all divided by book assets (at). The standard errors are calculated using the Huber-White robust estimator clustered at the firm level.

	Investment Grade			Speculative Grade		
Panel A: Explanatory Variables						
	Coefficient	Z - Stat	$\frac{\text{Coefficient}\times\text{Var.Std.Dev}}{\text{Rating Notch Length}}$	Coefficient	Z - Stat	$\frac{\text{Coefficient}\times\text{Var.Std.Dev}}{\text{Rating Notch Length}}$
Int. Cov. A	0.209***	7.113	0.564	0.232***	13.460	0.393
Int. Cov. B	0.024	1.620	0.090	-0.025	-1.396	-0.057
Int. Cov. C	0.029***	3.232	0.151	-0.009	-0.833	-0.029
Int. Cov. D	-0.004*	-1.876	-0.079	-0.002	-1.083	-0.025
Oper. Margin	0.955***	3.143	0.263	0.193	1.390	0.034
LT Debt	-5.997***	-9.682	-2.133	0.527	1.601	0.118
Total Debt	3.601***	6.283	1.299	-0.885***	-2.711	-0.201
NYSE%	0.089***	8.755	0.971	0.092***	16.123	0.630
Beta	-0.266***	-4.745	-0.253	-0.019	-0.618	-0.012
Id. Risk	-0.499***	-11.181	-1.232	-0.277***	-16.904	-0.430
Div. Payer	0.463***	4.933	0.425	0.464***	9.830	0.268
M/B	0.091**	2.346	0.140	-0.086***	-2.932	-0.083
R&D	2.035*	1.937	0.121	-0.729	-1.030	-0.027
RETA	0.938***	6.922	0.569	0.436***	6.357	0.166
Capex	-1.043*	-1.804	-0.114	-0.949***	-2.853	-0.065
Cash Balances	0.729**	2.219	0.137	-1.256***	-7.551	-0.148
Tangibility	0.980***	5.153	0.447	0.028	0.233	0.008
Panel B: Year Indicators						
Year Indicators	Coefficient	Z - Stat	$\frac{\text{Coefficient}}{\text{Rating Notch Length}}$	Coefficient	Z - Stat	$\frac{\text{Coefficient}}{\text{Rating Notch Length}}$
1986	-0.017	-0.491	-0.032	-0.214***	-3.176	-0.253
1987	0.113**	2.340	0.212	0.064	0.784	0.076
1988	-0.106**	-2.319	-0.198	-0.008	-0.087	-0.009
1989	-0.224***	-4.391	-0.421	0.050	0.563	0.060
1990	-0.147***	-2.831	-0.277	0.236**	2.345	0.279
1991	-0.156***	-2.932	-0.292	0.384***	3.892	0.454
1992	-0.201***	-3.658	-0.377	0.471***	4.820	0.557
1993	-0.246***	-4.428	-0.462	0.516***	5.787	0.610
1994	-0.364***	-6.454	-0.684	0.333***	3.662	0.394
1995	-0.479***	-8.206	-0.900	0.358***	4.060	0.423
1996	-0.557***	-9.283	-1.046	0.317***	3.701	0.374
1997	-0.591***	-9.260	-1.110	0.385***	4.574	0.455
1998	-0.386***	-5.791	-0.725	0.558***	6.529	0.659
1999	-0.389***	-5.070	-0.732	0.523***	5.873	0.618
2000	-0.233**	-2.572	-0.438	0.702***	7.627	0.830
2001	-0.510***	-6.853	-0.957	0.589***	6.597	0.696
2002	-0.597***	-8.317	-1.122	0.531***	6.068	0.627
2003	-0.879***	-12.845	-1.651	0.233***	2.836	0.275
2004	-1.102***	-15.865	-2.071	0.016	0.198	0.019
2005	-1.191***	-16.497	-2.237	-0.127	-1.559	-0.150
2006	-1.251***	-16.816	-2.349	-0.279***	-3.417	-0.330
2007	-1.280***	-16.492	-2.403	-0.320***	-3.900	-0.379
N	12887			10265		
Pseudo R2	0.155			0.190		

Table 1.7: Structural Break Tests

This table displays the tests for structural break at year 2002. For this test, I estimate an ordered probit model for the period 1985-2007. The dependent variable is S&P LT Issuer Rating. Panel A tests whether the intercepts before and after 2002 are equal. The independent variables include a dummy variable D, which takes value 1 for years 2003-2007 and control variables: interest coverage, operating margin, long term debt leverage, total debt leverage, NYSE%, market model beta, idiosyncratic risk, dividend payer, M/B, R&D, retained earnings, capital expenditures, cash balances, and tangibility. The standard errors are calculated using the Huber-White robust estimator clustered at the firm level. Panel A reports the coefficient estimate of dummy variable D, the coefficient estimate in units of rating step length, and the P-value for Wald test for the hypothesis that coefficient is equal to 0. Panel B presents tests for the structural break in the slopes of the year indicators from Equation 1.2. For this test, in the main model, Equation 1.2 is replaced with Equation 1.5. That is, the year indicators in Equation 1.2 are replaced with two trend variables to proxy for the slope of the year indicators for periods 1985-2002 and 2003-2007. Panel B displays coefficient estimates for b_1 and b_2, and Wald Test P-Values for the equality of the slopes b_1 and b_2. The results are reported for the entire sample, investment grade sample and speculative grade sample.

Panel A: Wald Test for Equality of Intercepts

$$Z_{it} = b_0 D + \beta' X_{it} + \epsilon_{it}$$
Test for $b_0 = 0$

	b_0	$\frac{b_0}{\text{Rating Notch Length}}$	P-Value
Whole Sample	-0.64	-1.16	0.000
Investment Grade	-0.81	-1.54	0.000
Speculative Grade	-0.37	-0.44	0.000

Panel B: Wald Test for Equality of Slopes

$$Z_{it} = b_0 D + b_1 tD + b_2 t(1 - D) + \beta' X_{it} + \epsilon_{it}$$
Test for $b_1 = b_2$

	b_1	b_2	P-Value
Whole Sample	0.00	-0.13	0.000
Investment Grade	-0.04	-0.09	0.000
Speculative Grade	0.04	-0.14	0.000

Table 1.8: Times Series Regression of BLM Trend on CLMX Idiosyncratic Volatility

This table displays the coefficients and t-statistics for univariate OLS regressions. The dependent variable is residual rating trend (year indicators) estimated from the BLM model. The independent variable is aggregate idiosyncratic volatility calculated using CLMX methodology. The results are reported for subperiods 1985-2002 and 1985-2007. The periods for speculative grade sample is taken as 1992-2002 and 1992-2007 due to the changing direction in trend after 1992.

		1985-2002	1985-2007
Whole Sample	b	-6.92	0.00
	T	-3.58	0.00
	N	18	23
	Adj R2	0.41	-0.05
Investment Grade	b	-10.23	-2.34
	T	-3.58	-0.53
	N	18	23
	Adj R2	0.41	-0.03
Speculative Grade*	b	-1.64	1.45
	T	-2.03	1.00
	N	11	16
	Adj R2	0.24	0.00

*Speculative grade BLM trend is taken from 1992-2007

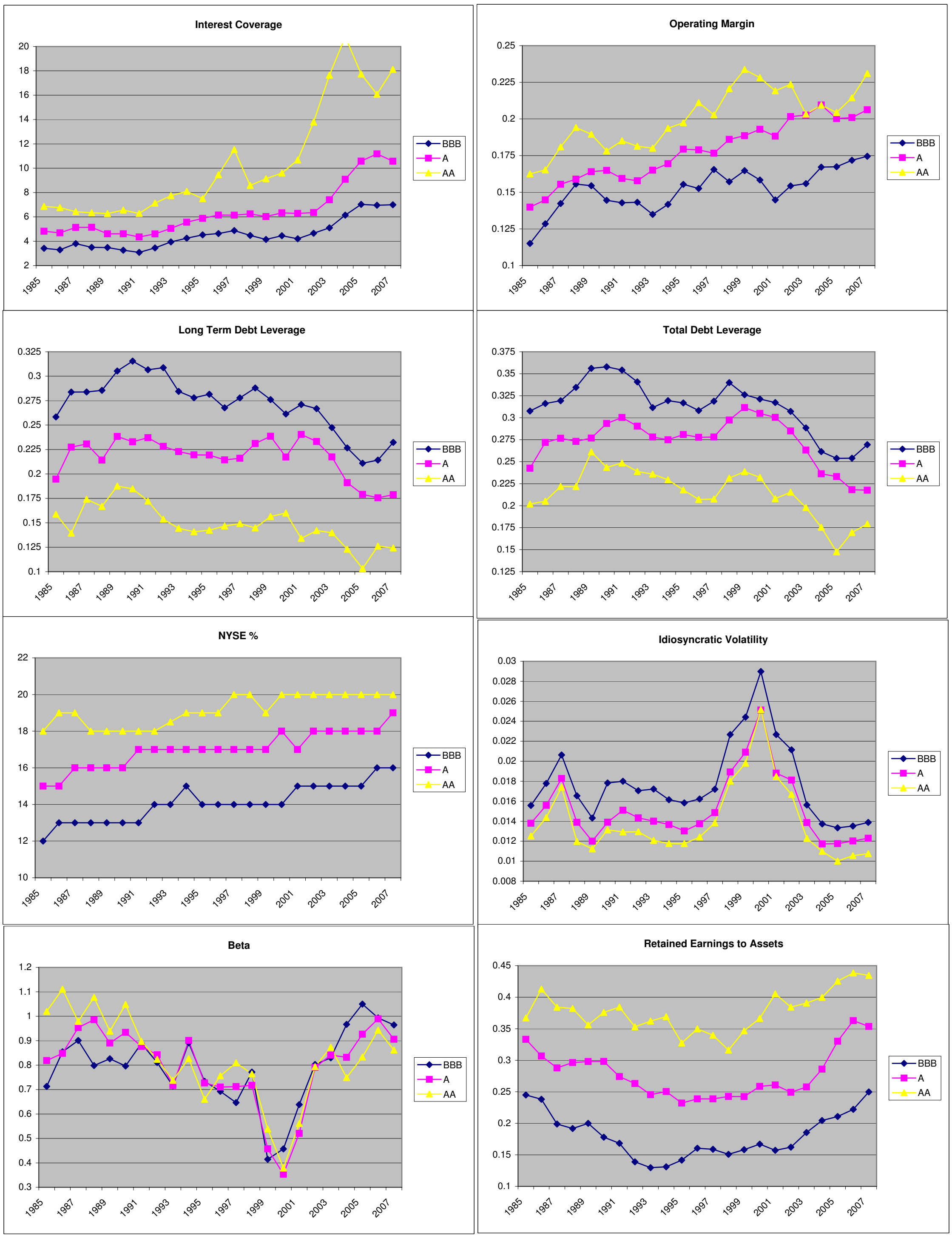


Figure 1.1: Medians of Key Explanatory Variables over Time in Select Rating Categories, 1985-2007

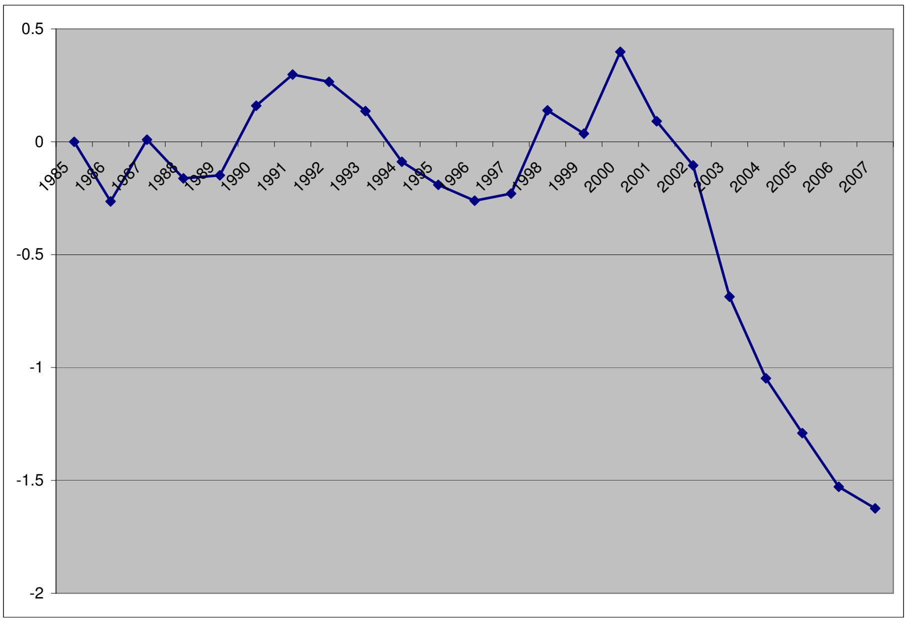


Figure 1.2: Plot of the Estimates of the Year Indicators from the Ordered Probit Model, Whole Sample, 1985-2007

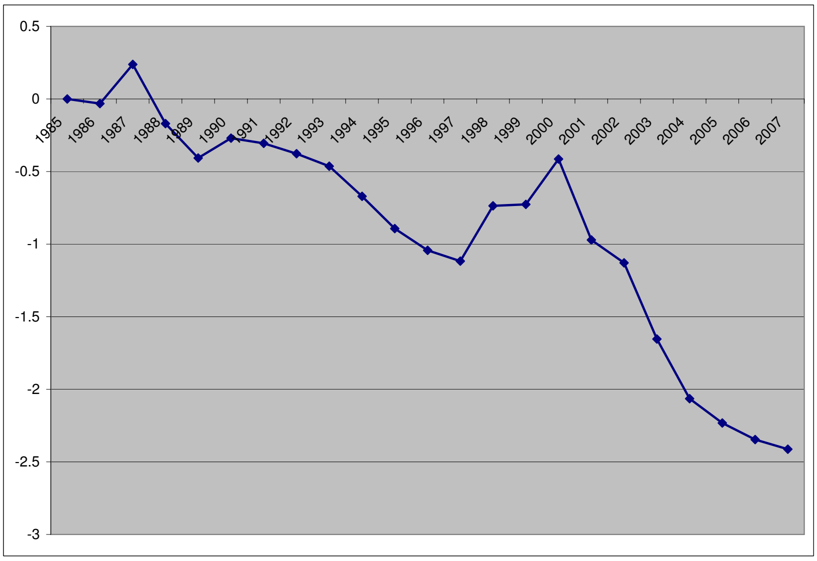


Figure 1.3: Plot of the Estimates of the Year Indicators from the Ordered Probit Model, Investment Grade Sample, 1985-2007

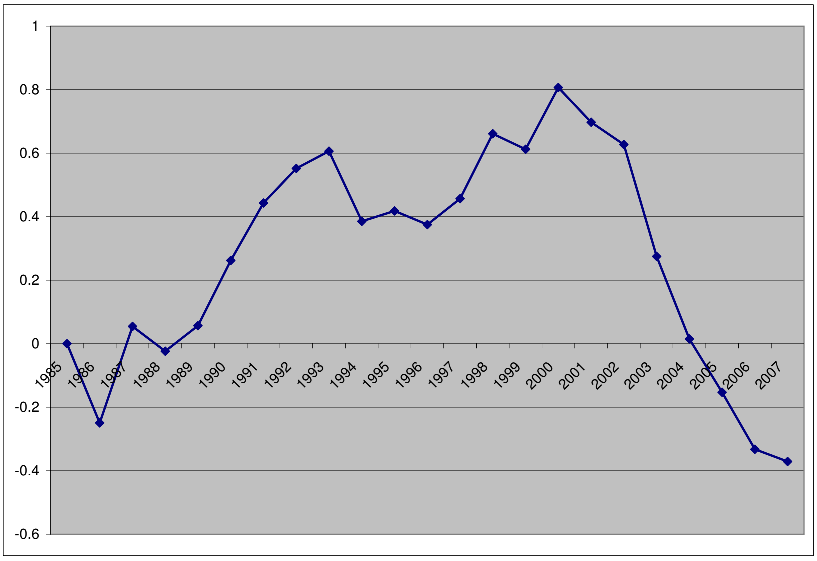


Figure 1.4: Plot of the Estimates of the Year Indicators from the Ordered Probit Model, Speculative Grade Sample, 1985-2007

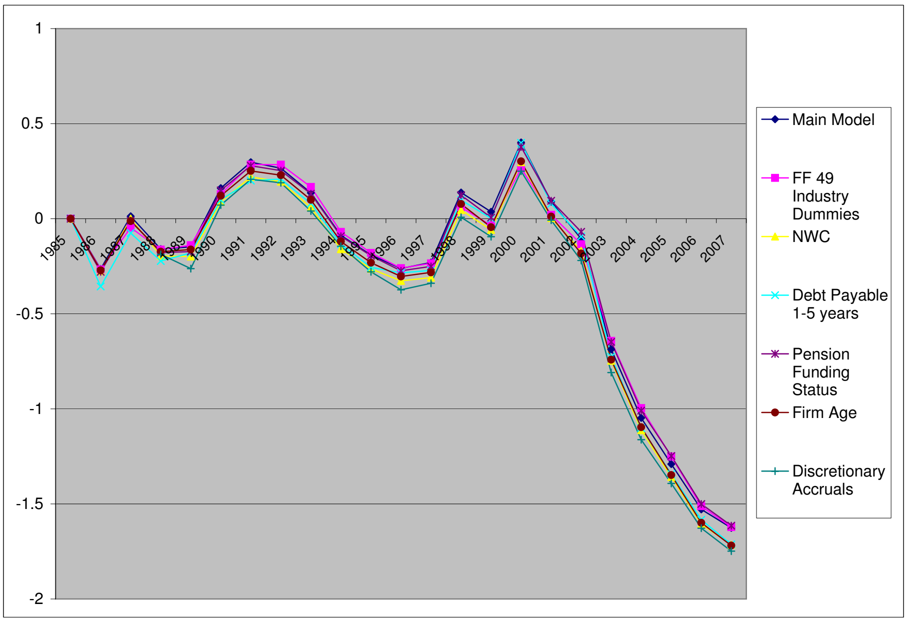


Figure 1.5: Plot of the Estimates of the Year Indicators from the Ordered Probit Model, Robustness Tests, Entire Sample, Additional Variables, 1985-2007

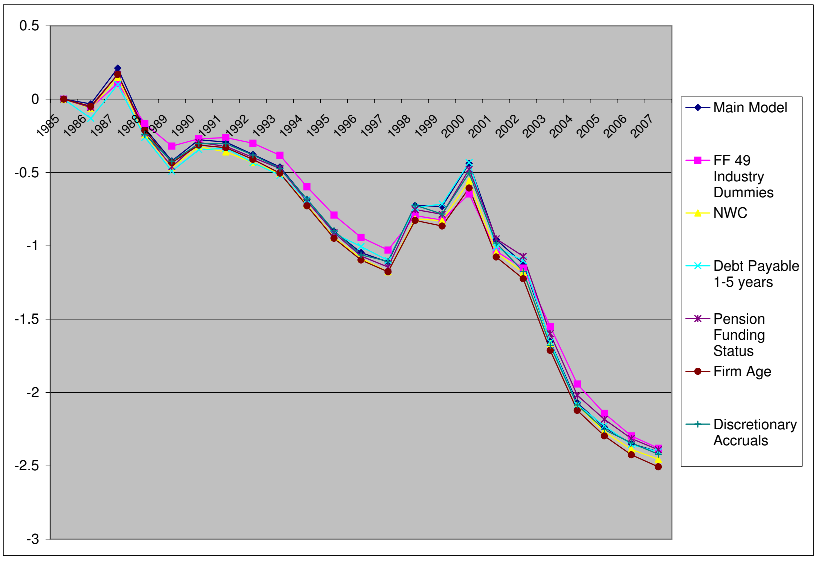


Figure 1.6: Plot of the Estimates of the Year Indicators from the Ordered Probit Model, Robustness Tests, Investment Grade Sample, Additional Variables, 1985-2007

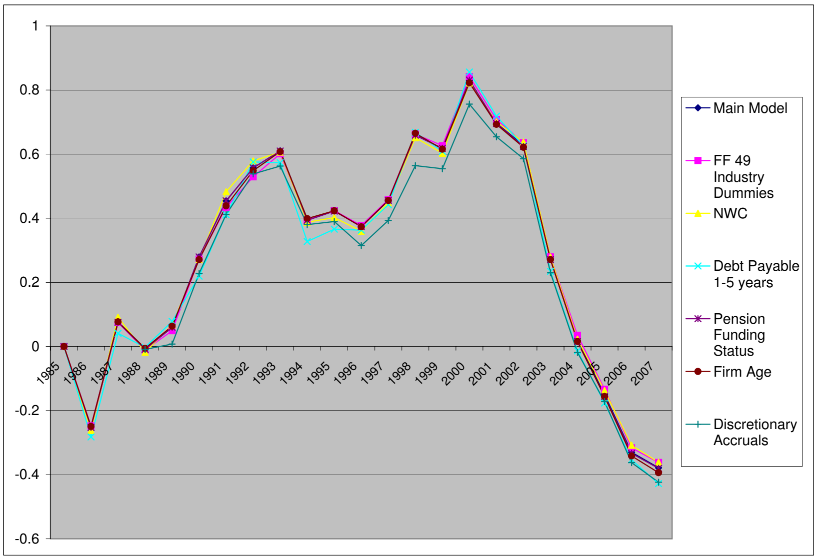
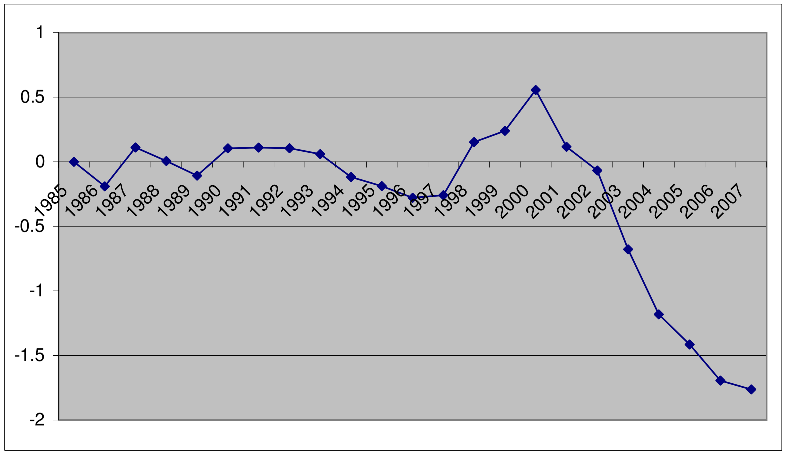
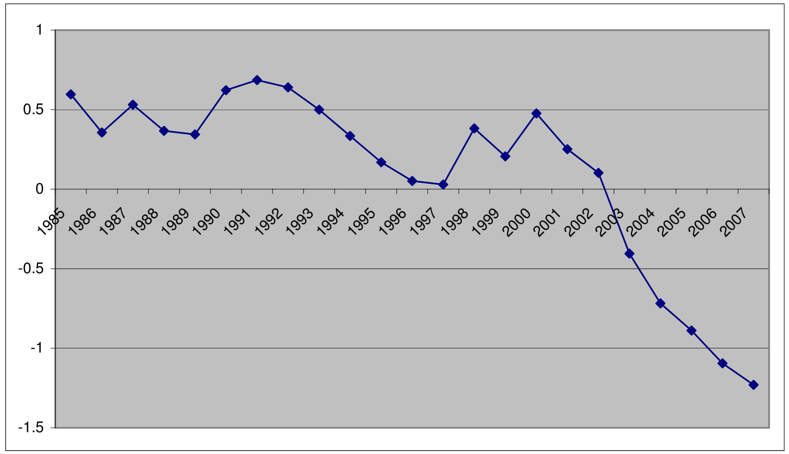


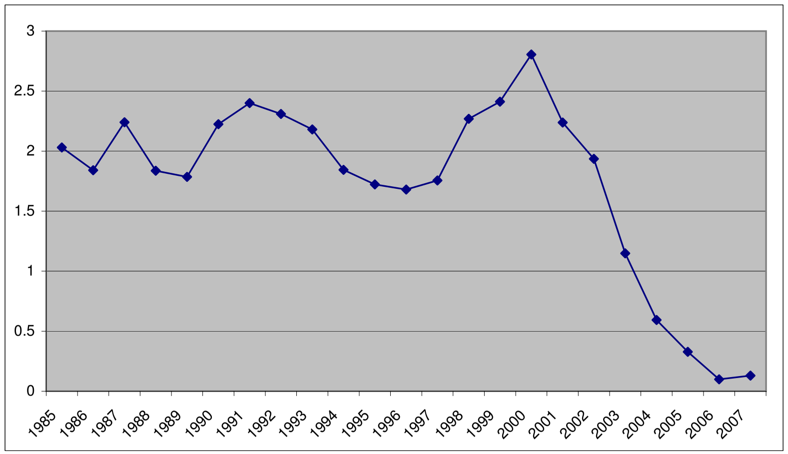
Figure 1.7: Plot of the Estimates of the Year Indicators from the Ordered Probit Model, Robustness Tests, Speculative Grade Sample, Additional Variables, 1985-2007



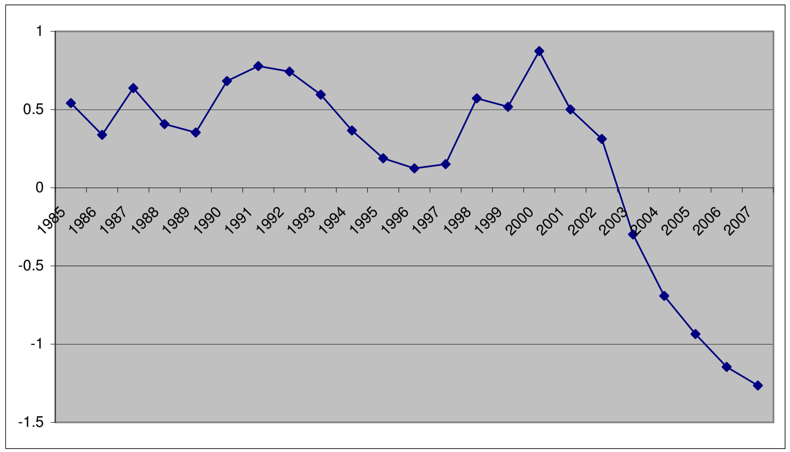
Panel A: Results using the 1985 Standards as a Reference Model



Panel B: Results using the 1996 Standards as a Reference Model

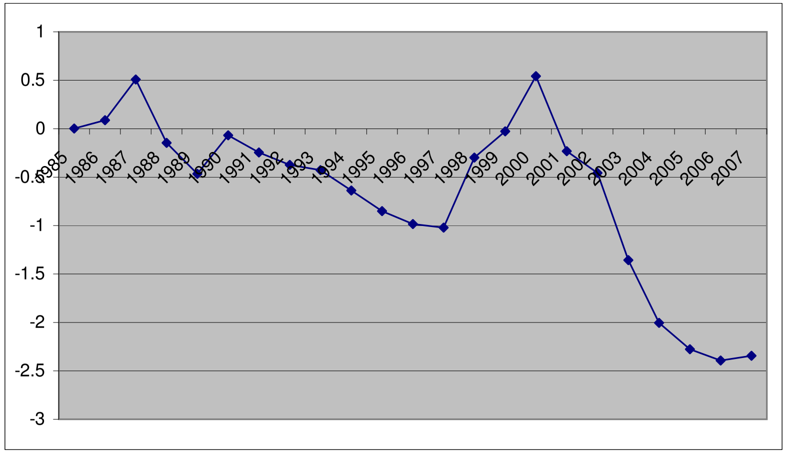


Panel C: Results using the 2007 Standards as a Reference Model

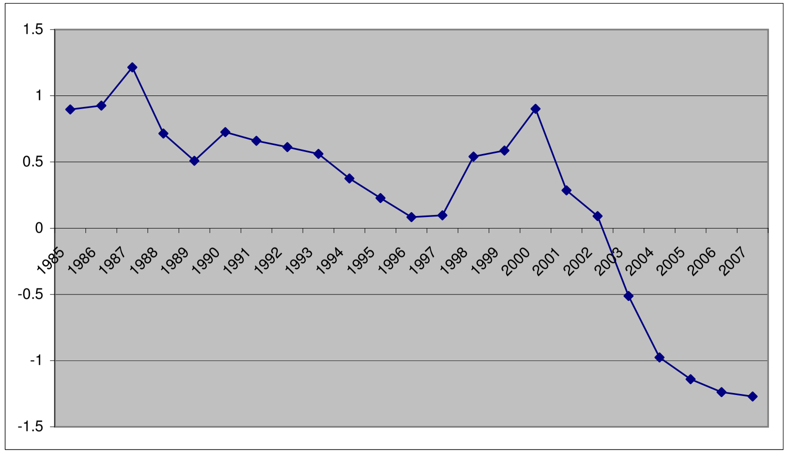


Panel D: Results using the Fama-Macbeth Approach as a Reference Model

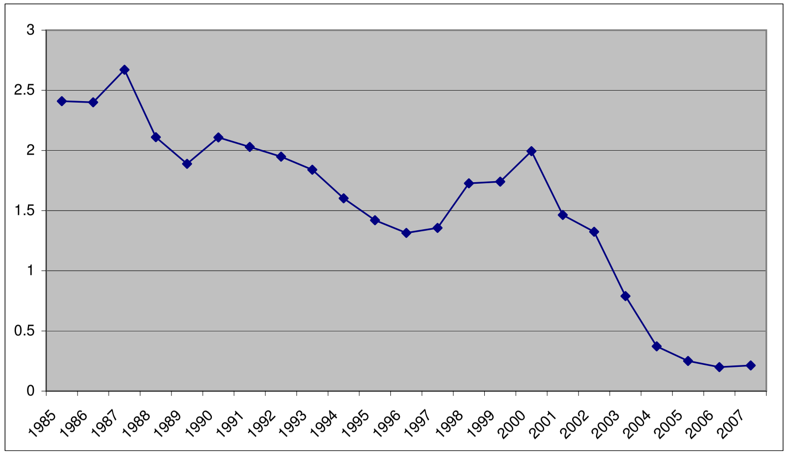
Figure 1.8: Plot of the Estimates of the Year Indicators from the Ordered Probit Model, Robustness for Year Indicators Approach, Entire Sample, 1985-2007



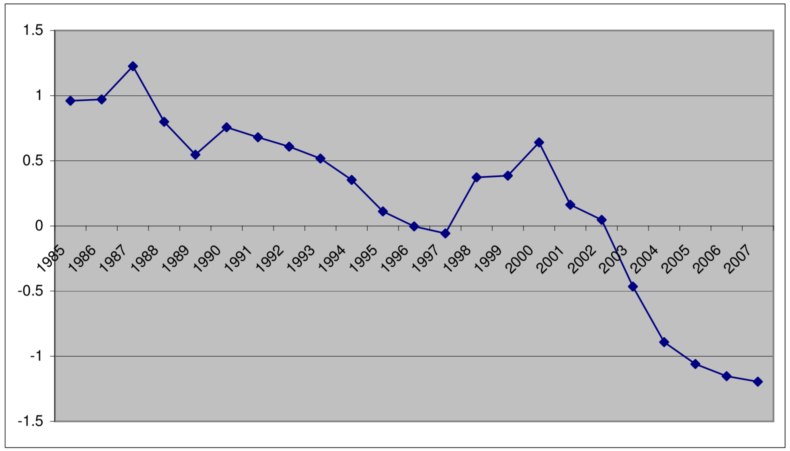
Panel A: Results using the 1985 Standards as a Reference Model



Panel B: Results using the 1996 Standards as a Reference Model

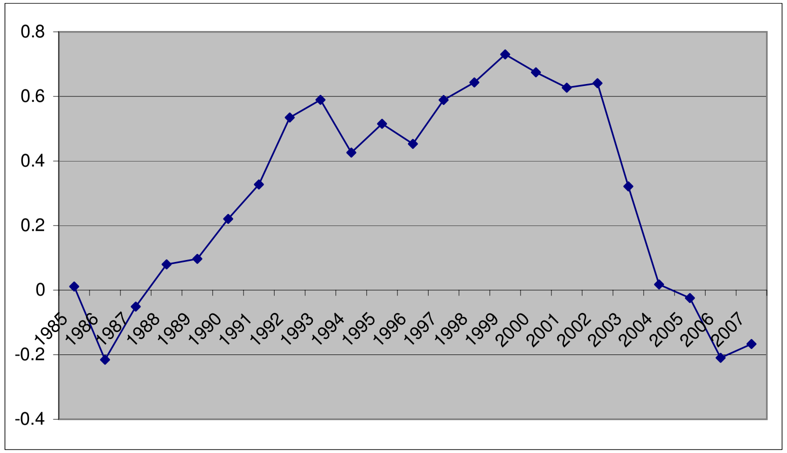


Panel C: Results using the 2007 Standards as a Reference Model

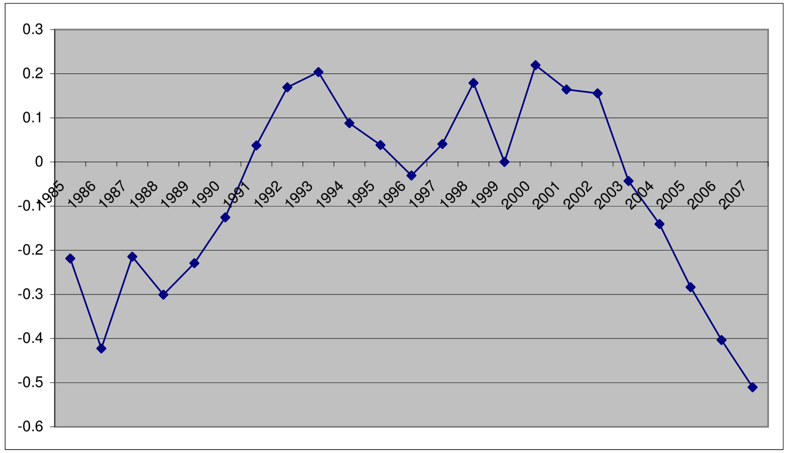


Panel D: Results using the Fama-Macbeth Approach as a Reference Model

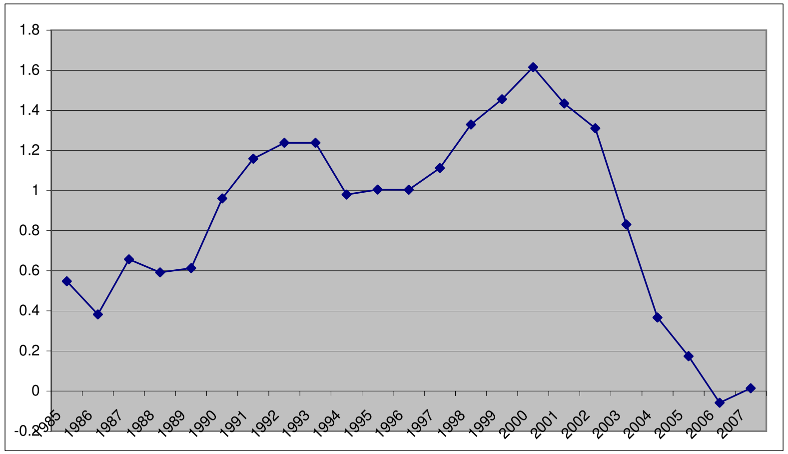
Figure 1.9: Plot of the Estimates of the Year Indicators from the Ordered Probit Model, Robustness for Year Indicators Approach, Investment Grade Sample, 1985-2007



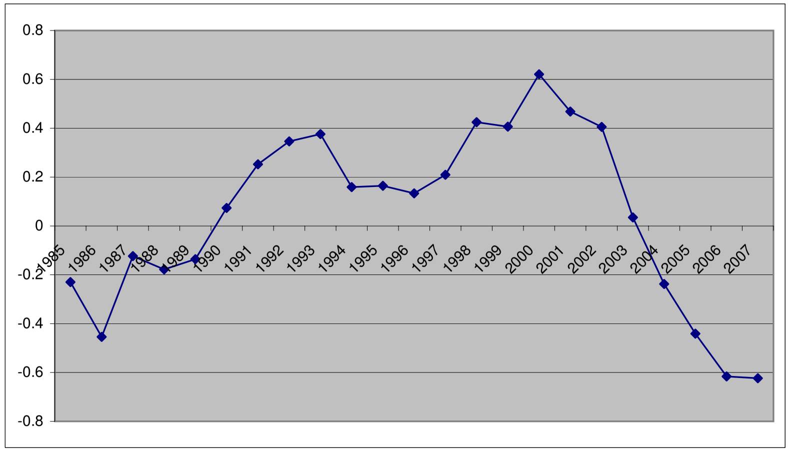
Panel A: Results using the 1985 Standards as a Reference Model



Panel B: Results using the 1996 Standards as a Reference Model

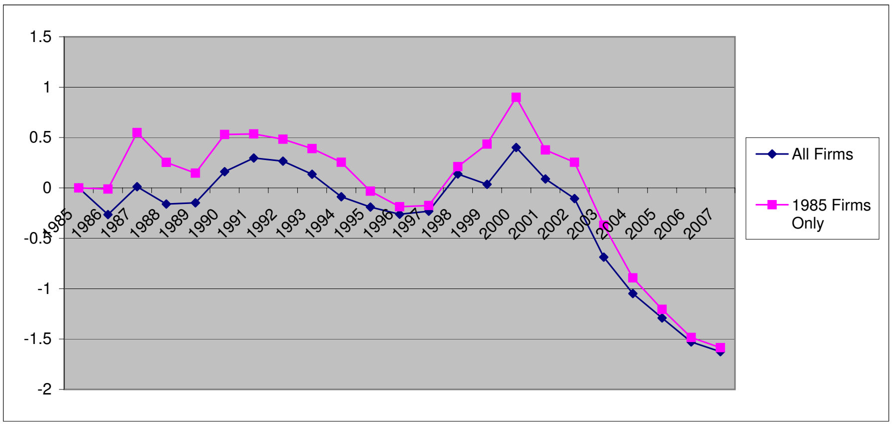


Panel C: Results using the 2007 Standards as a Reference Model

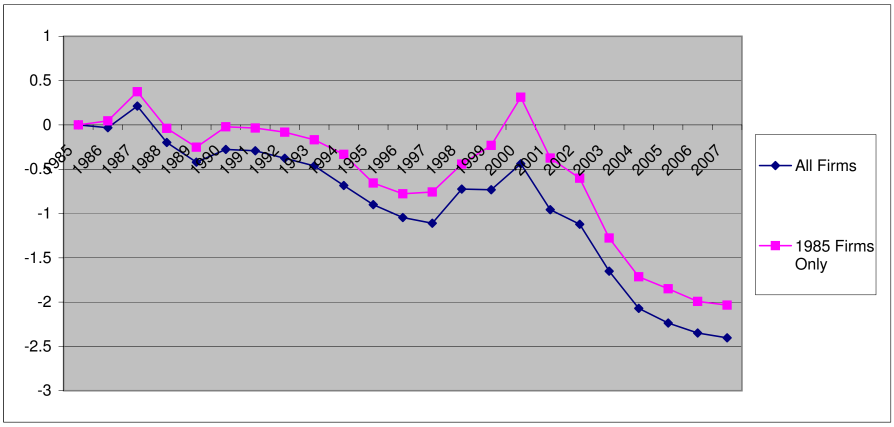


Panel D: Results using the Fama-Macbeth Approach as a Reference Model

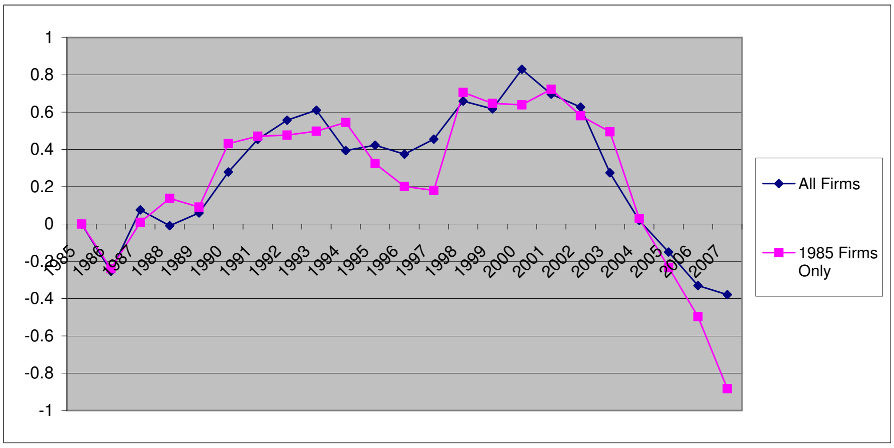
Figure 1.10: Plot of the Estimates of the Year Indicators from the Ordered Probit Model, Robustness for Year Indicators Approach, Speculative Grade Sample, 1985-2007



Panel A: Entire Sample

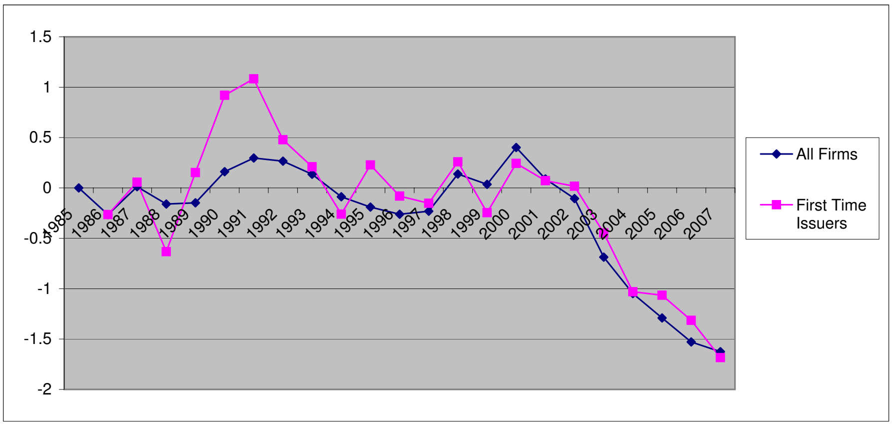


Panel B: Investment Grade Sample

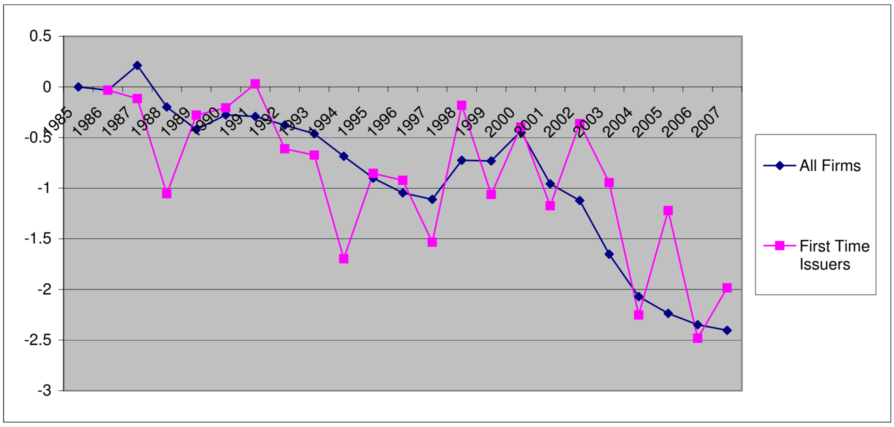


Panel C: Speculative Grade Sample

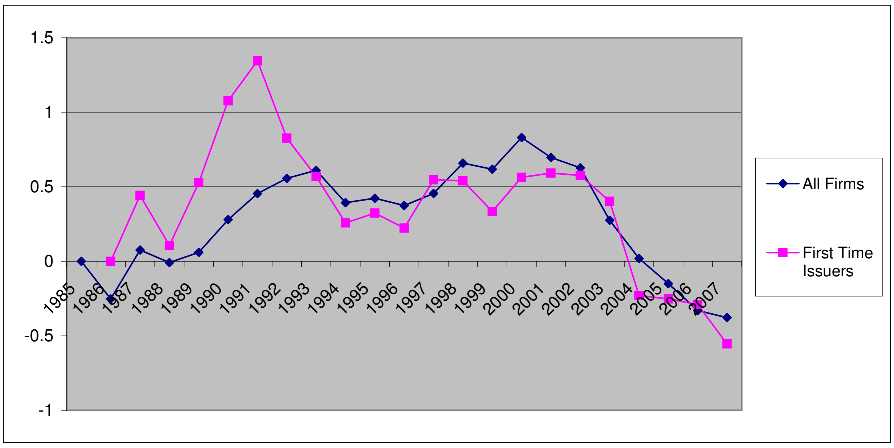
Figure 1.11: Plot of the Estimates of the Year Indicators from the Ordered Probit Model, Robustness for the Sample of Firms that Existed in 1985, 1985-2007



Panel A: Entire Sample



Panel B: Investment Grade Sample



Panel C: Speculative Grade Sample

Figure 1.12: Plot of the Estimates of the Year Indicators from the Ordered Probit Model, Robustness for First Time Issuers, 1985-2007

Chapter 2

Contagion Effects of Rating Downgrade Announcements

2.1 Introduction

The information content of credit ratings is the subject of a rich and growing literature. One branch of this literature examines whether ratings convey new information about the creditworthiness of a corporation, which the market has not already incorporated into prices from other available sources. Using standard event study techniques, this literature concludes that credit ratings provide valuable information to markets above and beyond what is publicly available. Rating downgrade news results in significantly negative abnormal equity and bond returns for the downgraded firm (Zaima and McCarthy (1988), Dichev and Piotroski (2001), Hand, Holthausen, and Leftwich (1992b), Holthausen and Leftwich (1986), Hite and Warga (1997), Pinches and Singleton (1978), Goh and Ederington (1993)). The rating upgrades, however, generate smaller and typically non-significant reactions.

Although the announcement reactions for the event firms are well understood, less is known about the effects of a rating downgrade news on the firms' industry rivals. Do the rating downgrade news reactions spillover to the firm's industry competitors? We attempt to answer this question in this paper. The information conveyed by a rating change can be firm specific or it might include an industry-wide component. If the information has implications for industry peers, then we should observe abnormal stock or bond reactions for the competitors around the rating change announcement dates.

The downgrade news can have negative or positive spillover effects for the industry peers. The former is generally referred to as contagion effects, while the latter is known as competition effects (Lang and Stulz (1992), Jorion and Zhang (2010)). The downgrade events can lead to contagion effects through several channels. First, the rating downgrade can reveal new information about deteriorating industry cash flows causing revaluation of the industry portfolio in the financial markets. Additionally, the industry peers might be subject to counterparty risk through their business connections with the downgraded firm. Jorion and Zhang (2009) examines spillover effects of bankruptcies through counterparty risk on firm's creditors and find significant contagion effects. Hertzel, Li, Officer, and Rodgers (2008) documents the transmission of bankruptcy effects along the supply chain. On the other hand, it is also possible that the downgrade news creates positive effects for industry rivals particularly if the firm is financially distressed and approaching default boundary. In this case, the downgrade can signal that the competitor is close to being eliminated from the industry, increasing the likelihood of greater future market share of remaining firms in case of fixed demand for the products (Jorion and Zhang (2010)).

In this paper, we analyze the effect of rating downgrades on the stock and CDS prices of industry competitors. Our sample covers S&P firm level credit rating downgrades between 1980 and 2008. The sample includes 2241 rating downgrades by S&P, which is substantially larger than the studies in the previous literature. We form portfolios of competitor firms for each downgrade event and carry out standard event study methods on portfolio equity and CDS prices. For the overall sample, we find minor contagion effects. The competitor industry portfolios experience an eight basis points reduction in value during the (0,1) window surrounding the event day, which is not statistically significant. The subsamples, however, yield more interesting results. When the downgraded firm originally carries an investment grade rating, then competitors suffer a negative 15 basis points return, which is statistically significant. For the speculative grade firms' rivals, we do not detect any contagion or competition effects. The abnormal return on the competitor portfolio is only an insignificant -0.01%.

Prior studies show that, the equity announcement effects for the downgraded firm are more negative, when the firm has a speculative grade rating prior to the downgrade (Jorion and Zhang (2007b)). In light of this fact, one might expect more severe contagion effects for the competitors of speculative grade firms yet we find the opposite result. The absence of any stock reaction in the speculative grade sample might be due cancelling effects of contagion and competition factors for this category. It is possible that the failure of a speculative grade firm is both good news and bad news for the competitors at the same time. The downgrade may be bad news and generate contagion effects because it signals unfavorable information about the industry prospects. At the same time, it might be good news because it increases the likelihood of the downgraded firm's exit from the industry. If the two forces are cancelling each other, we might observe minimal competitor reaction for the downgrades of speculative grade firms.

Additionally, we examine the CDS reactions of industry portfolios to downgrade news. We find minimal change in competitor CDS spreads within short event windows, however the reactions are more moderate for longer event windows such as (5,5) and (-10,10). For the whole sample, the CDS spreads of competitors widen about six basis points within the (-5,5) window. The widening amounts to seven basis points for (-10,10) window. Due to the illiquidity of the CDS securities, the longer windows might be necessary for the announcements effects to be priced in.

Our last set of tests are cross-sectional. We explore the cross sectional determinants of competitor equity and CDS reactions to downgrade news. We find a significant positive correlation between the event firm CAR and industry portfolio CAR which can be robustly observed for entire sample, investment grade sample and speculative grade sample. This result shows that, on the average, the industry portfolios are affected in the same direction as the event firms from the downgrade news. It provides further evidence that contagion effects dominate the competition effects. We additionally find that, for the speculative grade sample, the higher the median industry leverage, the greater the contagion effects. For the speculative grade sample, we also find that the higher the original rating the greater the contagion effects. The cross-sectional tests also show a negative correlation between equity returns and CDS spread changes. That is, for the industry portfolios, the equity reactions to rating downgrades are more negative when the CDS spreads widen. This suggest that, on the average, the downgrade affects the debt holders and the equity holders in the same way.

The rest of the paper is organized as follows. I begin with a summary of credit related literature in Section 2.2. Section 2.3 describes the data used in the study.

Section 2.4 presents the results. Section 2.5 concludes.

2.2 Literature Survey

Credit ratings are measures of ordinal rankings of credit risk across firms. At any point in time, a firm's credit rating is relative measure of creditworthiness, however, it does not correspond to absolute default probabilities over time. Issuer credit ratings provide "an opinion of the obligor's overall capacity and willingness to meet its financial obligations as they come due - whether rated or not" (Standard and Poor's (2008b)). S&P issuer ratings reflect only the risk of default and does not incorporate information about recovery rates. In addition, they do not take into account any provisions of a particular debt issue. Failure to make payment on any debt obligation leads to "Default" status in the issuer ratings.

Evidence from the event studies of rating changes show that ratings provide valuable information to the markets. Downgrades are associated with abnormal equity returns of about 2-2.5% (Hand, Holthausen, and Leftwich (1992b), Holthausen and Leftwich (1986), Dichev and Piotroski (2001)). In the case of upgrades, studies report much smaller generally insignificant effects. Goh and Ederington (1993) argues that this could be because the firms are eager to release favorable information to markets voluntarily. Hence, by the time of rating upgrade, the good news is already incorporated in the prices. However the firms are typically reluctant in disclosing bad information making the bad information uncovered by the rating agency more valuable. Rating downgrades can be predicted from publicly available data.

Typically, there is a negative stock price drift preceding rating downgrades.

This paper examines the wealth transfer effects of rating downgrades on industry competitors and is most similar to studies Akhigbe, Madura, and Whyte (1997), Caton and Goh (2003), and Jorion and Zhang (2010). Akhibe et. al. is the first article to study the intra-industry spillover effects of credit rating downgrades. Akhiebe et. al find significant contagion effects on industry rivals' equity by analyzing the 354 rating downgrades by S&P or Moody's during the period 1980-1993. The mean CAR of the competitor portfolio amounts to -0.19% based on a two day window of (-1,0). Caton and Goh examine the analysts' earnings forecasts revisions for industry competitors following rating downgrades. Using 453 downgrades of corporate bonds listed in Moody's Bond Record between 1984-1990, they find that stock analysts revise their earnings expectations downward for rivals of companies after announcements of bond rating downgrades. They also report a -0.33% mean CAR for (-1,0) window for the rival firms. More recently, Jorion and Zhang (2010) study the information transfer effects of bond rating downgrades for the period 1996-2002. Their sample constitutes 679 rating downgrades by S&P, Moody's, Fitch and Duff and Phelps. They find an insignificant contagion effect for the overall sample, which amounts to -0.08% mean CAR for the window (0, 1). However, their analysis shows that the industry reaction depends on the level of original rating of the downgraded firm. For the investment grade sample, they find a significant contagion effect with a mean CAR of -0.45%. In contrast, for the speculative grade sample they find a competition effect with a mean CAR of 0.17

Another branch of credit contagion literature focuses on information transfer effects of bankruptcy announcements. Lang and Stulz (1992) report significant negative abnormal equity reactions of industry rivals to Chapter 11 bankruptcy announcements. They report a 1% reduction in the value of the competitor portfolio within the 10 day window surrounding the announcement. Jorion and Zhang (2007a) find significant contagion effects around Chapter 11 bankruptcies and jumps in CDS spreads, but they document competition effects for Chapter 7 bankruptcies involving liquidation. Jorion and Zhang (2009) investigate contagion through counterparty risk. They find that bankruptcy announcement leads to negative share responses and widening of CDS spreads in creditors of the announcing firm. Hertzel, Li, Officer, and Rodgers (2008) study the wealth transfer effects of financial distress and bankruptcy through the supply chain. They find negative significant stock price response for suppliers of the distressed firms.

Prior literature detects intra industry information transfer effects for other corporate events as well. These events include earnings releases (Foster (1981), Firth (1996)) earnings forecasts (Han, Wild, and Ramesh (1989)), seasoned equity offerings (Slovin, Sushka, and Polonchek (1992)), dividend announcements (Laux, Starks, and Yoon (1998)), share repurchases (Erwin and Miller (1998)), stock splits (Tawatnuntachai and D'Melio (2002)), earnings restatements (Xu, Najand, and Ziegenfuss (2006)). These studies typically report moderate amounts of stock price response to the rivals in the same direction as the announcing firm. Ferreira and Gama (2007) report that sovereign rating downgrade of a country leads to spillover effects on the stock markets of other countries.

2.3 Data

We obtain data on rating changes from RatingsXpress Database under COMPUSTAT which covers S&P entity rating changes beginning 1980. We focus on upgrades and downgrades in the S&P long term issuer level rating but exclude defaulted entities. Our sample covers the period 1980 through 2008. We eliminate financial firms (sic 6000-6999), utilities (sic 4900 - 4999) and public administration (9000 and above) from the sample. We match the latest firm level information before the event date from COMPUSTAT to the remaining observations. We require that the firm has daily stock return data from CRSP between 255 days before and 10 days after the rating change. These filters yield a final sample of 2009 upgrades and 3495 downgrades. Table 2.1 reports the annual frequency of observations. Out of 3495 downgrades, 1786 observations are downgrades within speculative grade, 1338 observations within investment grade while 377 entities are downgraded from investment grade to speculative grade. Throughout much of the sample, the number of downgrades exceeds the number of upgrades. Particularly, during the period 1999-2002, which includes the Dot-Com crash, the number of downgrades reaches historically high levels.

Table 2.2 describes the sample characteristics for the downgraded firms. The sample covers 3495 downgraded firms belonging to 296 unique industries in terms of 4 digit SIC codes. On the average, there are 11.81 downgrades per industry. The median number of downgrades is 7 per industry. The downgrade sample spans 1359 unique firms. An average firm has 2.5 downgrades between 1980 and 2008.

Manufacturing firms constitute the majority of the sample (first digit of SIC codes 2 and 3), followed by transportation firms.

We identify the industry peer group as the portfolio of firms which have the same 4 digit SIC code as the announcing firm. We eliminate the observations with last digit of SIC code equal to zero because these observations practically report 3 digit SIC code. We further eliminate firms with SIC code ending with 9 since these firms belong to the miscellaneous category under 3 digit SIC code. We additionally require that the competitor has daily stock returns in CRSP 255 days before and 10 days after the event day. As Table 2.3 documents, these restrictions yield 2241 industry portfolios belonging to 168 unique industries. The industry portfolios consists of 7173 unique firms and 101164 total observations. The mean and median number of firms in an industry portfolio are 45 and 23 respectively. The largest industry portfolio carries 427 firms.

We employ standard event study methods through Eventus software to calculate the abnormal stock reaction of event firms and industry portfolios. The benchmark normal returns are obtained from the market model. We use the CRSP value weighted stock index as the market portfolio in the market model. We report the mean cumulative abnormal return for the two day event window (0,1). If an event occurs on a non-trading date, it is automatically converted to the next trading date. For the industry rivals, we form an equally weighted portfolio of industry competitors and perform event study tests on the portfolio returns. Following Jorion and Zhang (2010), we use the corrected Z statistic from the standardized cross sectional test of Boehmer, Musumeci, Poulsen to test the significance of abnormal returns.

We obtain the CDS data from Bloomberg. The data is available beginning August 2001. We focus on CDS spreads with 5 year maturity since this is the most common form of CDS contracts. In order to prevent double counting, we keep one CDS security per firm. Our final sample includes CDS data on 402 unique firms between 2001 and 2008. Our benchmark CDS market index is North America investment grade CDS index, CDX.NA.IG, which is composed of 125 investment grade reference entities with equal weights. The market adjusted CDS reactions to downgrades in different event windows are calculated in excess of the CDX.NA.IG index. Both raw returns and market adjusted returns are reported. The CDS index is available starting October 2003.

2.4 Results

In this section we present our main results. Section 2.4.1 and 2.4.2 discusses the equity reactions and CDS reactions respectively. Section 2.4.3 describes cross sectional evidence.

2.4.1 Equity Reaction

Table 2.4 presents abnormal equity returns for the event firms around rating downgrade announcements for the entire sample, investment grade sample and speculative grade sample. The samples are formed based on the event firm's rating prior to the downgrade. Consistent with prior literature, we find significantly negative abnormal returns for rating downgrade announcements. Table 2.4 reports the mean abnormal return for each day during the window (-10,10). The entire sample experiences an average of -1.80% return on the day of the rating downgrade. The reaction amounts to a -2.23% mean cumulative abnormal return over the two day event window (0,1). Consistent with Jorion and Zhang (2007b), the magnitude of the stock response depends on the initial rating of the announcing firm. When the downgraded firm originally has an investment grade rating, the mean (0,1) CAR is only 0.84%. However, for the speculative grade firms, the reaction is much more severe. We observe an -3.57% CAR for the speculative grade sample over the (0,1) window. This is consistent with the argument that the rating downgrade costs increases as a firm gets closer to the default boundary (Jorion and Zhang (2007b)). Inline with prior literature, there is consistent negative stock returns during the 10 days preceding the rating downgrade date.

For the upgrades, we find moderate positive stock reactions around the announcement date (not reported). The mean CAR for the event window (0,1) is 0.30%. This is consistent with the argument that the information produced by rating upgrades is limited. Unlike many prior studies, our results are significant at 1% level, perhaps due to the larger sample size in our study. Similar to downgrades, the reaction is stronger for speculative grade firms. The mean CAR for investment grade firms and speculative grade firms are 0.24% and 0.33% respectively. The results are significant at 5% and 1% level respectively.

Next we turn our attention to the stock response of industry competitors. Table 2.5 documents the abnormal equity returns for industry rivals around rating downgrade announcements. For the overall sample, we detect small intra-industry information spillovers effects of rating downgrades. The mean CAR for the (0,1) window is -0.08% which is statistically insignificant. We then examine stock reactions conditioned on the original rating of the downgraded firm. Unlike the whole sample, we do find significant contagion effects when an investment grade firm is downgraded. The mean CAR for the investment grade sample is -0.15% for the (0,1) window, which is significant at 5% level. The median (0,1) CAR is -0.11%. This finding is in contrast to the speculative grade sample, which experiences an insignificant -0.01% CAR during the two day event window. The median (0,1) CAR for speculative grade firms is -0.04% suggesting minor contagion effects. For the upgrades, we do not find significant transfer effects on the industry competitors. The mean (0,1) CAR is an insignificant -0.05%.

The different results between investment grade and speculative grade sample demands some explanation. Why do we observe contagion effects for the investment grade sample but not for speculative grade sample? One explanation is that investment grade firms are usually larger and more visible firms which are prominent in their industries. Hence, bad news associated with investment grade firms have bigger implications for the rest of the industry. Another explanation is that, for speculative grade firms, competition effects might be at play along with contagion effects. Downgrade news can convey unfavorable information about the industry cash flows creating the regular contagion effects. However, at the same time, downgrade news might signal a potential exit from the corresponding industry because speculative grade firms are close to the default boundary. As a result, contagion and competition effects can cancel each other for this subsample, leading to insignificant abnormal returns for industry peers. The cross sectional tests of Section 2.4.3 shed some light on these explanations.

2.4.2 CDS Reaction

In this section we examine the CDS reactions to rating downgrades. Table 2.6 presents the CDS reactions for the downgraded firms. Panel A and B reports raw returns and market adjusted returns respectively for the entire sample. We observe a clear widening in CDS spreads around the downgrade announcements for the event firms. Panel A shows that, on day zero, CDS spreads for the entire sample widens an average of 16 basis points. Out of 261 firms, 107 firms experience a widening while only 68 firms' CDS spreads narrow down. It is worth noting that, at the event day, the change in CDS spreads was zero for 86 firms. This could be due to the illiquidity of the CDS securities. Consistent with illiquidity argument, the mean CDS returns are greater for the longer event windows. For the (-10,10) window the mean return is 66 basis point. Panel B shows that the market adjusted returns are even higher. The mean return for the event day is 20 basis points while the return for the (-10,10) window is 73 basis points.

Panel C and D of Table 2.6 present results for the investment grade sample. As in equity announcement returns, the CDS reactions are much smaller for investment grade sample. At the event day, we observe a 3 basis points widening in CDS spreads, which is statistically significant at 1% level. However, the longer event window yield stronger reactions. For (-10,10) window, the widening in CDS spreads amounts to 25 basis points. Panel E and F of Table 2.6 report CDS reactions for the speculative grade sample. Consistent with Jorion and Zhang (2007b), the CDS returns to downgrade announcements are substantially greater for speculative grade firms compared to investment grade sample. The mean return at the event day is 49 basis points. The CDS reaction increases up to 163 basis points for the event window (-10,10). Overall, we conclude that downgrade news causes economically and statistically significant increase in event firms' CDS spreads.

Next we examine the CDS reactions for the industry portfolios which are reported in Table 2.7. Panel A and B presents the raw and market adjusted CDS reactions for entire sample. It is evident that, at the event day, there is very minor contagion effects for industry portfolios. On day zero, the raw mean return is 0.57 basis points which is significant at 10% level. For the event window (-1,1), the mean return increases to 2 basis points which is significant at 5% level. For the longer event windows such as (-5,5) and (-10,10), the event returns are larger in economic magnitude but still moderate. For the entire sample, the CDS spreads widen by 10 basis (7 basis) points within the 20 days window surrounding the downgrade announcement when raw (market adjusted) returns are reported. Although moderate in economic significance, the returns for (-5,5) and (-10,10) windows are statistically significant at 1% level. The longer event windows might be necessary to detect CDS reactions due to illiquidity of CDS securities. It might take a longer period for the announcement effects to be incorporated into the prices due to the infrequent trading. The results for investment grade and speculative grade subsamples are given in

Panels C through F. Consistent with equity announcement returns, the reaction is smaller for investment grade sample compared to the speculative grade sample. The investment grade sample reactions are not statistically significant once the market adjustment is taken into account. For the speculative grade sample, we observe 10 basis points raw return and market adjusted return in CDS spreads for the (-10,10) window. It is worth noting that, the CDS reactions are generally skewed to right. In Panel E, for the window (-5,5), the number of firms with widened CDS spreads is much less than the number of firms with narrowed spreads. However, the mean return is a positive 8 basis points for this window due to skewed nature of the reactions. Overall, we conclude that there is moderate contagion effects for industry portfolios of downgraded firms reflected in their CDS spreads. Despite the moderate size of reaction, the (-5,5) and (-10, 10) window returns are statistically significant for all specifications except for the market adjusted investment grade sample.

2.4.3 Cross Sectional Results

In this section, we investigate the cross sectional determinants of industry portfolios returns. We hypothesize that the following variables can be associated with the cross sectional differences in returns and employ them as explanatory variables in our cross-sectional regressions:

- **Event Firm Size** : Log of market capitalization of the downgraded firm deflated by CPI index

- **# Notches** : The number of rating notches the announcing firm's rating is downgraded. As an example, a downgrade from AA+ to AA- constitute two rating notches.

- **Original Rating** : The original rating of the event firm before the downgrade. We assign numerical identifiers one through 20 to the ratings (CC=1, AAA=20).

- **Herfindahl** : Herfindahl index calculated as the sum of squared fractions of sales of each individual firm over total sales of the industry.

- **Median Indus. Leverage** : Leverage of each firm is calculated as long term debt (dltt) plus short term debt (dlc) divided by assets (at). Then we use the median value for each industry portfolio.

- **Event Firm CAR(0,1)** : Cumulative abnormal equity return for the downgraded firm over the window (0,1).

We hypothesize that the contagion impact of the downgrade on the industry portfolios should be bigger if the event firm has a larger size. Larger firms tend to be more prominent players in the industry and have more ties with industry counterparties. Therefore we expect a negative sign for variable size. We hypothesize that the higher the number of notches of the downgrade, the higher the contagion effects. We expect the contagion effects to be larger for firms with a higher rating. Downgrade of firms with lower ratings can create competition effects and favor the competitors along with contagion effects. For Herfindahl index, the net effect can be positive or negative. For concentrated industries, the contagion effects can be greater if the firms are more connected and have more ties with each other. On the other hand, if the downgraded firm is close to the default boundary we can see higher competition effects. The failure of the firm in a concentrated industry might benefit the remaining firms by increasing their market power. We also explore the correlation between the downgraded firms equity CAR and the industry portfolio's equity CAR. If the correlation is positive, it would imply stronger contagion effects compared to competition effects. We additionally include median industry leverage as an explanatory variable. We expect the industries with more leverage to be more negatively affected by the downgrade news.

Table 2.8 presents results of the cross sectional tests of industry portfolio equity CAR. Here, the dependent variable is the industry portfolio CAR for the event window (0,1). In panel A, we report the results of the univariate regressions. Panel B shows the results of the multivariate regressions. We conduct both Ordinary Least Square (OLS) and Weighted Least Square Regressions (WLS) where the weights are the inverse of the portfolio return variance. The univariate results and multivariate results are generally comparable. Panel B shows that, the variable size has the expected negative sign, however it is not significant. Consistent with more severe contagion effects of higher rated firms, the variable original rating has a negative sign. However, this result is not robustly significant except for the speculative grade sample. Herfindahl index is negatively related to industry portfolio returns, suggesting greater contagion effects in more concentrated industries. However, this relation is not robustly significant. The variable is significant for WLS regressions but loses significance when the heteroskedasticity corrected standard errors are reported. The median industry leverage appears to matter only for speculative grade sample. For this sample, the higher the industry leverage, the higher the contagion effects of downgrades as expected. One clear message from Table 2.8 is that, the industry portfolio equity returns are strongly positively related to the event firm equity returns for all samples. This results suggests that, on the average contagion effects dominate competition effects for industry portfolios, regardless of whether the downgraded firm is an investment grade or speculative grade firm. The variable is significant at P-values indistinguishable from zero for the entire sample and for the speculative grade sample.

Table 2.9 presents the results of the cross sectional regressions where the dependent variable is the industry portfolio CDS return over the window (0,1). In the univariate regressions in Panel A, the CDS reactions are significantly related to event firm CAR and industry portfolio equity CAR. The signs indicate that, equity holders and bond holders of the competitors are affected similarly by the rating downgrade of the announcing firm. The industry portfolio CDS reaction is also in the same direction as the event firm equity movement. In multivariate regressions, the variable size is positively and significantly correlated with CDS reactions for the investment grade sample but the result is not robust for the entire sample and the speculative grade sample. This is consistent with greater contagion effects on the industry when bigger firms are downgraded. We conclude that one strong message from Table 2.8 is that, the competitor industry portfolio debt holders and equity holders react in the same direction to a rating downgrade. The CDS reaction is also positively correlated with the event firm equity response.

2.5 Conclusion

We examine the intra-industry spillover effects of rating downgrade announcements. We form portfolios of downgraded firms' competitors and analyze the stock and CDS response of these portfolios around the downgrade days. By employing standard event study methods, we find minor contagion effects for the equity prices of the industry portfolios for the entire sample. Then we condition the sample on the event firm's original rating prior to the downgrade. For the competitors of investment grade firms, we find significant contagion effects in the magnitude of -15 basis points for the window (0,1). For the speculative grade sample, we do not observe contagion or competition effects although this result can be due to cancellation of contagion and competition effects for the low rated firms. We find statistically significant CDS reaction of industry portfolios to downgrade news although in moderate magnitudes. For entire sample, during the window (-10,10), CDS spreads of industry portfolios widen by about 7 to 10 basis points. The cross sectional tests show that the industry portfolio equity response and event firm equity response are positively correlated. This finding presents further evidence of contagion effects. Our tests also show that the industry portfolio equity holders and bond holders react similarly to the downgrade news, i.e. the CDS spreads widen when equity returns are negative.

Although we present some evidence of ratings contagion, the industry reactions to downgrade news in our study are moderate in economic significance. One way to improve this study is to develop the definition of industry competitors based on the firms' concrete ties. Examining the reactions of downgraded firms' direct counterparties could be a fruitful research agenda. Future research can also condition the contagion effects on the rating downgrade reason.

Table 2.1: Annual Frequency of Rating Changes

			Inv. to Inv.		Spec. to Spec.		Spec. to Inv.	Inv. to Spec.
year	Up	Down	Up	Down	Up	Down	Up	Down
1980	35	17	25	13	2	3	8	1
1981	23	20	15	15	6	3	2	2
1982	17	34	13	30	2	1	2	3
1983	25	27	21	21	2	4	2	2
1984	18	30	15	21	1	5	2	4
1985	27	59	18	44	8	9	1	6
1986	31	86	23	54	5	18	3	14
1987	34	50	20	33	10	7	4	10
1988	50	50	23	27	20	15	7	8
1989	55	40	30	27	13	9	12	4
1990	32	68	18	43	11	19	3	6
1991	37	71	15	35	16	26	6	10
1992	44	59	18	36	17	17	9	6
1993	68	51	28	28	32	14	8	9
1994	54	51	19	27	28	20	7	4
1995	88	71	39	36	36	27	13	8
1996	90	85	37	40	43	39	10	6
1997	122	102	46	45	56	49	20	8
1998	121	178	44	57	61	105	16	16
1999	72	239	28	91	39	130	5	18
2000	93	260	29	98	48	134	16	28
2001	79	378	27	121	45	224	7	33
2002	69	355	17	94	46	227	6	34
2003	117	230	28	60	78	138	11	32
2004	117	152	26	40	75	96	16	16
2005	139	207	47	52	74	131	18	24
2006	119	200	36	70	72	104	11	26
2007	147	211	43	54	96	129	8	28
2008	86	114	27	26	47	77	12	11
Total	2009	3495	775	1338	989	1780	245	377

Table 2.2: Downgrade Sample Characteristics

Panel A: Distribution of downgrade events by industry(full sample)

Number of Events	Number of Unique Industries	Number of Events per Industry				
		Mean	Median	Max	Min	Std. Dev.
3495	296	11.81	7	172	1	17.27

Panel B: Distribution of downgrade events by firms(full sample, N=5040)

Number of Events	Number of Unique Firms	Number of Events per Firm				
		Mean	Median	Max	Min	Std. Dev.
3495	1359	2.57	2	15	1	1.82

Panel C: Industry Distribution

First Digit of SIC Code	Industry Description	Firm-Year Obs.	Fraction(%)
0	Agriculture, Forestry, and Fishing	21	0.6
1	Mining and Construction	331	9.47
2	Manufacturing(Food-Petroleum)	798	22.83
3	Manufacturing(Plastics-Electronics)	945	27.04
4	Transportation	546	15.62
5	Wholesale Trade and Retail Trade	440	12.59
7	Services (Hotel-Recreation)	310	8.87
8	Services (Health-Private Household)	104	2.98
Total		3495	100

Table 2.3: Industry Portfolios Sample Characteristics for Downgrades

Panel A: Distribution of industry portfolios

Number of Events	4-Digit Sic Exists	Number of Unique Sic-Date Pairs	Matched Industry Portfolios	Number of Unique Industries	Number of Unique Competitor Firms	Total Obs
3495	2337	2248	2241	168	7173	101164

Panel B: Statistics for the Number of Firms in Industry Portfolios

Mean	Median	Max	Min	Stdev
45.08	23	427	1	59.71

Table 2.4: Abnormal Equity Returns for Event Firms

	Whole Sample(3495 obs)			Investment Gr. Sample (1715 obs)			Speculative Gr. Sample (1780 obs)		
Day	Mean	Pos:Neg	StdCsect Z	Mean	Pos:Neg	StdCsect Z	Mean	Pos:Neg	StdCsect Z
-10	-0.14%	1641:1853	-1.305$	-0.08%	814:901	-0.528	-0.20%	827:952	-1.259
-9	0.03%	1676:1818	0.21	0.01%	839:876	1.121	0.06%	837:942	-0.534
-8	-0.14%	1646:1847	-1.846*	-0.02%	840:875	-0.501	-0.25%	806:972	-2.030*
-7	-0.23%	1653:1841	-2.452**	0.00%	817:898	-0.562	-0.45%	836:943	-2.706**
-6	-0.17%	1661:1833	-1.974*	-0.04%	846:869	-0.255	-0.30%	815:964	-2.291*
-5	-0.06%	1672:1822	-1.573$	-0.15%	813:902	-1.953*	0.02%	859:920	-0.405
-4	-0.26%	1633:1861	-3.071**	0.01%	814:901	-0.096	-0.52%	819:960	-3.679***
-3	-0.51%	1675:1819	-4.206***	-0.09%	853:862	-0.976	-0.92%	822:957	-4.391***
-2	-0.53%	1648:1845	-4.146***	-0.05%	843:871	-0.518	-0.99%	805:974	-4.689***
-1	-0.61%	1593:1899	-2.513**	-0.14%	826:888	-0.684	-1.06%	767:1011	-2.420**
0	-1.80%	1502:1992	-8.750***	-0.56%	789:926	-2.720**	-3.00%	713:1066	-9.134***
1	-0.44%	1543:1941	-4.084***	-0.28%	786:928	-3.182***	-0.58%	757:1013	-2.801**
2	-0.17%	1611:1869	-1.684*	-0.19%	789:923	-2.088*	-0.15%	822:946	-0.764
3	0.02%	1653:1825	0.122	0.06%	817:894	0.835	-0.02%	836:931	-0.506
4	-0.03%	1700:1773	0.002	0.17%	860:850	1.601$	-0.23%	840:923	-1.311$
5	0.22%	1691:1772	1.049	0.09%	799:907	1.341$	0.33%	892:865	0.422
6	0.26%	1664:1795	2.695**	0.05%	832:873	1.026	0.47%	832:922	2.518**
7	0.08%	1698:1753	0.848	0.16%	856:849	1.735*	0.01%	842:904	-0.19
8	0.19%	1710:1735	1.498$	0.11%	861:843	1.673*	0.26%	849:892	0.714
9	0.10%	1707:1737	1.748*	0.05%	854:850	1.07	0.14%	853:887	1.390$
10	0.20%	1687:1753	1.434$	0.10%	845:858	0.966	0.29%	842:895	1.071
Window (0,1)	-2.23%	1481:2014	-9.772***	-0.84%	791:924	-3.796***	-3.57%	690:1090	-9.662***

Table 2.5: Abnormal Equity Returns for Industry Portfolios

	Whole Sample (2241 obs)			Investment Gr. Sample (1083 obs)			Speculative Gr. Sample (1158 obs)		
Day	Mean	Pos:Neg	StdCsect Z	Mean	Pos:Neg	StdCsect Z	Mean	Pos:Neg	StdCsect Z
-10	0.06%	1152:1089	1.579$	0.03%	551:532	0.514	0.09%	601:557	1.673*
-9	0.05%	1075:1166	0.632	0.08%	552:531	1.415$	0.02%	523:635	-0.5
-8	0.03%	1103:1138	1.004	0.08%	542:541	1.822*	-0.01%	561:597	-0.323
-7	-0.01%	1089:1152	-0.298	0.04%	546:537	1.106	-0.06%	543:615	-1.410$
-6	0.03%	1104:1137	1.527$	-0.02%	527:556	0.598	0.08%	577:581	1.521$
-5	0.04%	1116:1125	1.405$	0.03%	534:549	0.837	0.06%	582:576	1.131
-4	-0.01%	1067:1174	-1.572$	-0.02%	525:558	-1.151	0.00%	542:616	-1.073
-3	-0.02%	1061:1180	-1.169	0.03%	521:562	0.138	-0.07%	540:618	-1.618$
-2	-0.02%	1072:1169	-0.057	-0.07%	527:556	-0.603	0.02%	545:613	0.519
-1	0.01%	1104:1137	0.337	0.06%	543:540	0.88	-0.04%	561:597	-0.336
0	-0.04%	1089:1152	-0.514	-0.06%	522:561	-1.342$	-0.01%	567:591	0.5
1	-0.04%	1057:1184	-1.215	-0.09%	502:581	-2.025*	0.00%	555:603	0.184
2	0.00%	1092:1149	-0.571	-0.04%	528:555	-0.965	0.03%	564:594	0.111
3	-0.03%	1054:1187	-0.94	0.04%	524:559	0.553	-0.09%	530:628	-1.741*
4	0.04%	1095:1146	1.390$	0.08%	531:552	0.932	0.01%	564:594	1.03
5	0.04%	1101:1140	1.776*	0.01%	518:565	1.176	0.06%	583:575	1.332$
6	0.00%	1073:1168	0.26	-0.06%	528:555	-0.722	0.07%	545:613	1.022
7	0.14%	1141:1100	3.684***	0.10%	557:526	1.799*	0.18%	584:574	3.321***
8	0.00%	1091:1150	0.472	-0.06%	530:553	-0.429	0.05%	561:597	1.003
9	0.08%	1118:1123	1.740*	0.10%	536:547	1.109	0.05%	582:576	1.344$
10	0.05%	1093:1148	0.11	0.05%	529:554	-0.343	0.05%	564:594	0.506
Window	Mean (Median)	Pos:Neg	StdCsect Z	Mean (Median)	Pos:Neg	StdCsect Z	Mean (Median)	Pos:Neg	StdCsect Z
(0,1)	-0.08% (-0.06%)	1067:1174	-1.262	-0.15% (-0.11%)	505:578	-2.448**	-0.01% (-0.04%)	562:596	0.424

Table 2.6: CDS Reaction to Downgrade Events - Event Firms

Panel A: All Firms - Raw Returns

Window	N	N <0	N >0	Mean	Median	Min	Max	Skewness	T-Stat
(0,0)	261	68	107	16.64	0.00	-124.92	1692.34	10.72	2.11
(0,1)	261	78	125	29.29	0.00	-352.00	1961.00	8.48	2.63
(-1,1)	261	79	130	32.55	0.00	-352.00	2473.75	9.18	2.58
(-5,5)	261	80	152	57.71	3.18	-286.25	2121.75	6.50	3.82
(-10,10)	258	86	151	66.42	6.02	-179.75	2131.43	6.17	4.37

Panel B: All Firms - Market Adj

Window	N	N <0	N >0	Mean	Median	Min	Max	Skewness	T-Stat
(0,0)	209	87	115	19.91	0.25	-124.51	1691.21	9.59	2.03
(0,1)	209	83	123	33.59	0.88	-351.92	1961.33	7.64	2.43
(-1,1)	209	80	129	37.37	1.23	-351.92	2474.75	8.32	2.39
(-5,5)	209	70	139	63.42	3.73	-285.69	2123.29	5.98	3.40
(-10,10)	208	69	139	73.41	9.33	-208.02	2141.65	5.77	3.95

Panel C: Investment Grade Firms - Raw Returns

Window	N	N <0	N >0	Mean	Median	Min	Max	Skewness	T-Stat
(0,0)	184	48	83	3.24	0.00	-37.50	126.04	4.81	3.29
(0,1)	184	58	92	9.17	0.05	-58.75	192.50	3.66	4.53
(-1,1)	184	58	94	9.54	0.28	-50.00	217.50	3.90	4.06
(-5,5)	184	54	111	21.35	3.00	-73.67	364.58	2.92	5.60
(-10,10)	181	61	105	25.51	3.50	-85.00	421.67	2.62	5.33

Panel D: Investment Grade Firms - Market Adj

Window	N	N <0	N >0	Mean	Median	Min	Max	Skewness	T-Stat
(0,0)	135	48	83	3.64	0.42	-20.30	125.56	5.88	3.09
(0,1)	135	48	84	8.52	0.91	-17.95	178.77	4.14	4.14
(-1,1)	135	44	91	9.15	1.49	-32.13	182.24	3.89	4.30
(-5,5)	135	40	95	17.80	3.01	-35.89	208.67	2.64	5.46
(-10,10)	134	44	90	23.38	4.57	-62.62	247.53	2.36	5.14

Panel E: Speculative Grade Firms - Raw Returns

Window	N	N <0	N >0	Mean	Median	Min	Max	Skewness	T-Stat
(0,0)	77	20	24	48.65	0.00	-124.92	1692.34	5.71	1.84
(0,1)	77	20	33	77.39	0.00	-352.00	1961.00	4.49	2.09
(-1,1)	77	21	36	87.54	0.00	-352.00	2473.75	4.91	2.09
(-5,5)	77	26	41	144.57	10.61	-286.25	2121.75	3.41	2.94
(-10,10)	77	25	46	162.59	46.83	-179.75	2131.43	3.34	3.37

Panel F: Speculative Grade Firms - Market Adj

Window	N	N <0	N >0	Mean	Median	Min	Max	Skewness	T-Stat
(0,0)	74	39	32	49.59	-0.08	-124.51	1691.21	5.59	1.81
(0,1)	74	35	39	79.32	0.25	-351.92	1961.33	4.40	2.06
(-1,1)	74	36	38	88.87	0.39	-351.92	2474.75	4.81	2.04
(-5,5)	74	30	44	146.66	12.21	-285.69	2123.29	3.36	2.87
(-10,10)	74	25	49	163.99	30.01	-208.02	2141.65	3.31	3.28

Table 2.7: CDS Reaction to Downgrade Events - Industry Portfolios

Panel A: All Firms - Raw Returns

Window	N	N <0	N >0	Mean	Median	Min	Max	Skewness	T-Stat
(0,0)	596	231	240	0.57	0.00	-50.58	69.68	1.64	1.83
(0,1)	596	256	264	1.44	0.00	-58.75	98.18	2.13	2.75
(-1,1)	596	260	278	2.07	0.00	-88.75	98.75	0.89	3.03
(-5,5)	594	305	271	7.17	-0.09	-189.71	471.61	3.86	3.94
(-10,10)	590	296	280	10.01	-0.04	-172.97	320.00	1.98	4.29

Panel B: All Firms - Market Adj

Window	N	N <0	N >0	Mean	Median	Min	Max	Skewness	T-Stat
(0,0)	390	181	199	0.47	0.02	-49.42	71.14	2.78	1.33
(0,1)	390	185	205	0.90	0.09	-48.05	98.06	2.80	1.62
(-1,1)	390	184	206	1.35	0.15	-45.21	70.80	1.58	2.05
(-5,5)	390	178	211	6.37	0.53	-85.32	470.59	5.60	3.16
(-10,10)	389	204	185	7.23	-0.33	-153.23	247.72	2.41	3.14

Panel C: Investment Grade Firms - Raw Returns

Window	N	N <0	N >0	Mean	Median	Min	Max	Skewness	T-Stat
(0,0)	237	89	100	0.96	0.00	-37.50	69.68	3.37	1.76
(0,1)	237	105	102	1.23	0.00	-58.75	80.00	2.22	1.46
(-1,1)	237	108	108	1.59	0.00	-88.75	98.75	0.95	1.45
(-5,5)	236	112	114	5.51	0.00	-102.92	274.38	3.11	2.41
(-10,10)	233	108	116	8.64	0.00	-146.25	270.26	2.39	2.78

Panel D: Investment Grade Firms - Market Adj

Window	N	N <0	N >0	Mean	Median	Min	Max	Skewness	T-Stat
(0,0)	161	67	91	1.10	0.12	-24.76	71.14	5.56	1.73
(0,1)	161	76	85	1.25	0.08	-26.00	71.14	3.66	1.56
(-1,1)	161	77	84	1.36	0.07	-34.43	66.68	2.93	1.53
(-5,5)	161	77	84	3.58	0.28	-85.32	238.42	4.34	1.55
(-10,10)	160	82	78	3.03	-0.09	-88.27	240.46	3.77	1.06

Panel E: Speculative Grade Firms - Raw Returns

Window	N	N <0	N >0	Mean	Median	Min	Max	Skewness	T-Stat
(0,0)	359	142	140	0.31	0.00	-50.58	39.25	-0.45	0.85
(0,1)	359	151	162	1.57	0.00	-48.90	98.18	2.07	2.36
(-1,1)	359	152	170	2.39	0.00	-80.00	92.50	0.86	2.74
(-5,5)	358	193	158	8.27	-0.61	-189.71	471.61	3.85	3.16
(-10,10)	357	188	166	10.90	-0.58	-172.97	320.00	1.79	3.33

Panel F: Speculative Grade Firms - Market Adj

Window	N	N <0	N >0	Mean	Median	Min	Max	Skewness	T-Stat
(0,0)	229	114	108	0.03	0.00	-49.42	25.51	-1.73	0.08
(0,1)	229	109	120	0.65	0.13	-48.05	98.06	2.37	0.86
(-1,1)	229	107	122	1.34	0.27	-45.21	70.80	1.05	1.44
(-5,5)	229	101	127	8.33	0.63	-73.66	470.59	5.43	2.76
(-10,10)	229	122	107	10.16	-0.36	-153.23	247.72	1.90	3.03

Table 2.8: Cross Sectional Determinants of Industry Portfolio Equity CAR(0,1)

Panel A: Univariate Analysis

	OLS			OLS (robust)			WLS		
	coef	t	R2	coef	t	R2	coef	t	R2
Event Firm Size	-0.000	-1.50	0.001	-0.000*	-1.69	0.001	-0.000	-1.45	0.000
#Nothces	0.001	1.03	0.000	0.001	1.03	0.000	0.001	1.11	0.000
Original rating	-0.000*	-1.73	0.001	-0.000*	-1.73	0.001	-0.000*	-1.77	0.001
Herfindahl	-0.005*	-1.94	0.001	-0.005	-1.22	0.001	-0.006**	-2.15	0.002
Median Indus. Leverage	-0.000	-0.03	-0.000	-0.000	-0.03	-0.000	-0.000	-0.03	-0.000
Event Firm Car(1,0)	0.023***	5.51	0.013	0.023***	3.46	0.013	0.024***	5.48	0.013

Panel B: Multivariate Analysis

	OLS			OLS (robust)			WLS		
	Full Sample	Inv. Gr. Sample	Spec. Gr. Sample	Full Sample	Inv. Gr. Sample	Spec. Gr. Sample	Full Sample	Inv. Gr. Sample	Spec. Gr. Sample
	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t
Event Firm Size	-0.000	-0.001	0.000	-0.000	-0.001	0.000	-0.000	-0.001	0.000
	(-0.446)	(-1.118)	(0.137)	(-0.450)	(-1.151)	(0.137)	(-0.375)	(-0.975)	(0.080)
#Nothces	0.001	0.000	0.001	0.001	0.000	0.001	0.001*	0.001	0.001
	(1.635)	(0.651)	(1.394)	(1.595)	(0.905)	(1.102)	(1.734)	(0.731)	(1.435)
Original rating	-0.000*	-0.000	-0.001**	-0.000	-0.000	-0.001*	-0.000*	-0.000	-0.001**
	(-1.656)	(-0.114)	(-2.213)	(-1.497)	(-0.123)	(-1.829)	(-1.675)	(-0.242)	(-2.209)
Herfindahl	-0.006**	-0.004	-0.008*	-0.006	-0.004	-0.008	-0.006**	-0.004	-0.009**
	(-2.038)	(-0.995)	(-1.929)	(-1.270)	(-0.535)	(-1.361)	(-2.233)	(-1.102)	(-2.084)
Median Indus. Leverage	-0.002	0.006	-0.011*	-0.002	0.006	-0.011*	-0.002	0.007	-0.011**
	(-0.575)	(1.243)	(-1.911)	(-0.514)	(1.036)	(-1.905)	(-0.631)	(1.279)	(-1.997)
Event Firm Car(0,1)	0.026***	0.032***	0.025***	0.026***	0.032*	0.025***	0.026***	0.032***	0.025***
	(5.980)	(3.913)	(4.685)	(3.656)	(1.865)	(3.227)	(5.969)	(3.819)	(4.700)
Constant	0.005*	0.003	0.011**	0.005*	0.003	0.011**	0.005*	0.003	0.012**
	(1.810)	(0.526)	(2.260)	(1.858)	(0.529)	(2.410)	(1.793)	(0.527)	(2.326)
Num. Obs.	2,238	1,081	1,157	2,238	1,081	1,157	2,238	1,081	1,157
Adjusted R2	0.017	0.013	0.022	0.017	0.013	0.022	0.017	0.012	0.022

Table 2.9: Cross Sectional Determinants of CDS Return (0,1)

Panel A: Univariate Analysis

	OLS			OLS (robust)			WLS		
	coef	t	R2	coef	t	R2	coef	t	R2
Event Firm Size	0.124	0.43	-0.001	0.124	0.39	-0.001	0.267	1.05	0.000
#Nothces	0.952	1.64	0.003	0.952	1.30	0.003	0.631	1.20	0.001
Original rating	-0.179	-1.20	0.001	-0.179	-1.22	0.001	-0.104	-0.79	-0.001
Herfindahl	-3.769	-1.01	0.000	-3.769	-1.28	0.000	-2.633	-0.80	-0.001
Median Indus. Leverage	5.466	1.26	0.001	5.466	1.27	0.001	6.484*	1.70	0.003
Event Firm Car(0,1)	-15.245***	-3.46	0.018	-15.245***	-2.73	0.018	-14.138***	-3.54	0.019
Industry Port. Car(0,1)	-65.600***	-2.78	0.011	-65.600**	-2.27	0.011	-70.581***	-3.36	0.017

Panel B: Multivariate Analysis

	OLS			OLS (robust)			WLS		
	Full Sample	Inv. Gr. Sample	Spec. Gr. Sample	Full Sample	Inv. Gr. Sample	Spec. Gr. Sample	Full Sample	Inv. Gr. Sample	Spec. Gr. Sample
	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t
Event Firm Size	0.667	1.648*	0.200	0.667	1.648*	0.200	0.816**	1.467*	0.469
	(1.586)	(1.912)	(0.410)	(1.402)	(1.829)	(0.346)	(2.186)	(1.797)	(1.129)
#Nothces	0.770	-0.155	1.535**	0.770	-0.155	1.535	0.468	-0.290	1.137*
	(1.317)	(-0.164)	(2.016)	(1.088)	(-0.254)	(1.443)	(0.889)	(-0.328)	(1.694)
Original rating	-0.398*	-0.749	-0.519	-0.398*	-0.749	-0.519	-0.377*	-0.519	-0.380
	(-1.779)	(-1.373)	(-1.331)	(-1.742)	(-1.357)	(-1.256)	(-1.899)	(-1.006)	(-1.138)
Herfindahl	-0.497	2.836	-1.848	-0.497	2.836	-1.848	0.969	3.452	0.243
	(-0.129)	(0.463)	(-0.367)	(-0.169)	(0.595)	(-0.469)	(0.289)	(0.600)	(0.057)
Median Indus. Leverage	2.958	5.200	0.157	2.958	5.200	0.157	4.649	4.004	4.199
	(0.661)	(0.699)	(0.028)	(0.630)	(0.700)	(0.026)	(1.183)	(0.571)	(0.873)
Industry Port. Car(0,1)	-64.571***	-105.401*	-54.634**	-64.571**	-105.401	-54.634**	-70.908***	-126.699**	-58.528***
	(-2.706)	(-1.829)	(-2.093)	(-2.356)	(-1.322)	(-1.996)	(-3.364)	(-2.318)	(-2.639)
Constant	-1.371	-4.774	2.106	-1.371	-4.774	2.106	-3.297	-6.155	-1.922
	(-0.487)	(-0.629)	(0.525)	(-0.403)	(-0.680)	(0.452)	(-1.326)	(-0.860)	(-0.559)
Num. of Obs.	596	237	359	596	237	359	596	237	359
Adjusted R2	0.015	0.011	0.018	0.015	0.011	0.018	0.024	0.017	0.024

Chapter 3

Confidence and the 2008 Crisis

3.1 Introduction

It is widely agreed that the 2007-2008 financial crisis was caused by a collapse of the housing bubble. How – and why – the shock to a single sector spread to the broader economy is the subject of much ongoing work. A common explanation stresses transmission via bank balance sheets. A drop in house prices leads to a drop in the value of the mortgage securities financing the houses, and institutions holding these now "toxic" securities become under capitalized and tend to cut the size of their balance sheets. This effect is amplified by illiquidity of the mortgage securities. The mutually reinforcing forces of illiquidity and insolvency cut credit supply to firms and consumers, causing spending and investment pullbacks, which in turn depresses asset prices and unleashes a fresh wave of insolvency and illiquidity.

While bank balance sheet effects have received considerable attention, a more recent casualty of the financial crisis has been the broad stock market. The timing of the stock market decline is interesting. The housing market peaks around August 2006 and has been in steady decline since then. Figure 3.1 plots the level of the S&P 500 stock market index. The index peaks at 1,565.15 on October 9, 2007 and then declines by 42% through December 2008. The bulk of the stock market decline occurs towards the end of the sample time period. Between September and

December 2008 the S&P 500 index declines by 29% and this period witnessed an unprecedented increase in volatility. The stock market drop in late 2008 was accompanied by an annualized contraction of 6.3% in the U.S. GDP. The decline in stock prices after September 2008 was accompanied by an unprecedented spike in volatility, with several swings and reversals of large magnitude both in the broad market indexes and individual stocks. As we discuss later, these patterns are quite abnormal relative to historical norms. Curiously, the decline and extreme fluctuations occur more than two years after the housing market peak and the subsequent downward trend in house prices.

Our study examines the stock market disruption in the fourth quarter of 2008, using a new dataset of closed-end fund discounts that we obtain at daily frequency. Closed-end funds are limited liability companies that invest in financial assets. The value of these assets or the "net asset value" (NAV) is observed and reported by the funds. The fund shares themselves trade at prices in the stock market that could be quite different from the NAV. The percentage difference between the fund's share price and its NAV is the closed-end fund discount. In frictionless markets with costless arbitrage, fund shares should trade at their true value, so the discounts should be zero. However, with frictions and limits to arbitrage, funds could trade at discounts, or less commonly, at premiums. Fund discounts represent a useful index of the extent of disruption in normal pricing relations in the financial marketplace, often but by no means unanimously, attributed to investor sentiment by an extensive literature on closed-end funds that we review later.

We obtain a time series of average fund discounts at a daily frequency for four categories of funds: US equity funds, growth and income funds, global funds, corporate bond funds. While closed end fund discounts show little movement during the housing market collapse and the collateral damage felt in the banking system – including the Bear Stearns and Merrill Lynch takeovers, the auction rate securities collapse, and the IndyMac run – the discounts are significantly wider in the fourth quarter of 2008. The average fund discounts more than double across all categories. There is a similar shift in the volatility of the average fund discounts, which also nearly double for all categories. Structural break tests for mean shifts identify the date of the shift rather precisely. The structural shift in fund discounts dates to September 15, 2008, when Lehman Brothers was allowed to go bankrupt.

The widening of closed-end funds around the Lehman Brothers collapse demands explanation. Consider three interpretations. One possibility is that the collapse signaled new information about the fragility of banks. While such information could certainly affect fundamental values of assets, it is less obvious why it should affect *discounts* relative to fundamental values. A second possibility is investor sentiment. If the closed-end fund discounts are interpreted as measures of investor sentiment towards the stock market, our evidence suggests that pessimism widened significantly after the Lehman collapse. The closed-end fund discount finding is also interesting due to a "dog that didn't bark" effect. Curiously, investor sentiment did *not* turn especially negative through much of the origin of the housing crisis and its ripple through effects on the banking system. It essentially takes root after the Lehman failure. This viewpoint is affirmed by additional tests that examine the daily changes of average closed-end fund discounts around several other news events related to the crisis. A third interpretation of widening discounts is that the Lehman collapse results in a negative shock to the supply of arbitrage capital. The shock could be the product of a direct effect of the collapse on unprotected Lehman counterparties or it could reflect an indirect effect in which investors are simply less willing to fund long-short arbitrage activities after a bulge bracket investment bank is allowed to go under by the regulators. The supply- side view is a necessary complement to the sentiment view. Limited or costly arbitrage is a necessity for pessimistic sentiments to take expression in the form of greater closed-end discounts. Supply side shocks to arbitrage capital coupled with pessimistic sentiments could produce widening closed-end fund discounts.

Our next tests examine the time series of stock market returns after the Lehman collapse. Instead of examining the level of closed-end fund discounts, these tests focus on the co-movement of the closed-end fund discounts with the market. We regress daily market returns on the changes in closed-end fund discounts of different fund categories and benchmark the results against different control periods, including time periods before the Lehman collapse but well after the housing crisis begins, other non-crisis periods, as well as other time periods covering other crises such as the 9-11 attack. We find that the relation between closed-end fund discounts and stock market returns is especially pronounced after the Lehman collapse relative to all other crisis and non-crisis periods. It is well known that closed-end fund returns track small firm returns, but the strengthening of the CEF discount-market relation strengthens after the Lehman collapse even for the value weighted stock market index.

When we examine the cross-section of the results across closed-end fund categories, we find that the post-Lehman relation between CEF discounts and market returns vary across fund categories. For instance, discounts on closed-end funds investing in large dividend paying U.S. equities experience the least increase in explanatory power during he crisis. On the other hand, the strongest results are for the spread of closed- end discounts between corporate bond funds and government bond funds, and for funds that invest in riskier growth stocks rather than large dividend paying stocks. The daily changes in closed end discounts is essentially unrelated to the market before the Lehman collapse, but the adjusted R^2 is close to 35% to 46% after September 15, 2008. The results are consistent with the view that sentiment-based variables have greater effect for hard-to-arbitrage categories of assets, as suggested by theories of limited or costly arbitrage.

To better assess the economic meaning of the closed-end fund discounts variable, we obtain a new dataset of high frequency measures of broad consumer mood from the polling organization Gallup. The organization samples consumer sentiment by polling consumers daily through a series of questions. For instance, one question focuses on a randomly selected set of consumers and asks them whether their current conditions are good or bad and whether the economy is getting better or worse. Others include questions on whether a consumer struggles with life, consumer spending plans, or whether the firm they are working for is hiring new workers. We include a fuller description of the dataset in a later section of the paper. We find reliable relationships between fund discounts, especially the corporate- government bond fund discount spread and the growth stock closed end discount, and measures of sentiment about the economy during the crisis period. These relations are especially remarkable because they come from orthogonal sources. Closed-end fund discounts are, of course, price variables derived from investor trading decisions. Gallup data are obtained by surveying consumers.

We also assess the relation between closed-end fund discounts and news media coverage by focusing on three phrases "great depression", "recession", and "bankruptcy." The number of Google searches for these terms correlates negatively with changes in fund discounts. There is a predictive relation between lagged news media coverage of these terms and one-day ahead changes in fund discounts. These results suggest that at least in the crisis period, there is sentiment content in the closed-end fund discount variables used in our study. To better interpret the closed-end fund discount coefficients within a standard framework, we conduct a "reverse regression" in which we regress changes in fund discounts on returns on stock market indexes. This is the familiar market model that returns betas of fund discounts. We find that discount betas increase markedly during the crisis period, often doubling in magnitude. In a broader 4-factor Fama-French model, fund discounts load significantly on the market and the distress HML factor, and the loadings either switch signs and become positive or become more positive during the crisis period. Thus, closed-end funds are a pro-cyclical anti-hedge because discounts widen exactly at the time when consumers seek refuge from market declines or market volatility. The pro-cyclical nature of fund betas might offer another explanation for why funds sell at a discount on average.

Our last set of tests are cross-sectional. We examine whether the extreme stock market movements during the crisis period are related to credit constraints faced by firms, using several proxies for credit constrained firms. We analyze the price reactions for specific dates on which there are key announcements, such as the rejection or passage of the Troubled Assets Relief Program (TARP), the subsequent plan to recapitalize banks, and more generally, using the (many) days when there are extreme positive or negative reactions. There is little evidence that credit constraints are key drivers of stock market reactions. These results should *not* be construed as evidence that credit constraints are irrelevant. Our point is that credit constraints probably do not play a major role in explaining the post-Lehman decline in the stock market and the extreme fluctuations during this period. Indeed, credit constraint related effects are likely priced into stocks during the earlier pre-Lehman phases of the crisis. The severe market decline and volatility spikes after the Lehman collapse appears to reflect a downward shift in investor confidence, at least partly born out of declining consumer sentiment about the broad economy. In our view, declining confidence is a third force that adds to the negative spiral created by declining asset values and financial institution fragility, as articulated in early work by Pigou (1947) or as recently elucidated by Krugman (2001), and Krugman (2008).

The rest of the paper is organized as follows. Section 3.2 presents a brief overview of the recent work on the financial crisis. Section 3.3 describes the closed-end fund dataset. In this section, we also present an analysis of the levels of fund discounts before and after the Lehman collapse. Section 3.4 analyzes the co-movement of fund discounts with the aggregate stock market. Section 3.5 relates fund discounts to daily sentiment data extracted from Gallup, internet searches, and newspaper articles. Section 3.6 examines the systematic risk attributes of closed end funds. Section 3.7 presents cross-sectional tests. Section 3.8 concludes.

3.2 The Crisis and Related Literature

3.2.1 Literature

The financial crisis of 2007-2008 is of relatively recent origin – and is perhaps even ongoing, as of this writing in April 2009 – but it has spawned a relatively large literature in a short span of time. To put our paper in perspective, we briefly overview some of the literature.[1]

The origins of the current financial crisis lie in the housing bubble and its subsequent deflation.[2] One portion of the literature explores the causes of the excessive investment in real estate. Diamond and Rajan (2009) argue that the housing boom was the result of an easy money policy in response to the bursting of the dot com bubble that led to investors chasing higher yields and fueling investments in real estate by individuals for home ownership or for speculation. The maturity of the U.S. capital market allowed the banking system to fulfill the yield hunger by originating and selling vast amounts of mortgage backed securities through securitization. The empirical evidence in Laeven, Igan, and Dell'Ariccia (2008), Demyanyk and Van Hemert (2008), Keys, Mukherjee, Seru, and Vig (2008) and Mian and Sufi

[1] Our list is not necessarily comprehensive but includes representative work covering each of the themes discussed below. We apologize for and welcome any additional citations of references that we have overlooked.

[2] Reinhart and Rogoff (2008) argue that the key features of the U.S. crisis are remarkably similar to 18 post-war crises experienced by other countries.

(2008) suggests that the originate-securitization model created a supply of mortgages that were measurably riskier by historical standards. Diamond and Rajan (2009), Rajan (2005) and Kashyap, Rajan, and Stein (2008) argue that the excessive risk-taking became embedded as part of the culture of U.S. banks, perhaps due to flawed internal reward systems.

A second element of the crisis was the role of the non-banking sector in the financial marketplace. The mortgages originated by banks were securitized into tranches, often fairly complex instruments, and were sold to non-traditional intermediaries such as hedge funds or held as investments made by bank-backed commercial paper programs. Simkovic (2009) argues that the doctrine of secret liens could explain the incentives to generate complex, opaque, and illiquid securities. While the assets were often complex and illiquid, the liabilities backing these were short-term, creating a liquidity mismatch and opening up the possibility of traditional runs (Bordo (2008), Krugman (2008)). The banks creating the securitized pools were vulnerable to such runs due to two reasons. One is that they often provided liquidity backstops to protect the short-term investors against liquidity shocks. A second channel is indirect. While banks had no legal liability to protect short-term investors to meet accounting criteria for avoiding consolidation, they were probably implicit promises to step in and these promises were credible because of the incentive of the originators to protect their reputation capital. Gorton and Souleles (2005) and Gorton (2008) provide an excellent discussion of securitization and its relation to the subprime crisis.

While the housing sector is an important component of the U.S. economy, an interesting theoretical question is how a shock to a single sector could multiply manifold and spread to the broad economy. Brunnermeier (2008) provides a careful review of the channels that could give rise to multiplier effects. Brunnermeier points out that a deterioration in asset value erodes its collateral value. Given fixed margins for lending, financial institutions cut back on leverage, exacerbating the initial drop in asset values. Alternatively (or additionally), the shock could be amplified through the lending channel, in which negative shocks lead banks to hoard cash in anticipation of future funding shortfalls – or future prospects for buying cheap assets, as pointed out by Diamond and Rajan (2009). Additional amplification mechanisms include bank runs due to illiquidity mismatch Diamond and Dybvig (1983) or network gridlock that occurs when banks that simultaneously borrow and lend in interbank or security repurchase markets become unwilling to trade with each other due to adverse selection.[3]

The consequences of the financial crisis for the broader economy is the focus of several recent articles. Greenlaw, Hatzius, Kashyap, and Shin (2008) estimate the housing crisis mortgage losses at $500 billion, 50% of which pass on to the leveraged financial sector, which has an effect of reducing GDP growth rate by 1.5% due to balance sheet multiplier effects. Campello, Graham, and Harvey (2008) survey 1,050 CFOs in the US, Europe and Asia to assess financial constraints as perceived by firm managers. Firms that say they are financially constrained plan to cut R&D, employment and capital spending severely. Campello et al. also document that

[3]Amplification effects due to collateral value constraints are also developed in Bernanke and Gertler (1989) or Kiyotaki and Moore (1997) in the context of explaining macroeconomic cycles and credit fluctuations.

46% of the constrained firms say that they pass attractive investment opportunities during normal times due to financial constraints, while 86% which pass attractive investments during the credit crisis. Duchin, Ozbas, and Sensoy (2008) find that firms' investments fall between the September 2007 and June 2008, particularly for firms that are financially constrained and have low cash reserves. Tong and Wei (2008) find in a cross-sectional regression that the 7-month returns of non-financial firms between July 31 2007 and March 31 2008 are related to the Whited and Wu (2006) index of financial constraints. Ivashina and Scharfstein (2008) find that during the crisis, there are precautionary cash drawdowns by lower rated firms from their bank lines. There is less evidence on the economic effect of government interventions in the crisis.Veronesi and Zingales (2008) present early evidence on this issue. They argue that the October 13, 2008 capital infusion by the U.S. government into major banks did not create any value in the banking system.

Confidence or sentiment plays no explicit role in the literature discussed above, but it is frequently mentioned in pronouncements by policy makers, regulators, and articles in the press, who view it as a barometer of economic stress. One view of confidence is that it is merely a symptom of broader problems in the macroeconomy or institutions. On the other hand, it could also exacerbate cycles in its own right if it varies in a procyclical manner. For instance, negative sentiments in a down market could lead investors to shift their asset allocations away from risky assets. This could put pressure on prices if arbitrage is limited or costly. Alternatively, a bearish environment could depress confidence and affect consumer spending or investment decisions and generate self-fulfilling effects in the real economy. The role of pessimism is more explicitly recognized in macroeconomics in models of currency crises that are structurally similar to bank run models. See, e.g.,Krugman (2008) p.88 for an informal exposition or Chang and Velasco (1998) for a third generation crisis model that builds on the work of Diamond and Dybvig (1983). Krugman (2001) illustrates how confidence alone could lead to a crisis. He sketches a (highly) stylized model of a fourth generation crisis model, a version of the Bernanke and Gertler (1989) collateral constraints model that generates underinvestment when investors lack the confidence to invest. Shleifer and Vishny (2009) argue that banks lending conditioned on investor sentiment can generate cyclical effects.[4] An entirely different perspective is presented by the Caballero and Krishnamurthy (2008) model of financial crises. In their view, a financial crisis can be triggered by a structural shift about the nature of uncertainty. The aversion to ambiguity, or Knightian uncertainty, can precipitate a crisis.

Our study offers new evidence on the variation of closed-end fund discounts around the crisis. The existence of closed-end fund discounts, and particularly their economic meaning, are heavily debated topics that continue to attract research. One branch of the literature is concerned with the relation of fund discounts to stock returns. Lee, Shleifer, and Thaler (1991) argue that the closed-end fund discount is a measure of small investor sentiment by virtue of its correlation with small stock returns. Swaminathan (1996) and Neal and Wheatley (1998) find that fund discounts predict the small firm return premium at longer horizons. These findings lead Baker

[4]Allusions to confidence can also be found in early work by Pigou (1947), who argues that economic fluctuations are driven by a negative psychological trap in which pessimism feeds on itself. See also Sen (2009).

and Wurgler (2007) to use fund discounts as an input into a broad sentiment index. On the other hand, Qiu and Welch (2005) and Lemmon and Portniaguina (2008) find that consumer confidence does not correlate with closed-end fund discounts and that consumer confidence is correlated with the small firm premium. The levels of fund discounts are the subject of several papers. Bodurtha, Kim, and Lee (1995) find that country closed-end fund discounts incorporate time-varying investor sentiment, a result supported by the news salience result in Klibanoff, Lamont, and Wizman (1998). More recently, Cherkes, Sagi, and Stanton (2008) find that closed-end fund discounts reflect a tradeoff between fund fees and the benefit of holding liquid shares of funds and that themselves invest in illiquid assets. In a different experiment, Pontiff (1996) analyzes the level of closed-end fund discounts. He finds that factors that affect arbitrage costs are related to explain the variation in fund discounts, consistent with noise trader models with costly arbitrage. Pontiff also argues that the cost of arbitrage framework explains other features of closed-end fund discounts.

3.2.2 An Event Calendar Prior to 4Q 2008

In this section, we briefly review the key events in the 2007-2008 financial crisis. We refer the reader also to Brunnermeier (2008), which also contains a logbook that includes many of the events discussed below until March 2008. The roots of the current crisis are often traced back to an easy money policy on the part of the Federal Reserve in the aftermath of the dot com crash. Low interest rates fueled a demand for housing. The interest rate environment also led investors to search for higher yields, which were satisfied through mortgage securities financing homes. As the supply of mortgages increased, the mortgage quality decreased as new buyers were less creditworthy and mortgages were financed through lower amounts of equity, including subprime mortgages, Alt-A mortgages, or NINJA (no income no job no assets) loans. For instance, subprime mortgages amounted to US$600 billion, or 20.6% of new mortgages by 2006, up from US$160 billion and 7.2% in 2001. Agency problems at originators, complex credit structures of securitized products, and a third layer of agency problems at the rating agencies who seemed overly generous with ratings of securitized products, exacerbated the process.

The first signs of stress in the financial markets was seen in May 2007, when the Swiss Bank UBS reported losses in subprime loans. In June 2007, the investment bank Bear Stearns reported that two of its hedge funds faced margin call problems. On June 20, 2007, Merrill Lynch seized $800 million in assets from two Bear Stearns hedge funds that were involved in securities backed by subprime loans. To preserve reputation, Bear Stearns made loans of over $3 billion to cover the margin calls to confront what was essentially a run on its funds. The stock markets showed little signs of this initial stress. For instance, on 19 July 2007, the Dow Jones Industrial Index crossed the 14,000 level for the first time in history. However, the stress was beginning to show in financial institutions, especially those exposed to real estate. For instance, Countrywide Financial, a major mortgage lender, reported an unexpected earnings drop on July 24, 2007. The asset backed commercial paper market began to dry up as ratings companies began to review and downgrade these programs. In Europe, the French Bank BNP Paribas suspended withdrawal from three of its funds on August 9, 2007. In response to the flight of capital now unwilling to lend against risky collateral, the Federal Reserve created a Term Auction Facility on December 12, 2007 under which banks could borrow from the Federal Reserve against a wide range of collateral securities.

In the next phase, the crisis spread to the municipal bond market. Bonds sold by municipal issuers are typically insured prior to being sold to investors. On January 19, 2008, Fitch downgraded Ambac, one of the three major bond insurers, raising doubts about the credit quality of municipal issues. Investors began to flee the municipal bond markets and the auction rate securities segment (ARS) of the municipal bond market witnessed a run. The ARS market is used by municipal borrowers to issue floating rate debt with interest rates being set at periodic auctions.[5] On Feburary 7, 2008, auctions used to set the floating interest rates failed, reflecting a lack of interest from bidders. Issuers had to pay penalty rates, and investors who wanted to redeem their investments in ARS faced difficulty in converting their investments to cash. 80% of auctions failed on February 14, 2008 and 87% on February 14, 2008. Two-thirds of the auctions failed at subsequent auctions on February 20 and February 22, 2008. 62% of auctions on Feb 20 failed. 67% failed on Feb 22. In contrast, just 44 auctions failed between 1984 and 2007.

The next major event in the financial crisis was a run on the investment bank Bear Stearns. On March 11, 2008 Goldman Sachs broadcast an email to its clients

[5]The four major auction houses running the ARS market, Bank of Mellon New York, Wilmington Trust, Deutsche Bank, and Wells Fargo.

advising that it would not necessarily allow netting that exposed it to Bear Stearns, which faced a run with investors unwilling to lend it money, trade with it, or accept anything except treasuries in repo deals.[6] Intervention by the New York Fed resulted in funding being made available to Bear Stearns on March 14, 2008 and its takeover by J P Morgan Chase Bank was arranged on March 16, 2008. Equity holders were bought out at a price of $2 per share, subsequently revised to $10 per share, which was down from $162.83 per share as of January 2007, a loss in market value of close to $19 billion. The Fed provided up to $30 billion to cover losses on assets transferred to J P Morgan in the takeover.

The next major event in the crisis was a classic bank run on Indymac Bank, a subsidiary of Independent National Mortgage Corporation. The bank, which focused on unconventional mortgages such as Alt-A loans, disclosed that it was undercapitalized on May 12, 2008. In June 2008, the bank began experiencing a run in which individuals withdrew their bank deposits. On June 26, 2008, the New York Senator released a history of his correspondence with regulators that revealed concerns about the soundness of Indymac. On July 8, Indymac's share price fell to $0.44, down from $45 in January 2007. The next day, Standard & Poor's cut its counterparty rating to CCC and on July 11, the bank was placed in conservatorship of the FDIC by the Office of Thrift Supervision. This was the fourth-largest bank failure in United States history, and the second-largest failure of a regulated thrift. Before its failure, IndyMac Bank was the largest savings and loan association in the Los

[6] See Duffie and Zhu (2009) for a recent discussion of netting and counterparty risk under netting versus that under a clearing house system.

Angeles area and the seventh-largest mortgage originator in the United States.

By far the most significant events in the crisis unfolded in September 2008. On September 7, 2008, there was a federal takeover of Fannie Mae and Freddie Mac, publicly held but government sponsored enterprises that constituted the backbone of the U.S. mortgage market. The GSEs directly or indirectly (through guarantees) financed close to $6 trillion of mortgage securities, or close to half the aggregate U.S. market. While the government did not explicitly back any GSE obligations, investors treated the institutions as having implicit guarantees from the U.S. government. By all accounts, the institutions appeared to be undercapitalized or insolvent, so the government placed them into conservatorship and issued to the Treasury preferred stock and warrants amounting to close to 80% of outstanding stock, which became essentially worthless. Under conservatorship, the Treasury could advance essentially unlimited funds to GSEs to stabilize them.

The last set of events related to private sector financial institutions. On September 14, 2008, the investment bank Merrill Lynch was sold to Bank of America for about 0.85 Bank of America shares per Merrill Lynch share, or about $29 per share, a 70% premium over Merrill's share price of $17 per share. Merrill was thought to face a severe liquidity crisis after writing down close to $20 billion in mortgage losses over the prior year. This was the second instance of a major investment bank being taken over by a commercial bank in the face of runs or closure. The next day, in a somewhat contradictory strategy, the investment bank Lehman Brothers was allowed to go bankrupt and the institution filed for Chapter 11 bankruptcy protection and began to liquidate its businesses through asset sales. The bankruptcy filing create externalities on counterparties of Lehman Brothers. Money market funds that were reported to have exposure to Lehman experienced runs, with the Primary Reserve Fund "breaking the buck" for the first time in history. Hedge funds exposed to Lehman found their positions locked due to bankruptcy and many counterparties, including European and Japanese banks and the energy company Constellation Energy, reported their exposures to Lehman and their overall effect on their balance sheets. Almost immediately after the Lehman Brothers filing, the government reversed course on permitting institutions to fail, and announced on September 16, 2008 that the prominent insurer American International Group (AIG) would receive $85 billion in loans to avoid bankruptcy. The treasury obtained close to 80% ownership of its equity through stock warrants. The financing to AIG eventually increased to over $150 billion by March 2009. On September 25, 2008, Washington Mutual was seized by the Federal Deposit Insurance Corporation, and its banking assets were sold to J P Morgan Chase for $1.9 billion. On September 29, 2008, the Federal Deposit Insurance Corporation announces that Citigroup Inc. would acquire banking operations of Wachovia, although Wells Fargo offered more favorable terms and ultimately acquired Wachovia.

The contours of the crisis began to emerge after the Lehman Brothers collapse. Attention turned to government rescue plans. The first reaction of the administration was to cleanse bank balance sheets of distressed mortgage assets, which seemed to lie at the root of the crisis. The government sought a $700 billion authorization from the Congress for this purpose formally on September 20, 2008. On the next day, the U.S. government also transformed the last major free-standing investment banks, Goldman Sachs and Morgan Stanley into bank holding companies to bring them under regulatory purview. On September 29, 2008, the legislation that would permit toxic asset purchase, the Emergency Economic Stabilization Act, was defeated 228-205 in the United States House of Representatives. On October 1, 2008 the Senate passed HR 1424, its version of the $700 billion bailout bill, and a bailout bill was then passed by the U.S. House of Representatives on October 3, 2008.

The stock market experienced unexpected volatility a few days after the passage of the bank bailout bill. On October 7, 2008, the S&P 500 dropped by 5.74% and on October 9, 2008 it dropped by a further 7.62%. The index reversed course on October 13, 2008, when it gained 11.58% upon word that the treasury planned to inject $250 billion by way of capital infusion into banks rather than the earlier plans to buy out toxic mortgage assets. The form of the rescue included the US government taking an equity position in banks that choose to participate in the program. In exchange, banks were required to agree to restrictions such as executive compensation. Nine banks initially agreed to (or were made to agree to) participate in the capital injection program and received close to $125 billion, including major commercial banks such as Bank of America, J P Morgan Chase, Wells Fargo, and Citigroup and major investment banks such as Goldman Sachs and Morgan Stanley. Other US financial institutions eligible for the plan were granted time to apply for capital and the government retained discretion to agree or disagree to the capital infusion proposals. According to the government website http://financialstability.gov, the capital purchase program has disbursed over $195 billion to 359 institutions.

The extreme stock market volatility continued after the capital purchase program was announced. For instance, the S&P index lost 9.03% and gained 10.79% on October 15, 2008 and October 28, 2008, respectively. Figures 3.1 through 3.4 depict the extent of stock market fluctuations after the bankruptcy of Lehman Brothers. Figure 3.1 plots the S&P 500 index between 2006 and 2008. The index was essentially flat through the whole period and closed at a level of 1,251 before the Lehman bankruptcy on September 15, 2008. After that date, the index fell to 903 through the year end. Figure 3.2 plots the CBOE VIX index of volatility, which peaks at historically unprecedented levels only in the fourth quarter of 2008 (the actual peak of 80.86% was attained on November 20, 2008). Figure 3.3 computes the Campbell, Lettau, Malkielm and Xu (2001) measure of idiosyncratic volatility. In the fourth quarter of 2008, the index attains its former peak attained after the dot com crash of 2001. Finally, Figure 3.4 counts the percentage of stocks with at least 10% movement in a day. Once again, there is a peak in the fourth quarter of 2008. Thus, by several metrics the post-Lehman period was a very unusual period of a steep stock market decline and high volatility.

3.3 Closed-End Fund Discounts

3.3.1 Data

We identify closed-end funds as stocks on the CRSP database with a CRSP distribution code ("SHRCD") equal to 4 or 5. We obtain data on the nature of the closed-end fund's investments by comparing the fund name and ticker with the closed-end fund database of the website http://www.etfconnect.com maintained by

Nuveen Investments. We retain funds classified as investing in any of the following five categories: corporate fixed income, government bonds, U.S. equities, global equities, and growth and income funds. Fund characteristics such as shares outstanding and prices are available from CRSP while other data such as the net assets of a fund or fund sponsors are available from ETF Connect.

Table 3.1 describes the sample characteristics. Our sample comprises 24 corporate bond funds, 26 growth and income funds and over 50 equity funds investing in global equities and a similar number investing in US equities. The median assets under management at each fund category ranges from \$237 million to \$392 million. We also obtain a rather small sample of three funds investing in taxable treasuries, to assess investor sentiment related to government bonds to account for interactions between demand for the risk-free and risky assets, a point made by Loewenstein and Willard (2006). We include the spread between the discounts of the two asset categories in some of our regressions. The government bond funds are relatively large compared to the other fund categories, with median assets under management that exceed \$550 million. Our tests on closed-end fund discounts can be thought of as having a time series and a cross-sectional dimension. The cross-section focuses on distinctions between fund categories and the time series addresses variations across time periods. We discuss these issues briefly before embarking on formal statistical tests.

We have two reasons for including different categories of closed-end funds. First, costly or limited arbitrage is a necessary condition for closed-end fund discounts reflect investor sentiment. This point has been long emphasized by the closed-end fund literature in general and is the focal point of the tests of Pontiff (1996). To arbitrage sentiment related discounts, investors need to buy the fund and take offsetting short positions in the fund's underlying assets. The payoffs from this strategy come about sentiment dissipates or the discount otherwise mean-reverts. As Thompson (1978) originally points out, much of the fluctuation in closed-end funds arises due to mean reversion in discounts. To set up the arbitrage position requires a short position in fund assets and the difficulty or cost of doing this, the costs of arbitrage, vary across fund categories. In our view, long-short positions are the easiest to establish for U.S. equities and are far more onerous for corporate bonds or funds invested in growth or international stocks. Sentiments should drive the variation in discounts in the latter far more than the former. A second motivation for including multiple fund categories is related specifically to corporate bonds. As discussed before, much of the 2008 financial crisis has ben attributed to credit constraints. Sentiments about the credit market should find expression in funds investing in corporate fixed income securities, or the corporate bond funds. These two reasons identify cross-sectional variation in arbitrage costs.

Time series variation comes from changes in the difficulties of conducting arbitrage across time. As the crisis evolved, there were increasing constraints on the supply of arbitrage capital. The broad constraints on credit represent one reason why arbitrage capital could shrink over time. The undercapitalization of banks meant that there was increased scrutiny from regulators over time as institutions began failing. Moreover, banks worried about each others' financial conditions cut back on inter-bank lending and refused to participate in security repurchase markets, putting further constraints on capital. Finally, hedge funds faced increasing pressures due to redemption pressures from investors. The shrinkage of arbitrage capital supply over time suggest that sentiment-related components could have a greater influence on price movements towards the end of our sample period when capital markets were more disrupted and affect harder-to-arbitrage funds more.

3.3.2 Empirical Evidence

Figure 3.5 presents the basic time series message conveyed by fund discounts. As an aggregate measure of fund discounts, we simply compute the average discount across all funds in all categories on each day in our sample. The 2007-2008 subprime crisis is often viewed as having kicked in the middle of 2007, when there was a run on two Bear Stearns sponsored hedge funds. Duchin, Ozbas, and Sensoy (2008), for instance, consider the August 2007-March 2008 period as the “sub-prime” crisis period. Accordingly, we graph the average discount from January 2006 to December 2008. Figure 3.5 reveals the essential features of the statistical analysis. Closed-end funds traded at discounts of under 5% for much of 2006-2007. There is a shift downwards around the middle of 2007, when the subprime crisis took root. Fund discounts plunge towards the end of the sample period. Further eyeballing Figure 3.5, it also appears that fund discounts are far more volatile towards the last part of the sample period, a fact that we confirm with statistical tests. Figures 3.6 and 3.7 depict the average discount for different categories of funds. Figure 3.6 focuses on closed-end funds investing in U.S. equities, global equities, and growth and income funds, while Figure 3.7 depicts funds investing in corporate fixed income, government bonds, and the spread in the discount between the two categories of funds. In each case, there is an especially clear disruption in the fund discount levels towards the end of the sample period.

To verify the patterns suggested in Figures 3.5 through 3.7, we conduct statistical tests for a structural break in the levels of the time series. We apply a structural break test to the average closed-end fund discount of each category. Given the extreme stock market decline and elevated volatility in the fourth quarter of 2008 beginning around the Lehman Brothers collapse and the evidence in Figures 3.1 through 3.3, we initially focus on the disruption after the Lehman collapse. We consider a sample of daily returns starting in January 2007 (other dates yield similar results) and specifying September 15, 2008 as a candidate structural break date, we test whether the levels of discounts are different before and after this period using the standard sum of squares test of Chow (1960). For every category of funds, the null of no break is rejected against the alternative of a break on September 15 at p-levels essentially indistinguishable from zero. A second generation of tests dates the structural break endogenously based on where the sum-of-squares test is maximized. However, the tests statistic is no longer a standard F or χ^2 test because it involves the distribution of a maximum of the test statistics. Andrews (1993) develops the asymptotic theory and Butler, Grullon, and Weston (2005) provide a finance application. The maximal tests also reject a null of no structural break and identify September 15, 2008 as the break date for every fund category.[7]

[7]To conserve space, we do not report the detailed results in this version but specific figures and

To supplement the basic tests and to develop a sense of the economic magnitudes of the breaks in our dataset, we provide two additional pieces of evidence. Table 3.2 presents data on average fund discounts by category for several periods. We report the number of funds for which the average is computed (identical to the sample data from Table 3.1) and the mean, median, and standard deviation of the CEF discounts for all funds in a category, computed across all the days in the relevant sample period. Panel A presents evidence for the period after the Lehman collapse on September 15, 2008, which we term as the stock crisis period. It is readily evident that the closed-end fund discounts widen across all fund categories in this period. For example, the median discount on corporate bonds is 17.29% and this is wider than the discounts on corporate bonds in all other periods reported in Panels B, C, and D. Not surprisingly, the difference between the post-Lehman period and other periods is the narrowest for government bonds. In all other categories, the discount is one order of magnitude greater than experienced in previous periods.

Panels B through D report data for prior time periods before the Lehman collapse. Panel B focuses on the 45 day period prior to the (45 day) period after September 15, 2008 in our sample. In four out of five categories, the average discounts are lower than in the post-Lehman period. For example, the median discount in the growth and income fund category is -8.15% in Panel B versus -19.77% in Panel A. Panel C reports the data for the subprime period from August 2007 to March 2008. The discounts are relatively flat compared to the June-September

a plot of the test statistic peaking around September 15, 2008 are available from the authors upon request.

2008 period. However, the more striking feature of the data is that the discounts in the subprime crisis period in Panel C are higher than the pre-subprime period from April 2007 to June 2007. In all categories except the government bond funds, the discounts more than double in the subprime period, although they are still lower than in the post-Lehman period.

3.3.3 Event Study Evidence

Table 3.3 reports evidence from a daily time series of fund discounts. Here, we conduct a different experiment. We identify several candidate event dates during which there were major announcements or events as outlined in the event history logged in Section 3.2 of the paper. We examine how the average discounts of each category of funds responds to the content of the announcement. We assess the statistical significance of the event through a t-test of the change in discounts on the event date, normalized by the standard error, which is computed based on the history of discount changes for the category over a 60 calendar day period prior to the event. This method is not necessarily powerful because it uses the only history of the average return in a category. However, as Fama (1998) points out, averaging returns on calendar dates mitigates issues with cross-sectional correlation. As we discuss below, power is largely a non-issue as most changes in average closed-end fund discounts turn out to be rather significant for several categories. The evidence on daily changes for selected days can also shed light on specific events that lead to movement in closed-end fund discounts.

Table 3.3 reports evidence on fund discount reactions to events prior to the Lehman collapse. January 22, 2008 is the first trading date after the downgrade of a monoline municipal bond insurer, Ambac. The results for this date suggest that the news was mixed. Three out of five categories show negative change, one has a significant positive change, while one is insignificant. There does not appear to be a consistently signed sentiment spillover of the disruption in the municipal bond market due to the Ambac downgrade. The first run in the auction rate market on February 7, 2008 does not seem to have alarmed investor sentiment significantly, as three out of four fund discount changes are positive. However, the second disruption on Feburary 14, 2008 resulted in a consistent widening of discounts of between -1.5% and -2.5%. (We note that this is *not* a percentage change in discount; rather, it is the change in the percentage discount).

The Bear Stearns collapse in March 2008 produces interesting results. The first rumors of the collapse on March 11, 2008 did not seem to alarm investors but the loan made by the treasury to Bear Stearns on March 14, 2008 seemed to set off a warning. The eventual takeover of Bear Stearns by J P Morgan Chase was an informationally negative event: it hurts investor sentiment, as reflected in a significant widening of discounts on March 17, 2008. The news about the extent of Bear Stearns' problems apparently overwhelmed any positive news in the action taken by the Feds to stave off Bear's bankruptcy. The Indymac bank failure is likewise not economically significant. The Fannie and Freddie takeovers are interesting because they result in a negative shift in sentiment for the equity markets and a mild positive shift for the bond markets, especially the government bonds. Equityholders essentially lost all capital in the government takeover of the two GSEs, which perhaps accounts for the negative sentiment in equities. It is harder to understand why government or corporate bond holders might benefit from the effective nationalization of the two enterprises.

In Table 3.4, we turn to the events around and immediately after the Lehman bankruptcy. Both the Lehman collapse on September 15, 2008 and the subsequent AIG bailout on September 16, 2008 resulted in a markedly negative turn of sentiment as funds in all categories experienced a widening of discounts. Curiously, the reaction to the AIG bailout was at least as negative as the reaction to the Lehman bankruptcy, perhaps because of some delay in incorporating the rather unanticipated event of a bulge bracket investment bank bankruptcy, or delay in assessing the broad consequences for counterparties. It is interesting that the magnitudes of the shocks to discounts are much greater on these two days compared to that in any of the days studied in Table 3.3. On September 22, 2008, the U.S. government released outlines of a plan to bail out banks through toxic asset repurchases. The reaction to this was distinctly negative and significant in four out of five categories. Either investor sentiment towards the plan was negative or the news about the magnitude of the bailout overwhelmed any positivity in the fact that the government was injecting capital into financial institutions. The September 25 takeover of Washington Mutual by Wells Fargo had a positive effect on discounts in three out of four categories. However, the rejection of the U.S. government plan to bail out banks through toxic asset repurchases had a significantly negative effect on investor sentiment, especially investors in corporate bonds.

In Table 3.5, we study the daily movements of the fund discounts in October 2008. The passage of the bailout bill by the Senate on October 1, 2008 was greeted by a positive shift in sentiment across all categories. The other data points in October 2008 show interesting patterns, with substantial swings in closed-end fund discounts. One of these movements, on October 13, 2008, is the most significant single day movement. This is the day on which the treasury secretary announced a move to recapitalize banks through direct capital infusion rather than the toxic asset repurchase program. For instance, the narrowing of average CEF discounts by 15.43% for corporate bonds represents the single largest move for this category in our sample. However, on the other dates recorded in Table 3.5, there is little news of comparable significance. Stocks showed significant volatility as the S&P 500 index went up or down by between 5% and 10% on several days. There was significant co-movement of fund discounts with the broad stock market on many (though not all) days. For instance, the market went down by 5.74% on October 6, 2008 and by 7.62% on October 9, 2008 and we see discounts widening for all categories of funds on these dates. On other dates with significant stock price moves, most but not all category discounts move in the direction of the stock return. The data suggest that once discounts turned downwards and sentiment worsened after September 15-16, the co-movement of the stock market with closed-end fund discounts increased, either because fund discounts responded to contemporaneous stock market moves or common elements drove both the stock market and investor sentiment. We examine the relation between stock returns and changes in closed-end funds in greater detail in the next section.

3.3.4 Summary

Statistically, the data say that closed-end fund discounts first widened in the subprime crisis period and then widened sharply yet again after the Lehman Brothers collapse. If fund discounts are interpreted as measures of investor sentiment, the evidence suggests that investor confidence lost traction during the subprime crisis. Greater pessimism took root in the fourth quarter of 2008 after the Lehman collapse. A plausible interpretation of the results is that the crises resulted in a shock to the supply of capital available to conduct risky arbitrage. The shock provided a channel for investor confidence or sentiment to express itself through stock prices. Alternatively, it is possible that there is no alteration in sentiment but increased constraints on arbitrage led to more pessimistic views being reflected in prices, in the spirit of Miller (1977). We shed more light on these issues in the next section, where we tie in closed-end fund discounts to real sentiment variables during the stock crisis period after the Lehman collapse.

A supply shock to arbitrage capital story can explain why the discounts especially widened after the Lehman collapse. Given the historical record of the treasury or the Federal Reserve, failing banks were more liable to be bailed out through mergers with some assistance from the government agencies. This was the process used in the case of Bear Stearns, and of course, in the rescue of Fannie Mae and Freddie Mac. Thus, it is not unreasonable to suppose that the Lehman Brothers bankruptcy filing came as an unanticipated shock to the system. A related point is made by Caballero and Krishnamurthy (2009), who argue that a structural shift of this nature introduces ambiguity, making it difficult for investors to form probability distributions over outcomes. Investors with Knightian aversion to ambiguity focus on and plan for worst case outcomes. A loss of confidence in the financial institutions could lead investors to exit the system for safer havens, and make them less willing to hold assets close to the fundamental value set by markets. The data seem less consistent with a liquidity explanation for discounts during the crisis. In periods of illiquidity, closed-end funds offer a liquid alternative to illiquid investments held by the fund, implying that discounts should narrow rather than widen during crisis episodes. This is not what we observe in the data. A more plausible reconciliation of liquidity and sentiment explanations for discounts is that while liquidity could matter in normal circumstances, sentiment is more relevant in crisis periods when the limits to arbitrage assume greater importance, so sentiment has a closer relation to the market movements in these period. We explore this interpretation further in the next sections.

3.4 Comovement

In this section, we examine whether closed end fund premia co-move with aggregate market returns. If closed end funds contain information related to retail investor sentiment, and if the crisis of late 2008 is related to investor sentiment, then the level of comovement should be very high at this time, but much lower in other periods. The objective is to test if CEF premia, which are disruptions in the normal pricing of securities, can explain high frequency aggregate market movements. In later sections, we explore the information contained in CEF premia and find support for the conclusion that it became very related to proxies for sentiment in late 2008, but not in earlier periods.

3.4.1 Closed End Fund Premia

Our emphasis is on comovement in CEF premia and aggregate market returns. Hence, we consider daily returns. These high frequency tests are critical, as our structural break tests reveal that the crisis period contains just 76 trading days in 2008. Low frequency tests would render the number of time series observations to be too few, and power too low, to test hypotheses relating to comovement during and before the crisis period.

In Table 3.6, we report the results of regressions in which the dependent variable is the return on the CRSP value weighted market index (Panel A), the change in the VIX volatility index (Panel B), or the change in the investment grade credit default swap (CDS) index (Panel C). The independent variable varies by row and is the change in the CEF premium for various fund classes (identified in the second column). The change in the CEF premium is measured over the same one day period during which the dependent variable is measured. Hence, all regressions are strictly associative and not predictive. We report results over three key subsamples: the 2008 Crisis, the pre-crisis period, and the full sample preceding these two periods ("other dates").

[**Insert Table 3.6 here**]

Panel A of Table 3.6 shows that many fund categories have premia that comove with the aggregate market over time. For example, in the largest sample "other dates", bond funds and global equity funds have premia that comove positively with the aggregate stock market. In contrast, domestic equity funds including growth and income and equity income funds have premia that comove negatively. Although premia appear to comove in a statistically significant fashion in this broad sample, all Adjusted R^2 statistics are less than 10%, suggesting that these comovements are meaningful but modest in economic size. The Pre-crisis preiod is generally similar to the broad sample, but most bond fund categories have somewhat elevated comovement with the aggregate market. Most striking, however, is that in the 2008 Crisis period, comovement with the market reached much higher levels. The corporate bond CEF premium, the default spread premium (the difference between the corporate bond CEF premium and the government bond CEF premium), and the growth and income premium, all have adjusted R^2 statistics exceeding 35%. Despite the fact that this sample only contains 76 observations, the associated t-statistics are very significant, and are larger than 6.0 for these three fund categories. Consistent with our structural break tests in the previous section, these tests show that the behavior of closed end fund premia changed in late 2008. We see similar results in Panel B regarding changes in the implied volatility index, and some weaker evidence in Panel C regarding the investment grade credit default swap index. These results suggest that the information contained in closed end fund premia became correlated with broad classes of financial assets and indices in late 2008.

Further analysis of Table 3.6 reveals that funds that invest in less liquid securities experience greater increases in adjusted R^2 in the 2008 crisis period. These results support a key idea initially forwarded by Pontiff (1996), that the cost of arbitrage is important in understanding CEF premia. In the context of our study, a higher cost of arbitrage is a necessary condition for investor sentiment to be fully expressed in closed end fund premia. Consistent with this notion, Table 3.6 shows that corporate bonds (adjusted R^2 50.6%) are generally less liquid than government bonds (adjusted R^2 24.0%), and growth and income funds (adjusted R^2 35.7%) are generally less liquid than equity income funds (adjusted R^2 0.8%). Equity income funds generally invest in large dividend paying stocks and have the primary objective of providing current income, which is in contrast to growth and income funds, which additionally invest in riskier non-dividend paying stocks that prioritize future growth over steady income. We conclude that shortages in arbitrage capital, or an inability to construct arbitrage portfolios, likely played a role in permitting the comovement of CEF premia and aggregate market indices to reach such abnormal levels. We explore the role of sentiment, for which the current findings suggesting limits to arbitrage capital are necessary, more in the next section.

Table 3.6 provides a natural difference in differences approach to understanding the crisis of 2008. The differences in adjusted R^2 for many categories across the periods support the conclusion that the structural break in CEF premium levels coincided with a break in the extent to which CEF premia comove with aggregate market indices.

However, this effect is somewhat blurred for bond funds, which have CEF premia that still comove with the market positively, although with lower R^2, in other periods. Because this effect is unique to fixed income funds, it is likely due to a stable relationship between interest rates (or interest rate liquidity or sentiment), and aggregate asset prices. Thus to understand the unique role played by the 2008 crisis in bond funds, this motivates a double difference in differences approach.

We consider the difference in the corporate bond CEF premium and the government bond CEF premium, as this difference should be purged of interest-rate specific content. We use the corporate bond CEF as the first item in this difference because corporate bonds are generally more difficult to arbitrage than government bonds, and our convention is to analyze CEF premia with positive theoretical links to sentiment. Table 3.6 shows that this "default spread CEF premium" is only very weakly related to aggregate market movements outside of the 2008 Crisis period (adjusted R^2 less than 1.6% for both the pre-crisis and the other dates sample in all three panels), indicating that it is indeed likely purged of the stable relationship between fixed income securities CEF premia and the aggregate market. In contrast, the table also shows that the default spread CEF premium is very statistically and economically significant during the 2008 crisis period with an adjusted R^2 exceeding 40% in Panel A, 38.1% for the VIX index in Panel B, and 10.1% for the credit default index in Panel C. These results, considered jointly with our results for equity CEFs, suggest that the structural breaks noted earlier in this study, are likely related to the content contained in both the default spread CEF premium and the growth and income CEF premium. Both series are strongly related to the value weighted market in the 2008 crisis, but not in other periods.

Similar to our fixed income securities CEFs, the global equity fund CEFs appear to have a stable link to aggregate market indices in all periods. This finding is consistent with Bodurtha, Kim, and Lee (1995), who find that international CEFs incorporate time varying sentiment in a broad setting. For these reasons, in the remainder of the paper we focus our attention most on the default spread CEF premium and the growth and income CEF premium, as information contained in these series appears to be most directly related to the structural break of late 2008.

3.4.2 Closed End Fund Net Asset Values

It is noteworthy that we find similar results across fund categories based on both fixed income securities and equity securities. This is both important because it suggests that the role of closed end funds is broad in late 2008, and also because it provides some initial evidence that contamination in reported fund net asset values (NAVs) is not responsible for our findings. For example, if net asset values are computed incorrectly, it is possible that computed closed end fund premia might be contaminated by information related to the valuations of the underlying assets (NAVs). Our finding of distinct structural breaks in more than one fund category helps to alleviate this concern because the contamination from NAVs from broadly different asset classes would have to be common in order to affect both CEF premia in the same way. We examine this question of NAV accuracy further in this section. In particular, we examine if our results are robust to controlling for NAV value changes, and we use both the reported NAVs and a fitted NAV based on actual bond prices and credit default indices.

First, some basic summary statistics strongly support the conclusion that NAV returns and CEF premia both experience considerable time series variation, and also that both contain distinct information, especially in late 2008. In the broad sample, regarding the default spread CEF variable, the standard deviation of the daily change in its CEF premium, and its daily NAV return, is 0.94% and 0.40%, respectively. During the pre-crisis period, these numbers are 0.58% and 0.45%, and during the 2008 crisis period both statistics increase to 2.53% and 1.13%, respectively. For the growth and income CEF, its change in CEF premium and reported NAV return have standard deviations of 0.57% and 0.79% prior to June 1, 2008, and standard deviations of 2.4% and 2.6% during the 2008 crisis period. We conclude that both asset values, and the wedge between asset values and CEF values, became more volatile during the crisis period.

Although it is unlikely that equity NAVs are computed with error due to the high degree of availability of closing equity prices, it seems more plausible that corporate bond NAVs might be more difficult to compute. We next explore whether the links we find between changes in closed end fund premia and aggregate equity indices are robust to controlling for NAV returns. We focus on the default spread CEF premium because, unlike the growth and income equity CEF, its NAV is indeed dependent upon the reliability of recent bond prices. We consider controls for both the reported NAV, and a simple fitted NAV.

The fitted NAV is based on a regression of changes in the default spread CEF price changes on four relevant variables: change in the the investment grade CDS spread, change in the BAA corporate bond yield, change in the AAA corporate bond yield, and the change in the US treasury 10 year bond yield. We fit this first stage regression using observations from October 30, 2003 through May 31, 2008 (based on availability of the CDS index data). Although we do not report the results of this regression to conserve space, we find highly significant negative loadings on the changes in credit default index (T=8.73), the changes in AAA corporate bond yields (T=-3.04), and a positive loading on the changes in US treasury yields (T=+3.74). Hence, we view our fitted model as being informative about the true NAV return series. We next use the coefficients from this model to form a "fitted" default spread CEF NAV return in later periods including the pre-crisis period and the 2008 crisis period following the structural break.

In Table 3.7, we examine if our Table 3.6 findings regarding the default spread CEF premium are robust to controlling for the "fitted" NAV return and the the reported NAV return. Panel A repeats the analysis in Table 3.6, where aggregate market variables are regressed on changes in the default CEF premium alone. Panels B and C replace the change in default CEF premium with the reported NAV return or the fitted NAV return, respectively. Panels D and E consider bivariate regressions with both the default CEF premium and either NAV, respectively.

[**Insert Table 3.7 here**]

The results strongly support the conclusion that the 2008 crisis coefficients in Panel A (CEF premium only) do not change very much when controls for either NAV return are included in Panels D and E. For example, the coefficient for the value weighted market return declines from 1.067 to 1.019 when the reported NAV return control is included, and to 1.031 when the fitted NAV return control is included. We conclude that the NAV return explains at most 5% of the link between CEF premia and aggregate market variables. The results in Panels B and C (NAV return only) also show that changes in bond prices (corporate minus government) are, not surprisingly, positively correlated with changes in aggregate equity prices. Comparing Panels B and C show that the fitted NAV and the reported NAV also seem to generate similar results with similar significance level patterns, supporting the conclusion that the reported NAVs are likely calculated accurately for the fixed income closed end fund categories. In particular, the expected correlation between NAV returns and market returns does not explain the observed correlation between CEF premia and aggregate market returns.

3.5 Sources of CEF premium variation

Because closed end fund premia contain a strong signal that is not related to net asset valuations, a large literature has developed possible explanations for what drives this CEF premia. Among the explanations are liquidity (see Cherkes, Sagi, and Stanton (2008)) and sentiment (see Lee, Shleifer, and Thaler (1991)). In this section, we examine in greater depth whether these explanations drive our results. Because CEF premia experienced a large structural break on September 15, 2008, we note that it is possible that key determinants of CEF premium might also be different before and after this date. Hence, we consider tests based on the 2008 crisis period, and the pre-crisis period. We are unable to consider a broader study in this section due to data availability restrictions.

We first note that some basic summary statistics support the conclusion that there is a link between liquidity and closed end fund premia. In particular, changes in liquidity should have an opposite effect on net asset values and closed end fund premia. For example, consider a fund investing in asset X, and consider the implications of asset X suddenly becoming more illiquid. It is well known in the Market Microstructure literature that asset X should decrease in value, hence we would expect a negative NAV return following this event. On the other hand, because closed end funds solve the asset illiquidity problem, the premium itself should increase following this event (the value of resolving asset illiquidity should increase when assets are less liquid). Hence, if there is a strong link between asset liquidity and closed end premia, we would expect a significant negative correlation between NAV returns and changes in the CEF premium. We find in our broad sample (from January 1, 2000 to May 31, 2008), that this correlation is indeed very significant and negative at -35.4% for the default CEF premium. Hence, our results are consistent with liquidity playing a large role in day to day changes in fund discounts, at least prior to the structural break (this correlation is almost unchanged at -34.3% in the pre-crisis period from June 1, 2008 to September 14, 2008). Similarly, we find that this correlation is -10.3% for the growth and income CEF premium prior to June 1, 2008. These pre-crisis findings are consistent with Cherkes, Sagi, and Stanton (2008).

However, after the structural break, two key findings suggest that liquidity likely does not explain the CEF premium in late 2008. First, the correlation between the NAV return and the changes in the default spread CEF premium actually changes sign and becomes +11.9%. For the growth and income CEF, this number becomes +63.5%.[8] This positive sign is not consistent with a liquidity interpretation, but is consistent with a sentiment interpretation as in Lee, Shleifer, and Thaler (1991). Second, it is likely that corporate bond liquidity deteriorated in late 2008, and hence liquidity based theories would predict that CEF premia should have increased during this period. As reported earlier, we find that all CEF premia actually declined significantly. We conclude that liquidity likely does not explain the changes in the CEF premia in late 2008 (although it does in other periods), and we next explore whether high frequency sentiment proxies can explain its changes.

3.5.1 Sentiment and CEF premia

Following Qiu and Welch (2005), we first consider direct measures of consumer and individual sentiment from UBS/Gallup polls. Starting in early 2008, UBS/Gallup provides the results of nine daily surveys (called "daily trends"). We consider eight of the nine surveys including personal finance, US economic conditions, US economic outlook, consumer mood, US job market, US life evaluation, US standard of living, and overall US mood.[9] We also consider one additional Gallup/UBS daily survey regarding actual consumer spending. All nine surveys (eight daily trends and one covering consumer spending), although reported daily, are based on three day moving averages. For each survey, we compute its daily

[8] The result for the growth and income CEF essentially restates our Table 3.6 finding that the growth and income CEF premium co-moves positively with aggregate stock valuations (the growth and income NAV is an example), but only after the structural break.

[9] The ninth survey is on the topic of US health, which we omit.

relative change, which is equal to the reported survey result on a given day minus its previous day result, scaled by its previous day result. Our objective is to examine whether these high frequency changes in sentiment are associated with our high frequency changes in CEF premia. In particular, we wish to examine whether any observed relationship changes before and after the structural break of September 15, 2008.

Table 3.8 reports the results of univariate time series regressions in which changes in the CEF premium for a given fund class is the dependent variable (varies by panel and noted in each panel header), and the relative change in one of the survey results is the independent variable. As before, these regressions are not predictive, as our aim is to establish comovement. We report results for the 2008 crisis period and the pre-crisis period.

In Panels A to C, Table 3.8 shows without exception that changes in our survey-based sentiment proxies do not explain changes in CEF premia prior to the structural break. In fact, the only variable that is statistically significant even at the 10% level (Economy is getting worse) has the wrong sign in Panel B. In stark contrast, many survey results are strongly correlated with changes in CEF premia after the structural break. Most relevant, changes in survey results asking three questions are especially significant in all five panels: (1) is the economy getting worse, (2) Is the economy poor, and (3) is the consumer mood negative. We view all three surveys as proxies for retail investor sentiment, and all three are significantly related to CEF premia at better than the 1% level despite the fact that the 2008 crisis period has just 76 observations. When viewed together with our findings relating to liquidity, our broad evidence supports the conclusion that the September 15th structural break is associated with a shift in which CEF premia change from being associated with changes in liquidity prior to the break, to being associated with sentiment following the break.

Because retail investors are far more numerous than institutional investors, it is likely that the Gallup survey results reflect the beliefs of retail investors on average. Our findings regarding closed end funds suggest that that their beliefs translated to actual trading activity, and this activity ultimately became associated with aggregate stock market returns. Although retail investors have limited wealth, their numbers are large, and they have the potential to affect broad asset classes in an economically relevant manner.

Overall, despite the strong findings regarding in late 2008, our findings are consistent with both Qiu and Welch (2005) and Lemmon and Portniaguina (2008). In particular, we also find that CEFs do not correlate highly with sentiment measures in broad samples. However, the late 2008 crisis period is separated by a structural break, and is not part of the sample studied by either article. Our results suggest that the relationship between CEFs and sentiment is likely related to the overall state of the economy. This conclusion supports ideas presented in Pigou (1947), Krugman (2001), and Shleifer and Vishny (2009). In particular, the role of sentiment can be both elevated and highly systemic in times of crisis. In turn, these theories can generate patterns consistent with our findings, and those of Qiu and Welch (2005) and Lemmon and Portniaguina (2008).

Although our results are consistent with a sentiment based interpretation, it remains an open question whether the actions of retail investors are rational or irrational in this context. For example, if their beliefs about the economy getting worse are valid, then future corporate profits are likely to be lower, and selling financial assets can be rational if their prices do not yet fully reflect this information. Because these results are related to broad surveys, however, it is unlikely that each retail investor holds any private information that is not yet known by the market, which favors a sentiment interpretation. We explore this question in greater depth by considering the consumer spending survey as a special case. Unlike the other surveys, which focus on moods and beliefs, this survey queries individuals regarding their actual spending patterns. If the information contained in closed end funds was more about fundamentals than irrational sentiment, then this one survey should be more informative regarding the information contained in CEF premia.

In three of the five panels, Table 3.8 shows that increases in surveyed consumer spending are indeed positively associated with increases in CEF premia for corporate bond funds, government bond funds, and growth and income funds. However, we do not see a significant relationship for the default spread CEF variable. This variable is significantly related to consumer mood and expectations about the economy deteriorating at better than the 1% level. We conclude that the evidence regarding consumer spending is mixed, whereas the evidence regarding sentiment is strong and consistently significant at the 1% level.

In unreported regressions, we also examine whether the Gallup Survey variables explain aggregate market returns. We find that the same three sentiment surveys that explain changes in CEF premia also explain the value weighted market return, but primarily at the 10% level. This relationship only exists during the 2008 crisis period. Also relevant, the consumer spending survey is not significantly related to aggregate market returns. Our broad results are thus most consistent with the conclusion that investor sentiment is the most likely interpretation of our findings during the 2008 crisis period.

3.5.2 The Internet and the Media

Our evidence related to the Gallup surveys is especially compelling because this data obtains from a source that is entirely unrelated to financial assets or financial markets more generally. We now test for robustness using two additional sources of high frequency data: Google Trends and Lexis/Nexis newspaper article counts. We extract daily time series from both sources based on the key phrases "Great Depression", "Recession" and "Bankruptcy". Google trends summarize daily aggregate web searches on these topics, and Lexis/Nexis allows us to count the number of newspaper articles written on each topic. Because the typical web user, and the typical newspaper reader, are likely to be retail investors, we believe these tests can help to establish robustness regarding the link between retail investor sentiment and aggregate stock returns during the 2008 crisis suggested by our UBS/Gallup survey results.

[Insert Table 3.9 here]

Table 3.9 displays the results of these tests. The change in the CEF premium for a given fund class is the dependent variable (varies by panel and noted in each panel header), and the relative change in the number of Google searches or the number of newspaper articles on the Great Depression, recession, or bankruptcy is the independent variable as noted in the first column. The regressions are synchronous, and the independent variable and the dependent variable are measured over the same day. We examine lead vs lag relationships later in this section.

Consistent with our findings regarding Gallup surveys, the table shows that our Google Trends variables are only negative and significant during the 2008 crisis period. Moreover, for all five fund classes examined, including the key default spread CEF premium in Panel C and the growth and income CEF premium in Panel D, web searches on the Great Depression and Recession are negatively associated with changes in the CEF premia at better than the 1% level of significance. Google searches on bankruptcy have the proper sign, but are not significant in most panels. We generally see weaker relationships for Lexis/Nexis newspaper article counts, but note that articles on bankruptcy explain some variation in closed end fund premia in some panels. Also, in unreported regressions, these same Google Trends variables are negatively related to the value weighted market return also at better than the 1% level.

[**Insert Table 3.10 here**]

Table 3.10 reproduces the tests in Table 3.9 after lagging the independent variables by one day. We find a strong and consistent lead relationship between the previous day's newspaper articles and the next day's changes in CEF premia. Most noteworthy, newspaper articles on all three topics significantly predict the next day's change in growth and income CEF premium and the default spread CEF premium, most at the 5% level or better. Because newspaper articles are generally available early on a given day, it is quite striking that this information leads CEF premium changes given that a full day of trading was available prior to this interaction, allowing this information to become public information. Considering our results thus far, we conclude that newspaper articles on our key topics lead changes in CEF premia, and Google searches on our key topics move synchronously with our key variables. Both findings support the conclusion that after the structural break, closed end fund premia became strongly related to proxies for sentiment. Our results are especially compelling given that the sentiment proxies obtain from non-financial data.

[**Insert Table 3.11 here**]

Table 3.11 reproduces the tests in Table 3.9 after lagging the closed end fund premia by one day. Because the closed end fund premia are lagged, the dependent variable is now the future change in google searching activity, or the change in newspaper article counts. Although the evidence of lead relationship in CEF premia relative to changes in future sentiment proxies is less robust overall than our earlier findings, we see some evidence that changes in CEF premia do generate higher future google searches on the Great Depression and Recession, and perhaps some press coverage on the topic of bankruptcy, especially in Panels C and D, which are based on our key CEF premium variables: the default spread and the growth and income equity funds. Regarding the more liquid government bond funds in Panel

B, and the equity income funds in Panel E, the evidence is weaker. These findings support the prediction that limits to arbitrage are necessary in order for sentiment to be visible in asset returns.

In unreported regressions, although the Google search variables significantly move with the market in a synchronous fashion at better than the 1% level, we do not find a significant lead or lag relationship between the google and Lexis/Nexis variables and the value weighted market index, although most variables have the predicted sign. Overall, we view the results in this section as providing robustness supporting the conclusion that changes in sentiment are highly correlated with changes in closed end fund premia after the September 15th structural break, but not before. This key date likely marked a shift in the content of CEF premia from liquidity to consumer sentiment.

Although our lead lag results are not as strong as our synchronous results, we believe that they provide some evidence of a recycling effect. For example, negative sentiment generates poor stock returns, which in turn generates further negative sentiment and sensational press coverage, which in turn generates further stock price declines accompanied by a strong signature in closed end fund premia.

3.6 Systematic Risk

Our broad findings suggest that changes in CEF premia have content that seems to shift from a liquidity orientation in normal times to a sentiment orientation in negative states, for example following the September 15, 2008 structural break.

These findings suggest that closed end funds might more generally be exposed to abnormally high levels of systematic risk, especially relative to the assets they invest in. This exposure to systematic risk might be much more severe in negative market conditions.

It is important to note that a buyer of a closed end fund effectively receives the sum of two return series: the net asset value return plus the change in the closed end fund premium. Hence, if the closed end fund premium return has a positive exposure to systematic risk, especially in negative states, investors should demand a discount when purchasing closed end funds when compared to the raw assets. It follows that the well known finding that closed end funds trade at discounts on average, can be explained in part by the fact that investments in closed end funds embody greater systematic risk than their underlying assets. To the extent our data availability permits, we next explore whether this relationship holds in broader samples.

[**Insert Table 3.12 here**]

Table 3.12 displays the results of reverse regressions in which the change in CEF premium is the dependent variable, and the independent variables include the synchronous value weighted market factor (Panel A) or the Fama French plus momentum four factors (Panel B). We consider five different fund classes as noted in the first column, and we explore all three samples including the 2008 crisis, the pre-crisis, and the sample of other dates starting in January 2000 and ending in May of 2008.

The table's results are striking. The default spread CEF has an economically large beta of 0.39 during the crisis period, and a relatively small beta of 0.04 to 0.07 in the non-crisis periods. If the beta of the underlying assets is one for example, this would imply that the beta of the closed end fund is as high as 1.39 during the crisis. The results for the growth and income CEF are just as striking, as its 2008 crisis beta of 0.34 is 0.42 higher than its level in the long "other" sample, and 0.28 higher than in the pre-crisis period.

The systematic risk exposure of the corporate bond fund is high both in and before the crisis. In the crisis, its beta is 0.56, and outside the crisis, its beta is near 0.20. If we assume an equity risk premium of 5%, this implies that the expected return of the corporate bond CEF should be at least 1% per annum higher to compensate investors for market risk (this should be even higher if we account for the higher beta in the crisis). The discount of this fund should be related to the discounted value of this 1% per annum annuity, which in turn can explain a possibly economically large portion of its observed CEF discount.

Although this link is compelling, we interpret these findings with some caution for two reasons. First, the magnitude of the exposure to systematic risk is highly dependent on the fund category. For example, we actually find a relatively small negative beta for equity income funds, although this becomes insignificantly positive during the crisis.[10] In contrast, growth and income equity funds have a more striking beta of 0.34 during the crisis. These results suggest that the difficulty of arbitraging a

[10] This concern might be mitigated if, for example, different types of crises result in different classes of closed end funds experiencing greater risk. For example, equity income funds did experience elevated betas following the September 11, 2001 terrorist attacks.

given fund class is important in determining the amount of additional systematic risk the fund is exposed to, especially in negative states (consistent with ideas presented in Pontiff (1996)).

Panel B of Table 3.12 shows that these findings are robust to including the HML, SMB and UMD factors. The market risk coefficients change little in the multi-factor setting. The table also suggests that some fund classes also have significant positive exposures to HML. The corporate bond funds and the growth and income funds are most exposed. However, these HML exposures do not seem to change during the crisis period and are less consistent overall, and are thus less likely than market risk to explain observed CEF discounts.

3.7 Financial Constraints and the Cross Section

In this section we consider cross sectional tests to analyze whether the extreme stock returns we report are related to financial constraints, or other key variables known to predict returns. We focus on four key event dates on which market moved sharply; namely, September 15, 2008 (Failure of Lehman Brothers), September 29, 2008 (Rejection of passage of TARP), October 9, 2008 (S & P 500 drops 7.62%), October 13, 2008 (Capital Infusion Announced). These tests are important given basic summary statistics reported earlier indicating that cross sectional variance increased in the days surrounding the crisis period. It is important to note that although our earlier evidence supports a role for sentiment, the changes in late 2008 might have multiple causes.

Given the literature on the topic, financial constraints are important to consider. Our analysis in this section is most similar to Tong and Wei (2008) who examine the impact of credit constraints on stock prices between July 31 2007 and March 31 2008. Duchin, Ozbas, and Sensoy (2008) also take a similar approach, but study the effect of the 2007 subprime crisis on firm investment. Our focus is on late 2008. Campello, Graham, and Harvey (2008) examine the real effects of financial constraints based on a survey 1050 CFOs in the US, Europe and Asia, and find that financially constrained firms plan to cut R&D, employment and capital spending severely. Although this body of evidence motivates the importance of considering financial constraints, the predicted effect on stock prices during our sample is less clear. Since the initial signs of crisis began in 2007, for example, it is quite possible that issues relating to constraints are already "priced" by late 2008. Furthermore, Bates, Kahle, and Stulz (2009) suggest that firms were merely piling up cash due to precautionary motives, rather than using any additional cash to make investments.

3.7.1 Data and Variables

We gather firm accounting data from the CRSP/Compustat Merged Annual database. We exclude financial firms (SIC code in 6000-6999). We obtain daily stock returns from CRSP database. To ensure information is public at the time we predict returns, we match a CRSP observation to the latest Compustat entry available with a minimum six months lag. We discard an observation if no Compustat observation is available from the past two years. We gather data from SDC Platinum to construct our merger dummy variables.

We consider several proxies to identify financial constraints. Our primary measure is the index created by Kaplan and Zingales (1997) (also considered in Baker, Stein, and Wurgler (2003) and Duchin, Ozbas, and Sensoy (2008)), which is computed as follows:

$$\text{KZ index} \;=\; -1.002\,\frac{cashflow}{laggedassets} + -39.368\,\frac{dividend}{laggedassets} - 1.315\,\frac{cash}{laggedassets} + \tag{3.1}$$
$$3.139\; leverage + 0.283\; Tobin'sQ$$

Cashflow is income before extraordinary items plus depreciation and amortization. Dividends include common and preferred dividends. Cash includes short-term investments, and leverage is long-term debt plus debt in current liabilities divided by this quantity plus stockholders equity. Tobin's Q is the market value of equity plus assets minus the Book value of equity all divided by assets. We also consider the following proxies for financial constraints.

- **Age**: 2009 minus the first year the firm has positive assets and sales.
- **Dividend Payout Ratio**: Dividends per share on the ex date divided by earnings per share-basic.
- **Long Term Rated**: A dummy variable equal to 1 if the firm has a S&P domestic long-term credit rating in 2008.
- **Short Term Rated**: A dummy variable equal to 1 if the firm has a S&P

domestic short-term credit rating in 2008.

- **LT - Investment Grade**: A dummy variable equal to 1 if a firm has long term rating of BBB or better.

- **ST - Investment Grade**: A dummy variable equal to 1 if a firm has a short term rating of A1.

- **LT- Rating**: The rating level, which is equal to 5 if the long term rating is AAA, 4 if AA, 3 if A, 2 if BBB, 1 if B and 0 otherwise.

We also control for the following variables.

- **Capital Expenditures to Assets**: Capital expenditures divided by assets.

- **Tobin's Q**: Market value of equity plus assets minus the book value of equity, all divided by assets.

- **Retained Earnings to Assets**: Retained earnings divided by assets.

- **Beta** Market model beta calculated using 100 daily returns between April 10, 2008 and August 31, 2008.

- **MergerDummy**: A dummy equal to 1 if the firm has done a merger between January 1, 2006 and August 31, 2008.

- **CashMergerDummy**: A dummy variable equal to 1 if the firm has done a merger using at least 51% cash as a method of payment in this period.

- **Average August Turnover**: Average of volume over shares outstanding in August 2008, deflated by a factor of 2 for Nasdaq firms (due to Nasdaq double counting volume in buy and sell).

All continuous variables are winsorized at 1% level, and we include Fama-French 48 Industry fixed effects in all specifications.

3.7.2 Results

Table 3.13 (includes the K-Z index) and Table 3.14 (includes the components of the K-Z index separately) present the results of these cross sectional tests. The dependent variable is the one-day stock return on the key date noted in the column headers. Table 3.13 shows that financial constraint proxies do not robustly explain the stock returns on these dates. Neither the KZ index, nor the rating variables, are robustly related to stock returns. The only exceptions are that firms with high cash balances outperform on October 9th, and long-term investment grade firms outperformed on September 29th. The fact that high Tobin's Q firms experienced significant performance on some days could also be consistent with financial crisis, however this variable has many interpretations. Overall, given the insignificance of the vast majority of financial constraint proxies, we conclude that credit constraints likely explain little on these key dates. Table 3.14 suggests that this conclusion is robust to separately considering the components of the K-Z index.

The performance of other variables is of independent interest. For example, large firms lost more than small firms on the day Lehman collapsed and the day

TARP was rejected. This is generally not consistent with financial constraints, as larger firms are likely to be less constrained. Our results also indicate that more liquid firms also had more negative returns. We also find that firms with high capital expenditures reacted more on all three negative dates. As capital expenditures are often interpreted as a proxy for growth opportunities, it is possible that price uncertainty played a role (consistent with the knightian uncertainty hypothesis promoted by Caballero and Krishnamurthy (2008), or that the impact of the crisis was more damaging to cashflows with a longer duration.

The results for October 13, 2008 when the S&P 500 gained 11.58%, are also independently interesting. The coefficients of many key variables reversed sign, and firms that lost on earlier dates regained some of their losses. This is consistent with the idea that the same stocks were among the most volatile throughout this period, suggesting that the main drivers of stock prices might have remained unchanged during this period. For example, if sentiment was pervasive in market returns during this entire period, then the same sentiment-sensitive stocks would be most volatile, and in the same direction, throughout this period. To test this argument more directly, we include the September 29, 2008 and the October, 9 2008 returns as independent variables, and find that the returns on October 13 are indeed highly negatively correlated with the earlier returns.

As additional robustness, we consider the index presented in Whited and Wu (2006) (the WW index) in unreported regressions. We find qualitatively similar results. In particular, the WW index is significant in some specifications, however this significance is driven by the fact that firm size is a component in this index.

Overall, we conclude that there is little evidence that credit constraints mattered greatly on the key dates we analyze. However, the results suggest a possible role for firm size, liquidity, and growth options. We leave further analysis on this topic to future research.

3.8 Conclusion

There is a significant and growing literature on the 2007-2008 financial crisis, much of which focuses on credit channel multiplier and amplification mechanisms that cause a housing crisis to spread to the broad economy. Comparatively less has been said about the issue of investor or broad consumer sentiment and its role in the crisis. We provide empirical evidence on this issue, using new high frequency data on closed-end fund discounts for several asset classes and daily data on non-financial measures of sentiment collected by Gallup./UBS, daily web searches from Google, and LEXIS/NEXIS newspaper counts. Variables from these data sources are especially compelling as proxies for investor sentiment because they are orthogonal to traditional financial databases, and their content is uniquely related to the median individual within the economy. Although each median individual is resource poor, they are numerous. Hence, when very large numbers of such individuals act in unison, their impact on financial markets can be substantial.

Our study's goal is to use the new datasets to enhance our understanding the determinants of asset prices during the financial crisis, especially after the enormous dislocation in stock prices in the fourth quarter of 2008, which was deep into the financial crisis, to shed new light on the spread of financial crises. We find that there is some, but relatively little movement in closed-end fund discounts through much of the crisis. However, there is a strong structural break in closed-end funds around the September 15, 2008 bankruptcy of Lehman Brothers. After this date, fund discounts turn sharply downward and exhibit fluctuations that are much higher than historical norms. These fluctuations correlate well with broad market movements after September 15, 2008 (but not before), particularly for asset classes that appear to be hard-to-arbitrage. Turning to broader measures of sentiment, these measures also dip after September 15, 2008 and tend to be more correlated with closed-end fund discounts. The impact of the break is vast and numerous asset classes are affected.

We find strong evidence supporting the conclusion that closed end fund premia became strongly related to investor sentiment proxies after the structural break, but not before the break. At the same time, these CEF premia (which do not represent the value of assets, but rather disruptions in normal pricing relationships) suddenly comove highly with the aggregate value weighted equity index. Prior to the break, our evidence supports the conclusion that high frequency changes in CEF premia were most consistent with liquidity considerations. CEF premia are unrelated to our sentiment proxies prior to the break. Our findings regarding the pre-structural break dynamics are consistent with numerous existing studies including Cherkes, Sagi, and Stanton (2008), Qiu and Welch (2005), and Lemmon and Portniaguina (2008). One interpretation of our findings after the structural break is that sentiment, once brought to the median individual's sight by key events and intense media coverage, can generate a recycling effect in which poor consumer sentiment can generate poor asset price performance, and this in turn further weakens sentiment, which in turn further weakens asset prices. Our evidence thus supports theoretical ideas discussed in Pigou (1947) and Krugman (2001). We view our evidence as highly suggestive of these theories, but we believe additional research is necessary to more firmly test these theories.

Our paper's findings are not only relevant to understanding the role of sentiment in crisis periods, but also shed new light on the nature of closed end fund pricing. Our findings suggest that closed end funds are exposed to higher levels of systematic risk than their underlying assets, especially during stressed conditions as in the current crisis. Thus, closed end funds appear to have discounts that have conditional betas with poor hedging properties. This anti-hedging feature of closed end fund returns can help to explain why closed end funds traditionally trade at discounts. This new explanation does not rule out other explanations, but likely is a contributing factor.

Table 3.1: Number and Characteristics of Closed-End Funds With Daily Discount Data

The table reports the number and characteristics of closed-end funds for which we can obtain daily NAV and closing price data. The sample was constructed as an intersection of closed-end funds listed on ETF Connect and on CRSP. The fund investing style is obtained from ETF connect. A stock listed on CRSP is a closed-end fund if the second digit in its share code is either 4 or 5. Total assets of each fund are as of December 31, 2007 and are reported in millions of dollars.

		Total Assets	
Fund Type	*# Funds*	*Median*	*Mean*
Corporate Bonds	24	290	466
Equity - Global	52	344	596
Equity - U.S.	70	392	653
Growth & Income	26	237	579
Government Bond	3	554	655

Table 3.2: Level of Closed-End Fund Discounts in Different Time Periods

The table reports the number of funds in each category and the median, mean, and standard deviation of daily closed-end fund discounts for four time periods, the stock market crisis period, the post-subprime crisis period, the subprime crisis period, and the pre-subprime crisis period. Fund categories are obtained from ETF Connect. The sample was constructed as an intersection of closed-end funds listed on ETF Connect and on CRSP. The fund investing style is obtained from ETF connect. A stock listed on CRSP is a closed-end fund if the second digit in its share code is either 4 or 5.

Category	**# Funds**	**Median**	**Mean**	σ
Stock Crisis: September 15, 2008 to December 31, 2008				
Corporate Bonds	24	-17.29	-15.59	10.97
Equity Global	52	-17.21	-15.56	8.07
Equity US	70	-15.54	-13.38	13.62
Growth & Income	26	-19.77	-19.11	10.14
Government Bond	3	-9.79	-9.23	5.23
Post-Subprime: June 1, 2008 to September 12, 2008				
Corporate Bonds	24	-11.20	-8.36	8.28
Equity Global	52	-8.82	-7.89	5.33
Equity US	70	-9.10	-6.37	10.12
Growth & Income	26	-8.15	-7.65	5.03
Government Bond	3	-8.49	-7.58	2.47
Subprime: August 1, 2007 to March 31, 2008				
Corporate Bonds	24	-10.12	-8.63	5.74
Equity Global	52	-8.90	-7.79	6.68
Equity US	70	-8.65	-6.86	7.78
Growth & Income	26	-7.59	-6.65	5.67
Government Bond	3	-11.05	-9.21	4.29
Pre-Subprime: April 1, 2007 to June 30, 2007				
Corporate Bonds	24	-4.16	-2.92	5.51
Equity Global	52	-3.74	-3.58	7.03
Equity US	70	-3.50	-3.22	7.13
Growth & Income	26	-0.28	-0.01	8.18
Government Bond	3	-9.52	-5.01	7.36

Table 3.3: Daily Changes in CEF Discounts Around Critical Events: Pre-Lehman

The table reports the mean change in the average percentage discount on closed-end funds for several categories of funds on significant event dates during the 2008 financial crisis prior to the collapse of Lehman Brothers on September 15, 2008. Closed-end fund categories are obtained from ETF Connect. The sample was constructed as an intersection of closed-end funds listed on ETF Connect and on CRSP. A stock listed on CRSP is a closed-end fund if the second digit in its share code is either 4 or 5. t-statistics for testing significance are reported in parentheses and ae based on data for 60 calendar days prior to and not including an event date. ^{c}, ^{b}, and ^{a} denote significance levels at the 10%, 5%, and the 1% levels, respectively.

	Fund Category				
Date (Event)	*Corporate Bond*	*Equity US*	*Equity Global*	*Growth & Income*	*Government Bond*
January 22, 2008	0.13	-0.41^a	1.60^a	-0.39^a	-0.48^a
Ambac Downgrade	(1.44)	(-5.42)	(25.10)	(-4.43)	(-6.75)
February 7, 2008	0.78^a	-0.21^b	0.63^a	0.27^a	0.33^a
Auction-Rate Run	(8.38)	(-2.36)	(7.20)	(3.09)	(4.03)
February 14, 2008	-1.52^a	-1.57^a	-2.48^a	-2.22^a	-1.63^a
Auction-Rate Run	(-16.98)	(-17.60)	(-27.74)	(-25.04)	(-19.63)
March 11, 2008	1.13^a	-0.42^a	0.60	0.06	0.92^a
Bear Stearns Rumor	(10.01)	(-4.42)	(5.86)	(0.59)	(9.61)
March 14, 2008	-0.97^a	0.35^a	-0.25^b	-0.47^a	-0.62^a
Bear Stearns Loan	(-9.05)	(3.88)	(-2.41)	(-4.75)	(-6.84)
March 17, 2008	-2.37^a	-1.20^a	-0.43^a	-1.67^a	-0.68^a
Bear Stearns Takeover	(-22.81)	(-14.03)	(-4.44)	(-17.82)	(-7.81)
July 8, 2008	0.66^a	-0.77^a	0.59^a	0.36^a	0.98^a
Indymac Failure	(10.20)	(-18.52)	(14.39)	(6.61)	(14.14)
September 8, 2008	0.33^a	-0.25^a	-0.82^a	-0.43^a	1.38^a
Fannie, Freddie Takeover	(3.43)	(-3.53)	(-10.44)	(-4.57)	(17.00)

Table 3.4: Daily Changes in CEF Discounts Around Critical Events: September 2008

The Table reports the mean change in the average percentage discount on closed-end funds for several categories of funds on significant event dates during the 2008 financial crisis in September 2008 after the collapse of Lehman Brothers on September 15, 2008. Closed-end fund categories are obtained from ETF Connect. The sample was constructed as an intersection of closed-end funds listed on ETF Connect and on CRSP. A stock listed on CRSP is a closed-end fund if the second digit in its share code is either 4 or 5. t-statistics for testing significance are reported in parentheses and ae based on data for 60 calendar days prior to and not including an event date. ^{c}, ^{b}, and ^{a} denote significance levels at the 10%, 5%, and the 1% levels, respectively.

	Fund Category				
Date (Event)	*Corporate Bond*	*Equity US*	*Equity Global*	*Growth & Income*	*Government Bond*
September 15, 2008	-2.72^a	-0.13^a	-1.31^a	-1.57^a	-2.26^a
Lehman Collapse	(-27.83)	(-1.93)	(-16.67)	(-16.59)	(-27.09)
September 16, 2008	-2.89^a	-3.99^a	-2.50^a	-4.72^a	-1.35^a
AIG Bailout	(-31.00)	(-60.25)	(-34.17)	(-53.10)	(-15.79)
September 22, 2008	-2.31^a	-0.07	-1.63^a	-1.78^a	-0.48^a
TARP Proposal Developed	(-25.22)	(-1.10)	(-20.81)	(-19.12)	(-5.48)
September 25, 2008	2.94^a	-0.80^a	0.61^a	1.42^a	0.79^a
Washington Mutual Collapse	(29.10)	(-12.98)	(7.94)	(16.72)	(7.96)
September 29, 2008	-6.74^a	0.02	-2.25^a	-4.54^a	-1.54^a
TARP Rejected	(-21.85)	(0.12)	(-17.19)	(-22.03)	(-10.09)

Table 3.5: Daily Changes in CEF Discounts Around Critical Events: October 2008

Table 3c reports the mean change in the average percentage discount on closed-end funds for several categories of funds on significant event dates during the 2008 financial crisis for events identified in the month of October 2008. Closed-end fund categories are obtained from ETF Connect. The sample was constructed as an intersection of closed-end funds listed on ETF Connect and on CRSP. A stock listed on CRSP is a closed-end fund if the second digit in its share code is either 4 or 5. t-statistics for testing significance are reported in parentheses and ae based on data for 60 calendar days prior to and not including an event date. ^{c}, ^{b}, and ^{a} denote significance levels at the 10%, 5%, and the 1% levels, respectively.

	Fund Category				
Date	*Corporate*	*Equity*	*Equity*	*Growth*	*Government*
(Event)	*Bond*	*US*	*Global*	*& Income*	*Bond*
October 1, 2008	1.85^a	1.90^a	1.21^a	2.86^a	1.27^a
Senate Passes HR1424	(5.75)	(11.72)	(8.90)	(13.26)	(7.93)
October 6, 2008	-4.42^a	-4.28^a	-3.45^a	-6.38^a	-2.90^a
S&P 500 Drops 5.74%	(-13.86)	(-27.52)	(-25.56)	(-30.35)	(-19.01)
October 9, 2008	-4.84^a	-1.05^a	-1.61^a	-4.41^a	-1.46^a
S&P 500 Drops 7.62%	(-13.15)	(-6.46)	(-10.89)	(-18.16)	(-9.06)
October 13, 2008	15.43^a	6.20^a	6.33^a	10.41^a	6.21^a
Capital Infusion Announced	(42.69)	(37.78)	(43.25)	(41.90)	(39.20)
October 15, 2008	-2.08^a	1.05^a	-1.21^a	-1.15^a	-0.44^a
S&P 500 Drops 9.03%	(-5.48)	(6.10)	(-7.90)	(-4.41)	(-2.63)
October 28, 2008	2.15^a	-2.29^a	-0.45^c	-0.08	1.15^a
S&P 500 Gains 10.79%	(3.82)	(-7.73)	(-1.66)	(-0.18)	(4.39)

Table 3.6: Comovement of closed end fund premia and the aggregate market

The table displays the coefficients and t-statistics (in parentheses) for univariate OLS regressions. The dependent variable is either the return on the CRSP value weighted market index (Panel A), the change in the VIX implied volatility index (Panel B), or the change in the investment grade credit default swap (CDS) index (Panel C). The independent variable varies by row and is the change in the CEF premium for various fund classes (identified in the second column), where the change in the CEF premium is measured over the same one day period during which the dependent variable is measured. Hence, all regressions are strictly associative and not predictive. We also report the adjusted R^2 for each regression, and we report results over three key subsamples. The first sample is the 2008 crisis, which begins on 9/15/2008 and ends on 12/31/2008. The pre-crisis period is chosen to be roughly the same length, and begins on 6/1/2008 and ends on 9/14/2008. The "Other Dates" sample includes all observations from 1/1/2000 to 5/31/2008 (the Govt. Bond CEF is an exception as data for this category first becomes available on 10/14/2003).

		2008 Crisis (76 obs)		***Pre Crisis (73 obs)***		***Other Dates (2114 obs)***	
Dependent Variable	Closed End Fund Premium	Coefficient (t statistic)	Adj. R^2	Coefficient (t statistic)	Adj. R^2	Coefficient (t statistic)	Adj. R^2
		Panel A: Dependent Variable = Value Weighted Market Index					
VW Market	Corp. Bond	0.911 (8.83)	0.506	1.217 (5.41)	0.282	0.486 (14.70)	0.092
VW Market	Govt. Bond	1.427 (4.97)	0.240	1.129 (4.62)	0.220	0.108 (3.90)	0.012
VW Market	Default Spr.	1.067 (7.23)	0.406	0.178 (0.67)	-0.008	0.053 (2.05)	0.003
VW Market	Growth+Income	1.062 (6.52)	0.357	0.323 (1.20)	0.006	-0.171 (-5.37)	0.013
VW Market	Equity Income	0.356 (1.25)	0.008	-0.975 (-2.94)	0.096	-0.265 (-9.42)	0.040
VW Market	Global Eq.	1.373 (5.14)	0.253	0.829 (2.70)	0.080	0.441 (15.19)	0.098
		Panel B: Dependent Variable = Change in VIX Index					
VIX Index	Corp. Bond	-2.267 (-7.77)	0.442	-5.269 (-4.35)	0.199	-1.927 (-11.03)	0.054
VIX Index	Govt. Bond	-3.265 (-4.10)	0.174	-4.622 (-3.53)	0.137	-0.592 (-2.80)	0.006
VIX Index	Default Spr.	-2.752 (-6.87)	0.381	-1.013 (-0.75)	-0.006	-0.255 (-1.30)	0.001
VIX Index	Growth+Income	-2.432 (-5.25)	0.261	-0.541 (-0.39)	-0.012	0.849 (5.15)	0.012
VIX Index	Equity Income	-0.810 (-1.07)	0.002	5.698 (3.44)	0.131	1.057 (7.20)	0.024
VIX Index	Global Eq.	-3.036 (-4.06)	0.171	-3.254 (-2.04)	0.042	-1.630 (-10.56)	0.050
		Panel C: Dependent Variable = Change in CDS Index					
CDS Index	Corp. Bond	-0.678 (-3.47)	0.128	-0.200 (-0.34)	-0.012	-0.448 (-2.58)	0.005
CDS Index	Govt. Bond	-1.064 (-2.33)	0.056	-1.213 (-2.03)	0.041	-0.246 (-1.77)	0.002
CDS Index	Default Spr.	-0.793 (-3.06)	0.101	0.917 (1.58)	0.020	-0.030 (-0.25)	-0.001
CDS Index	Growth+Income	-1.047 (-3.96)	0.164	0.101 (0.17)	-0.014	0.231 (1.25)	0.000
CDS Index	Equity Income	-1.658 (-4.58)	0.211	0.361 (0.47)	-0.011	0.490 (2.45)	0.004
CDS Index	Global Eq.	-1.522 (-3.74)	0.148	-0.501 (-0.70)	-0.007	-0.949 (-5.23)	0.022

Table 3.7: Default spread CEF net asset values (NAV) versus fund premia

The table displays the coefficients and t-statistics (in parentheses) for univariate (Panels A to C) and bivariate (Panels C and D) OLS regressions. The dependent variable is noted in the first column and is either the return on the CRSP value weighted market index, the change in the VIX implied volatility index, or the change in the investment grade credit default swap (CDS) index. The independent variable varies by panel and is the change in the default spread CEF premium, the reported daily net asset value (NAV) return (Panel B), the fitted daily net asset value (NAV) return (Panel C), both the change in CEF premium and the reported NAV return (Panel D), or both the change in CEF premium and the fitted NAV return (Panel E). The change in the CEF premium, reported NAV, and fitted NAV are measured over the same one day period during which the dependent variable is measured. The fitted NAV is based on a first stage regression using observations from October 30, 2003 through May 31, 2008 (based on availability of CDS index data) in which the default spread closed end fund raw return is regressed on four items: change in the the investment grade CDS spread, change in the BAA corporate bond yield, change in the AAA corporate bond yield, and the change in the US treasury 10 year bond yield. The coefficients from this model are then used in the pre-crisis peiod and the 2008 crisis period to compute the fitted NAV. We do not report results for the fitted NAV in the "Other Dates" period because this period is used for the first stage regression, and we do not report results for the CDS spread for the fitted NAV because the fitted NAV is a direct function of the CDS spread. All regressions are strictly associative and not predictive. We also report the adjusted R^2 for each regression, and we report results over three key subsamples. The first sample is the 2008 crisis, which begins on 9/15/2008 and ends on 12/31/2008. The pre-crisis period is chosen to be roughly the same length, and begins on 6/1/2008 and ends on 9/14/2008. The "Other Dates" sample includes all observations from 1/1/2000 to 5/31/2008 (the Govt. Bond CEF is an exception as data for this category first becomes available on 10/14/2003).

Dependent Variable	Period	Δ CEF Premium Coefficient (t statistic)	NAV Return Coefficient (t statistic)	Adj. R^2
		Panel A: Δ CEF premium only		
VW Market	2008 Crisis	1.067 (7.23)		0.406
VW Market	Other	0.053 (2.05)		0.003
VW Market	Pre Crisis	0.178 (0.67)		-0.008
VIX Index	2008 Crisis	-2.752 (-6.87)		0.381
VIX Index	Other	-0.255 (-1.30)		0.001
VIX Index	Pre Crisis	-1.013 (-0.75)		-0.006
CDS Index	2008 Crisis	-0.793 (-3.06)		0.101
CDS Index	Other	-0.030 (-0.25)		-0.001
CDS Index	Pre Crisis	0.917 (1.58)		0.020
		Panel B: Reported NAV return only		
VW Market	2008 Crisis		1.187 (2.90)	0.090
VW Market	Other		0.518 (8.60)	0.061
VW Market	Pre Crisis		1.365 (4.38)	0.207
VIX Index	2008 Crisis		-3.758 (-3.54)	0.133
VIX Index	Other		-3.019 (-6.60)	0.036
VIX Index	Pre Crisis		-5.176 (-3.08)	0.108
CDS Index	2008 Crisis		-1.366 (-2.29)	0.054
CDS Index	Other		-2.442 (-12.10)	0.115
CDS Index	Pre Crisis		-3.064 (-4.66)	0.228
		Panel C: Fitted NAV return only		
VW Market	2008 Crisis		2.870 (2.17)	0.047
VW Market	Pre Crisis		4.050 (5.27)	0.271
VIX Index	2008 Crisis		-8.457 (-2.42)	0.061
VIX Index	Pre Crisis		-18.995 (-4.71)	0.227
		Panel D: Δ CEF Premium and True NAV return		
VW Market	2008 Crisis	1.019 (7.18)	0.915 (2.87)	0.459
VW Market	Other	0.250 (6.98)	0.674 (10.68)	0.099
VW Market	Pre Crisis	0.587 (2.20)	1.608 (4.98)	0.248
VIX Index	2008 Crisis	-2.590 (-6.94)	-3.067 (-3.66)	0.470
VIX Index	Other	-1.310 (-4.75)	-3.835 (-7.91)	0.054
VIX Index	Pre Crisis	-2.473 (-1.69)	-6.200 (-3.52)	0.132
CDS Index	2008 Crisis	-0.731 (-2.86)	-1.171 (-2.05)	0.138
CDS Index	Other	-0.585 (-4.81)	-2.806 (-13.13)	0.132
CDS Index	Pre Crisis	-0.408 (-0.70)	-3.233 (-4.60)	0.222
		Panel E: Δ CEF Premium and Fitted NAV return		
VW Market	2008 Crisis	1.031 (6.74)	0.987 (0.91)	0.405
VW Market	Pre Crisis	0.373 (1.64)	4.247 (5.53)	0.288
VIX Index	2008 Crisis	-2.619 (-6.34)	-3.675 (-1.26)	0.386
VIX Index	Pre Crisis	-1.931 (-1.62)	-20.013 (-4.95)	0.244

Table 3.8: Changes in closed end fund premia and gallup survey data

The table displays the coefficients and t-statistics (in parentheses) for univariate OLS regressions. The dependent variable is the change in closed end fund premium for a given fund class, as noted in the panel header. The independent variable varies by row and is the day-of-week-adjusted relative change in a given Gallup daily Survey (identified in the first column), where the dependent variable and the independent variable are measured over the same one day period. Hence, all regressions are strictly associative and not predictive. We also report the adjusted R^2 for each regression, and we report results over two key subsamples. The first sample is the 2008 crisis, which begins on 9/15/2008 and ends on 12/31/2008. The pre-crisis period is chosen to be roughly the same length, and begins on 6/1/2008 and ends on 9/14/2008. All daily Gallup survey results are obtained from Gallup.com, and are based on three day moving averages. A relative change is equal to the survey value on day t, minus that on day t-1, scaled by the day t-1 value. Day of week adjustments are extracted by taking residuals from a regression of the raw relative change on day of week dummies.

	2008 Crisis (76 obs)		***Pre Crisis (73 obs)***	
Independent Variable	Coefficient (t statistic)	Adj. R^2	Coefficient (t statistic)	Adj. R^2
Panel A: Dependent Variable = Change in Corp Bond CEF Premium				
Econ. Getting Worse	-0.697 (-3.75)	0.148	0.039 (0.68)	-0.008
Econ. is Poor	-0.418 (-3.01)	0.097	-0.024 (-1.04)	0.001
Firm is Hiring	0.091 (1.03)	0.001	0.005 (0.32)	-0.013
Consumer Spending	0.082 (1.98)	0.037	-0.011 (-1.67)	0.024
Negative Consumer Mood	-0.578 (-3.46)	0.127	0.015 (0.40)	-0.012
Negative Mood	-0.020 (-1.18)	0.005	-0.000 (-0.12)	-0.014
Struggling with Life	-0.346 (-1.94)	0.036	0.029 (0.63)	-0.008
Lower Stan. Living	-0.299 (-1.76)	0.027	-0.019 (-0.67)	-0.008
Worried Pers. Fin.	0.107 (1.54)	0.018	0.009 (0.64)	-0.008
Panel B: Dependent Variable = Change in Govt Bond CEF Premium				
Econ. Getting Worse	-0.251 (-2.94)	0.092	0.099 (1.82)	0.031
Econ. is Poor	-0.187 (-3.02)	0.097	-0.018 (-0.80)	-0.005
Firm is Hiring	0.067 (1.72)	0.025	-0.001 (-0.04)	-0.014
Consumer Spending	0.036 (1.93)	0.035	-0.005 (-0.83)	-0.004
Negative Consumer Mood	-0.222 (-2.92)	0.091	0.018 (0.48)	-0.011
Negative Mood	-0.004 (-0.55)	-0.009	-0.004 (-1.31)	0.010
Struggling with Life	-0.024 (-0.30)	-0.012	0.005 (0.12)	-0.014
Lower Stan. Living	-0.187 (-2.52)	0.066	-0.011 (-0.39)	-0.012
Worried Pers. Fin.	0.037 (1.19)	0.006	0.001 (0.08)	-0.014
Panel C: Dependent Variable = Change in Def Spread CEF Premium				
Econ. Getting Worse	-0.445 (-3.04)	0.099	-0.060 (-1.05)	0.001
Econ. is Poor	-0.232 (-2.12)	0.044	-0.006 (-0.27)	-0.013
Firm is Hiring	0.024 (0.36)	-0.012	0.006 (0.35)	-0.012
Consumer Spending	0.046 (1.44)	0.014	-0.006 (-0.85)	-0.004
Negative Consumer Mood	-0.356 (-2.70)	0.077	-0.002 (-0.06)	-0.014
Negative Mood	-0.015 (-1.22)	0.007	0.003 (1.14)	0.004
Struggling with Life	-0.322 (-2.38)	0.059	0.023 (0.51)	-0.010
Lower Stan. Living	-0.112 (-0.84)	-0.004	-0.009 (-0.30)	-0.013
Worried Pers. Fin.	0.070 (1.30)	0.009	0.008 (0.56)	-0.010
Panel D: Dependent Variable = Change in Growth+Inc. CEF Premium				
Econ. Getting Worse	-0.479 (-3.52)	0.132	-0.048 (-0.85)	-0.004
Econ. is Poor	-0.291 (-2.88)	0.089	-0.034 (-1.50)	0.017
Firm is Hiring	0.087 (1.37)	0.011	0.042 (2.68)	0.079
Consumer Spending	0.054 (1.77)	0.028	-0.001 (-0.22)	-0.013
Negative Consumer Mood	-0.410 (-3.37)	0.122	-0.038 (-1.02)	0.001
Negative Mood	-0.008 (-0.70)	-0.007	0.003 (0.97)	-0.001
Struggling with Life	-0.177 (-1.36)	0.011	0.017 (0.38)	-0.012
Lower Stan. Living	-0.291 (-2.40)	0.060	-0.016 (-0.59)	-0.009
Worried Pers. Fin.	0.082 (1.62)	0.021	-0.015 (-1.06)	0.002
Panel E: Dependent Variable = Change in Equity Income CEF Premium				
Econ. Getting Worse	-0.283 (-2.86)	0.087	-0.067 (-1.54)	0.019
Econ. is Poor	-0.149 (-2.02)	0.039	-0.012 (-0.66)	-0.008
Firm is Hiring	0.113 (2.57)	0.070	0.025 (2.03)	0.041
Consumer Spending	0.022 (1.03)	0.001	0.000 (0.01)	-0.014
Negative Consumer Mood	-0.303 (-3.53)	0.132	-0.017 (-0.58)	-0.009
Negative Mood	-0.008 (-0.97)	-0.001	0.002 (0.80)	-0.005
Struggling with Life	0.008 (0.08)	-0.013	-0.062 (-1.84)	0.032
Lower Stan. Living	-0.238 (-2.81)	0.084	-0.013 (-0.59)	-0.009
Worried Pers. Fin.	0.028 (0.77)	-0.006	-0.023 (-2.17)	0.049

Table 3.9: Changes in closed end fund premia and information sources

The table displays the coefficients and t-statistics (in parentheses) for univariate OLS regressions. The dependent variable is the change in closed end fund premium for a given fund class, as noted in the panel header. The independent variable varies by row and is the day-of-week-adjusted relative change in a Google Trends variable (see http://www.google.com/trends), or a Lexis/Nexis newspaper article count variable (see Lexis/Nexis Database). Independent variables are measured over the same one day period as the dependent variable, and hence these regressions are strictly associative and not predictive. We also report the adjusted R^2 for each regression, and we report results over two key subsamples. The first sample is the 2008 crisis, which begins on 9/15/2008 and ends on 12/31/2008. The pre-crisis period is chosen to be roughly the same length, and begins on 6/1/2008 and ends on 9/14/2008. All Google Trends variables and Lexis/Nexis article counts are based on the phrases "Great Depression" or "Recession" as noted in the first column. A relative change is equal to the survey value on day t, minus that on day t-1, scaled by the day t-1 value. Day of week adjustments are extracted by taking residuals from a regression of the raw relative change on day of week dummies.

	2008 Crisis (76 obs)		***Pre Crisis (73 obs)***	
Independent Variable	Coefficient (t statistic)	Adj. R^2	Coefficient (t statistic)	Adj. R^2
Panel A: Dependent Variable = Change in Corp Bond CEF Premium (Synchronous)				
Google Great Dep.	-0.053 (-4.35)	0.193	-0.003 (-0.65)	-0.008
Google Recession	-0.026 (-3.10)	0.103	0.006 (1.61)	0.022
Google Bankruptcy	-0.028 (-1.89)	0.033	0.006 (1.01)	0.000
Lexis Great Dep.	-0.006 (-0.76)	-0.006	-0.000 (-0.57)	-0.009
Lexis Recession	-0.021 (-1.46)	0.015	0.003 (1.23)	0.007
Lexis Bankruptcy	-0.023 (-2.44)	0.062	-0.003 (-1.47)	0.016
Panel B: Dependent Variable = Change in Govt Bond CEF Premium (Synchronous)				
Google Great Dep.	-0.023 (-4.26)	0.186	-0.007 (-1.57)	0.020
Google Recession	-0.008 (-2.03)	0.040	-0.003 (-0.78)	-0.005
Google Bankruptcy	-0.015 (-2.37)	0.058	0.015 (2.95)	0.097
Lexis Great Dep.	-0.003 (-0.78)	-0.005	-0.000 (-0.40)	-0.012
Lexis Recession	-0.011 (-1.76)	0.027	0.002 (0.76)	-0.006
Lexis Bankruptcy	-0.014 (-3.53)	0.132	-0.004 (-2.52)	0.069
Panel C: Dependent Variable = Change in Def Spread CEF Premium (Synchronous)				
Google Great Dep.	-0.030 (-3.01)	0.097	0.004 (0.83)	-0.004
Google Recession	-0.018 (-2.80)	0.083	0.009 (2.42)	0.063
Google Bankruptcy	-0.012 (-1.09)	0.002	-0.009 (-1.70)	0.026
Lexis Great Dep.	-0.003 (-0.54)	-0.010	-0.000 (-0.19)	-0.014
Lexis Recession	-0.010 (-0.88)	-0.003	0.001 (0.50)	-0.011
Lexis Bankruptcy	-0.009 (-1.17)	0.005	0.002 (0.87)	-0.003
Panel D: Dependent Variable = Change in Growth+Inc. CEF Premium (Synchronous)				
Google Great Dep.	-0.040 (-4.65)	0.215	-0.003 (-0.61)	-0.009
Google Recession	-0.016 (-2.65)	0.074	0.004 (1.04)	0.001
Google Bankruptcy	-0.012 (-1.10)	0.003	0.005 (0.95)	-0.001
Lexis Great Dep.	-0.007 (-1.32)	0.010	0.000 (0.63)	-0.008
Lexis Recession	-0.015 (-1.44)	0.014	-0.002 (-0.63)	-0.009
Lexis Bankruptcy	-0.022 (-3.28)	0.115	-0.004 (-2.17)	0.049
Panel E: Dependent Variable = Change in Equity Income CEF Premium (Synchronous)				
Google Great Dep.	-0.022 (-3.35)	0.120	0.001 (0.26)	-0.013
Google Recession	-0.010 (-2.17)	0.047	0.002 (0.63)	-0.008
Google Bankruptcy	-0.004 (-0.54)	-0.009	0.004 (0.86)	-0.004
Lexis Great Dep.	-0.005 (-1.16)	0.005	0.001 (1.15)	0.004
Lexis Recession	-0.012 (-1.67)	0.023	-0.001 (-0.62)	-0.009
Lexis Bankruptcy	-0.014 (-2.99)	0.096	-0.000 (-0.35)	-0.012

Table 3.10: Changes in future closed end fund premia and lagged information sources

The table displays the coefficients and t-statistics (in parentheses) for univariate OLS regressions. The dependent variable is the change in closed end fund premium for a given fund class, as noted in the panel header. The independent variable varies by row and is the day-of-week-adjusted relative change in a Google Trends variable (see http://www.google.com/trends), or a Lexis/Nexis newspaper article count variable (see Lexis/Nexis Database). Independent variables are measured over the previous day relative to the dependent variable, and hence these regressions are predictive. We also report the adjusted R^2 for each regression, and we report results over two key subsamples. The first sample is the 2008 crisis, which begins on 9/15/2008 and ends on 12/31/2008. The pre-crisis period is chosen to be roughly the same length, and begins on 6/1/2008 and ends on 9/14/2008. All Google Trends variables and Lexis/Nexis article counts are based on the phrases "Great Depression" or "Recession" as noted in the first column. A relative change is equal to the survey value on day t, minus that on day t-1, scaled by the day t-1 value. Day of week adjustments are extracted by taking residuals from a regression of the raw relative change on day of week dummies.

	2008 Crisis (76 obs)		*Pre Crisis (73 obs)*	
Independent Variable	Coefficient (t statistic)	Adj. R^2	Coefficient (t statistic)	Adj. R^2
Panel A: Dependent Variable = Next Day Change in Corp Bond CEF Premium				
Google Great Dep.	-0.003 (-0.21)	-0.013	0.002 (0.53)	-0.010
Google Recession	0.001 (0.10)	-0.013	0.003 (0.86)	-0.004
Google Bankruptcy	-0.024 (-1.64)	0.022	-0.003 (-0.46)	-0.011
Lexis Great Dep.	-0.017 (-2.28)	0.053	-0.001 (-0.90)	-0.003
Lexis Recession	-0.032 (-2.25)	0.051	-0.001 (-0.20)	-0.013
Lexis Bankruptcy	-0.022 (-2.30)	0.054	-0.002 (-1.05)	0.002
Panel B: Dependent Variable = Next Day Change in Govt Bond CEF Premium				
Google Great Dep.	-0.008 (-1.33)	0.010	-0.003 (-0.59)	-0.009
Google Recession	-0.003 (-0.74)	-0.006	0.002 (0.65)	-0.008
Google Bankruptcy	-0.011 (-1.64)	0.022	-0.000 (-0.01)	-0.014
Lexis Great Dep.	-0.004 (-1.34)	0.010	-0.000 (-0.67)	-0.008
Lexis Recession	-0.009 (-1.34)	0.011	0.004 (1.86)	0.033
Lexis Bankruptcy	-0.008 (-1.84)	0.031	-0.002 (-0.93)	-0.002
Panel C: Dependent Variable = Next Day Change in Def Spread CEF Premium				
Google Great Dep.	0.005 (0.49)	-0.010	0.005 (1.10)	0.003
Google Recession	0.004 (0.56)	-0.009	0.001 (0.23)	-0.013
Google Bankruptcy	-0.013 (-1.17)	0.005	-0.003 (-0.46)	-0.011
Lexis Great Dep.	-0.012 (-2.17)	0.047	-0.000 (-0.26)	-0.013
Lexis Recession	-0.024 (-2.13)	0.045	-0.005 (-2.00)	0.040
Lexis Bankruptcy	-0.014 (-1.90)	0.034	-0.000 (-0.16)	-0.014
Panel D: Dependent Variable = Next Day Change in Growth+Inc. CEF Premium				
Google Great Dep.	-0.007 (-0.68)	-0.007	-0.007 (-1.66)	0.024
Google Recession	-0.001 (-0.20)	-0.013	0.002 (0.60)	-0.009
Google Bankruptcy	-0.028 (-2.69)	0.077	-0.000 (-0.09)	-0.014
Lexis Great Dep.	-0.009 (-1.74)	0.026	-0.001 (-1.59)	0.021
Lexis Recession	-0.024 (-2.36)	0.057	0.004 (1.46)	0.016
Lexis Bankruptcy	-0.020 (-3.03)	0.099	-0.000 (-0.16)	-0.014
Panel E: Dependent Variable = Next Day Change in Equity Income CEF Premium				
Google Great Dep.	-0.013 (-1.93)	0.035	-0.004 (-1.17)	0.005
Google Recession	-0.005 (-1.01)	0.000	0.002 (0.53)	-0.010
Google Bankruptcy	-0.021 (-2.90)	0.090	0.003 (0.82)	-0.005
Lexis Great Dep.	-0.006 (-1.54)	0.018	-0.000 (-0.57)	-0.009
Lexis Recession	-0.011 (-1.51)	0.017	0.002 (0.84)	-0.004
Lexis Bankruptcy	-0.013 (-2.78)	0.083	-0.002 (-1.41)	0.014

Table 3.11: Changes in future information sources and lagged changes in closed end fund premia

The table displays the coefficients and t-statistics (in parentheses) for univariate OLS regressions. The dependent variable is the change in a given information source as noted in the first column. The independent variable varies by panel and is the previous day's change in closed end fund premium for a given fund class, as noted in the panel header. The dependent variable information sources are the day-of-week-adjusted relative change in a Google Trends variable (see http://www.google.com/trends), or a Lexis/Nexis newspaper article count variable (see Lexis/Nexis Database). Independent variables measured over the previous day relative to the dependent variable, and hence these regressions are predictive. We also report the adjusted R^2 for each regression, and we report results over two key subsamples. The first sample is the 2008 crisis, which begins on 9/15/2008 and ends on 12/31/2008. The pre-crisis period is chosen to be roughly the same length, and begins on 6/1/2008 and ends on 9/14/2008. All Google Trends variables and Lexis/Nexis article counts are based on the phrases "Great Depression" or "Recession" as noted in the first column. A relative change is equal to the survey value on day t, minus that on day t-1, scaled by the day t-1 value. Day of week adjustments are extracted by taking residuals from a regression of the raw relative change on day of week dummies.

	2008 Crisis (76 obs)		***Pre Crisis (73 obs)***	
Dependent Variable	Coefficient (t statistic)	Adj. R^2	Coefficient (t statistic)	Adj. R^2
Panel A: Independent Variable = Previous Day Change in Corp Bond CEF Premium				
Google Great Dep.	-2.014 (-2.34)	0.057	-5.889 (-1.49)	0.016
Google Recession	-1.579 (-1.03)	0.001	-2.028 (-0.59)	-0.009
Google Bankruptcy	0.268 (0.46)	-0.011	-2.564 (-0.54)	-0.010
Lexis Great Dep.	-1.082 (-0.63)	-0.008	4.747 (0.20)	-0.014
Lexis Recession	-0.500 (-0.55)	-0.010	-11.464 (-2.11)	0.046
Lexis Bankruptcy	-2.086 (-1.85)	0.032	-1.175 (-0.13)	-0.014
Panel B: Independent Variable = Previous Day Change in Govt Bond CEF Premium				
Google Great Dep.	-2.752 (-1.39)	0.013	-2.118 (-0.51)	-0.010
Google Recession	4.162 (1.22)	0.007	-4.236 (-1.20)	0.006
Google Bankruptcy	3.037 (2.43)	0.062	-1.888 (-0.38)	-0.012
Lexis Great Dep.	-6.829 (-1.80)	0.029	39.622 (1.60)	0.021
Lexis Recession	1.004 (0.49)	-0.010	-6.453 (-1.12)	0.003
Lexis Bankruptcy	-1.682 (-0.65)	-0.008	11.060 (1.17)	0.005
Panel C: Independent Variable = Previous Day Change in Def Spread CEF Premium				
Google Great Dep.	-2.490 (-2.21)	0.050	-3.940 (-0.99)	-0.000
Google Recession	-4.091 (-2.10)	0.044	1.873 (0.55)	-0.010
Google Bankruptcy	-0.574 (-0.76)	-0.006	-0.826 (-0.17)	-0.014
Lexis Great Dep.	0.474 (0.21)	-0.013	-31.738 (-1.33)	0.011
Lexis Recession	-1.190 (-1.00)	0.000	-5.523 (-0.99)	-0.000
Lexis Bankruptcy	-2.973 (-2.03)	0.041	-11.359 (-1.26)	0.008
Panel D: Independent Variable = Previous Day Change in Growth+Inc. CEF Premium				
Google Great Dep.	-2.614 (-2.19)	0.049	-3.412 (-0.84)	-0.004
Google Recession	0.157 (0.07)	-0.014	-1.183 (-0.34)	-0.012
Google Bankruptcy	0.174 (0.22)	-0.013	-2.475 (-0.51)	-0.010
Lexis Great Dep.	-0.360 (-0.15)	-0.013	16.155 (0.66)	-0.008
Lexis Recession	0.348 (0.27)	-0.013	-3.338 (-0.59)	-0.009
Lexis Bankruptcy	-2.098 (-1.34)	0.010	-7.719 (-0.83)	-0.004
Panel E: Independent Variable = Previous Day Change in Equity Income CEF Premium				
Google Great Dep.	-2.322 (-1.36)	0.011	1.692 (0.32)	-0.013
Google Recession	5.432 (1.86)	0.032	4.432 (0.99)	-0.000
Google Bankruptcy	0.633 (0.56)	-0.009	0.458 (0.07)	-0.014
Lexis Great Dep.	-1.013 (-0.30)	-0.012	-3.928 (-0.12)	-0.014
Lexis Recession	1.461 (0.82)	-0.004	-3.591 (-0.49)	-0.011
Lexis Bankruptcy	-0.933 (-0.42)	-0.011	-13.689 (-1.15)	0.005

Table 3.12: Changes in closed end fund premia and market betas

The table displays the coefficients and t-statistics for univariate OLS regressions. The dependent variable is the daily change in the Closed End Fund premium by category as noted in the first column. The independent variable is the return on the CRSP value weighted market index less the riskless rate (Panel A), or the three Fama-French factors plus momentum (Panel B). The independent variable is measured over the same one day period during which the dependent variable is measured. Hence, all regressions are strictly associative and are aimed at computing risk exposures, and are not predictive. We also report the adjusted R^2 for each regression, and we report results over three key subsamples. The first sample is the 2008 crisis, which begins on 9/15/2008 and ends on 12/31/2008. The pre-crisis period is chosen to be roughly the same length, and begins on 6/1/2008 and ends on 9/14/2008. The "Other" sample includes all observations from 1/1/2000 to 5/31/2008 (the Govt. Bond CEF is an exception as data for this category first becomes available on 10/14/2003).

Closed End Fund Premium	Period	MKT	t-MKT	HML	t-HML	SMB	t-SMB	UMD	t-UMD	Adj. R^2
					Panel A: Market Model					
Corp. Bond	2008 Crisis	0.563	8.826							0.506
Corp. Bond	Pre Crisis	0.240	5.407							0.282
Corp. Bond	Other	0.191	14.681							0.092
Govt. Bond	2008 Crisis	0.175	4.971							0.240
Govt. Bond	Pre Crisis	0.205	4.621							0.220
Govt. Bond	Other	0.119	3.907							0.012
Default Spr.	2008 Crisis	0.388	7.226							0.406
Default Spr.	Pre Crisis	0.035	0.665							-0.008
Default Spr.	Other	0.068	2.045							0.003
Growth+Income	2008 Crisis	0.344	6.524							0.357
Growth+Income	Pre Crisis	0.061	1.192							0.006
Growth+Income	Other	-0.079	-5.377							0.013
Equity Income	2008 Crisis	0.058	1.252							0.008
Equity Income	Pre Crisis	-0.112	-2.947							0.096
Equity Income	Other	-0.152	-9.425							0.040
					Panel B: FF+UMD 4 Factor Model					
Corp. Bond	2008 Crisis	0.523	4.991	0.264	0.976	-0.121	-0.631	0.055	0.230	0.497
Corp. Bond	Pre Crisis	0.137	2.855	0.280	3.040	0.174	1.928	0.024	0.459	0.458
Corp. Bond	Other	0.244	15.739	0.212	7.206	0.031	1.180	-0.055	-3.426	0.117
Govt. Bond	2008 Crisis	0.101	1.861	0.038	0.269	-0.337	-3.406	-0.075	-0.601	0.323
Govt. Bond	Pre Crisis	0.159	2.934	0.201	1.937	0.103	1.018	0.049	0.854	0.252
Govt. Bond	Other	0.114	3.431	0.098	1.162	0.049	0.797	-0.006	-0.138	0.011
Default Spr.	2008 Crisis	0.422	4.828	0.227	1.003	0.216	1.355	0.130	0.648	0.404
Default Spr.	Pre Crisis	-0.022	-0.332	0.079	0.632	0.070	0.575	-0.026	-0.370	-0.000
Default Spr.	Other	0.096	2.681	0.089	0.973	-0.118	-1.783	0.015	0.332	0.004
Growth+Income	2008 Crisis	0.222	2.626	0.166	0.757	-0.198	-1.282	-0.167	-0.856	0.372
Growth+Income	Pre Crisis	-0.113	-2.307	0.322	3.423	0.144	1.559	-0.037	-0.703	0.411
Growth+Income	Other	-0.060	-3.409	0.079	2.328	0.035	1.164	-0.020	-1.105	0.015
Equity Income	2008 Crisis	-0.127	-1.767	-0.085	-0.459	-0.263	-2.002	-0.419	-2.535	0.108
Equity Income	Pre Crisis	-0.210	-4.854	0.185	2.238	-0.059	-0.728	-0.016	-0.346	0.242
Equity Income	Other	-0.150	-7.711	0.043	1.158	0.031	0.919	-0.058	-2.875	0.043

Table 3.13: Key Dates and returns versus financial constraints

The table displays the coefficients and *t*-statistics (in parentheses) for cross sectional OLS regressions in which the single day stock return (on a key date) is the dependent variable. All regressions include controls for the Fama-French 48 industries, and all continuous independent variables are winsorized at 1% level. The independent variables include the Kaplan and Zingales (1997) financial constraints index (based on a fitted linear function of cashflow/assets, dividend payments/assets, cash balances/lagged assets, book leverage, and Tobin's Q). We also consider seven proxies for financial constraints: Firm age defined as 2009 minus the first year the firm has positive assets and sales, the dividend Payout Ratio (dividends/earnings), a long-term rated dummy (based on S&P Domestic Long-Term Issuer Credit Rating in 2008), a short-term rated dummy, a long-term investment grade dummy (long-term rating of BBB or better), a short-term investment grade dummy (short-term rating of A1), and a long-term rating level (5=AAA, 4=AA, 3=A, 2=BBB, 1=B, 0=Otherwise). We also include the following controls: capital expenditures/assets, Tobin's Q, retained earnings/assets, market model beta (calculated using 100 daily returns between 10 April 2008 and 31 August 2008), a merger dummy (based on mergers between January 1, 2006 and August 31, 2008), a cash merger dummy (consideration must be at least 51% cash), and average August turnover (based on August 2008).

Independent Variable	09/15/2008 (Lehman)	09/29/2008 (TARP Rejected)	10/9/2008 (S&P –6.62%)	10/13/2008 (Cap. Infusion)
Size	-0.002	-0.007	0.000	0.006
	(-2.780)	(-8.032)	(0.357)	(4.078)
Beta	-0.007	-0.009	-0.020	-0.008
	(-4.225)	(-3.964)	(-7.631)	(-1.847)
Age	0.000	0.000	-0.000	-0.000
	(1.621)	(4.213)	(-0.124)	(-2.810)
KZ Index	-0.001	-0.001	-0.000	0.001
	(-1.653)	(-0.966)	(-0.345)	(0.973)
Long Term Rated	-0.001	-0.000	-0.004	0.003
	(-0.571)	(-0.162)	(-1.135)	(0.547)
LT Investment Grade	0.003	0.008	0.007	-0.007
	(0.954)	(2.345)	(1.710)	(-1.200)
Short Term Rated	0.004	0.003	-0.003	-0.007
	(1.267)	(0.983)	(-0.621)	(-1.090)
ST Investment Grade	0.004	0.003	-0.004	-0.008
	(1.577)	(0.873)	(-1.056)	(-1.190)
Capex to Assets	-0.066	-0.060	-0.059	0.087
	(-5.651)	(-2.519)	(-2.849)	(3.323)
Tobin's Q	-0.000	-0.003	0.002	0.006
	(-0.110)	(-3.326)	(2.190)	(4.431)
Avg. August Turnover	-0.001	-0.001	-0.000	0.000
	(-5.128)	(-6.201)	(-0.535)	(0.959)
Retained Earnings to Assets	0.003	0.003	0.001	-0.005
	(2.796)	(1.573)	(0.552)	(-1.977)
Merger Dummy	-0.001	-0.012	-0.001	0.005
	(-0.341)	(-2.131)	(-0.255)	(0.680)
Cash Merger Dummy	0.001	0.016	-0.001	-0.005
	(0.317)	(2.660)	(-0.117)	(-0.635)
Return on 29 September				-0.376
				(-8.039)
Return on 9 October				-0.253
				(-6.318)
Constant	-0.016	-0.025	-0.051	0.026
	(-1.617)	(-0.838)	(-2.577)	(0.762)
Number of observations	2,427	2,387	2,150	2,212
Adjusted R2	0.256	0.271	0.075	0.315

Table 3.14: Key Dates and returns versus financial constraint components

The table displays the coefficients and t-statistics (in parentheses) for cross sectional OLS regressions in which the single day stock return (on a key date) is the dependent variable. All regressions include controls for the Fama-French 48 industries, and all continuous independent variables are winsorized at 1% level. The independent variables include the variables included in the Kaplan and Zingales (1997) financial constraints index, but included separately: cashflow/assets, dividend payments/assets, cash balances/lagged assets, book leverage, and Tobin's Q. We also consider seven proxies for financial constraints: Firm age defined as 2009 minus the first year the firm has positive assets and sales, the dividend Payout Ratio (dividends/earnings), a long-term rated dummy (based on S&P Domestic Long-Term Issuer Credit Rating in 2008), a short-term rated dummy, a long-term investment grade dummy (long-term rating of BBB or better), a short-term investment grade dummy (short-term rating of A1), and a long-term rating level (5=AAA, 4=AA, 3=A, 2=BBB, 1=B, 0=Otherwise). We also include the following controls: capital expenditures/assets, Tobin's Q, retained earnings/assets, market model beta (calculated using 100 daily returns between 10 April 2008 and 31 August 2008), a merger dummy (based on mergers between January 1, 2006 and August 31, 2008), a cash merger dummy (consideration must be at least 51% cash), and average August turnover (based on August 2008).

Independent Variable	09/15/2008 (Lehman)	09/29/2008 (TARP Rejected)	10/9/2008 (S&P –6.62%)	10/13/2008 (Cap. Infusion)
Size	-0.001	-0.006	0.001	0.005
	(-2.359)	(-6.517)	(1.419)	(3.098)
Beta	-0.007	-0.010	-0.021	-0.011
	(-4.129)	(-4.282)	(-7.431)	(-2.482)
Age	0.000	0.000	0.000	-0.000
	(1.022)	(3.523)	(0.006)	(-2.378)
Cash Flow to Assets	0.010	0.029	0.024	-0.047
	(0.665)	(1.202)	(1.004)	(-1.288)
Cash Balances to Assets	-0.002	-0.003	0.024	0.014
	(-0.453)	(-0.435)	(3.002)	(1.219)
Leverage	-0.004	-0.001	-0.001	0.004
	(-0.920)	(-0.227)	(-0.104)	(0.538)
Dividend Payout Ratio	0.001	0.002	-0.003	-0.004
	(0.522)	(1.021)	(-0.805)	(-1.046)
Long Term Rated	-0.002	-0.001	-0.004	0.005
	(-0.953)	(-0.385)	(-1.002)	(0.949)
LT Investment Grade	0.002	0.005	0.003	-0.007
	(0.662)	(1.432)	(0.775)	(-1.059)
Short Term Rated	0.005	0.003	-0.001	-0.007
	(1.546)	(0.836)	(-0.207)	(-1.124)
ST Investment Grade	0.003	0.001	-0.005	-0.004
	(1.199)	(0.246)	(-1.252)	(-0.512)
Capex to Assets	-0.093	-0.087	-0.045	0.100
	(-7.270)	(-5.513)	(-2.036)	(3.671)
Tobin's Q	-0.001	-0.004	0.001	0.006
	(-0.762)	(-3.848)	(1.333)	(3.538)
Avg. August Turnover	-0.001	-0.001	-0.000	0.000
	(-3.896)	(-5.646)	(-0.264)	(1.578)
Retained Earnings to Assets	0.003	0.009	-0.000	-0.004
	(2.029)	(2.297)	(-0.089)	(-0.994)
Merger Dummy	-0.002	-0.014	0.004	0.003
	(-0.725)	(-2.420)	(0.687)	(0.422)
Cash Merger Dummy	0.002	0.018	-0.003	-0.008
	(0.479)	(2.915)	(-0.446)	(-0.889)
Return on 29 September				-0.445
				(-8.656)
Return on 9 October				-0.188
				(-4.529)
Constant	-0.015	-0.050	-0.074	0.032
	(-1.238)	(-1.318)	(-3.413)	(0.718)
Number of observations	2,034	2,004	1,864	1,893
Adjusted R2	0.277	0.296	0.081	0.327

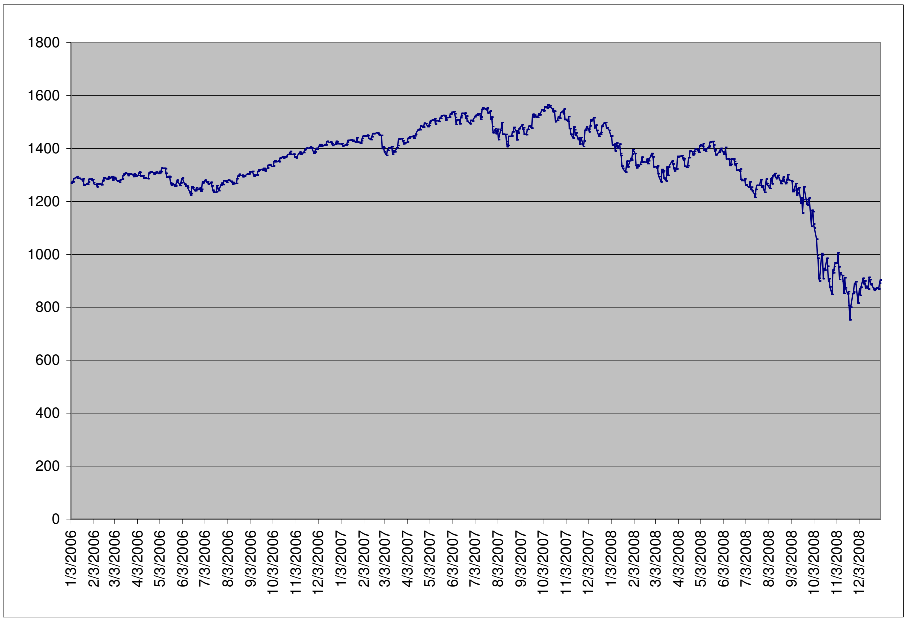


Figure 3.1: S&P500 Index Level

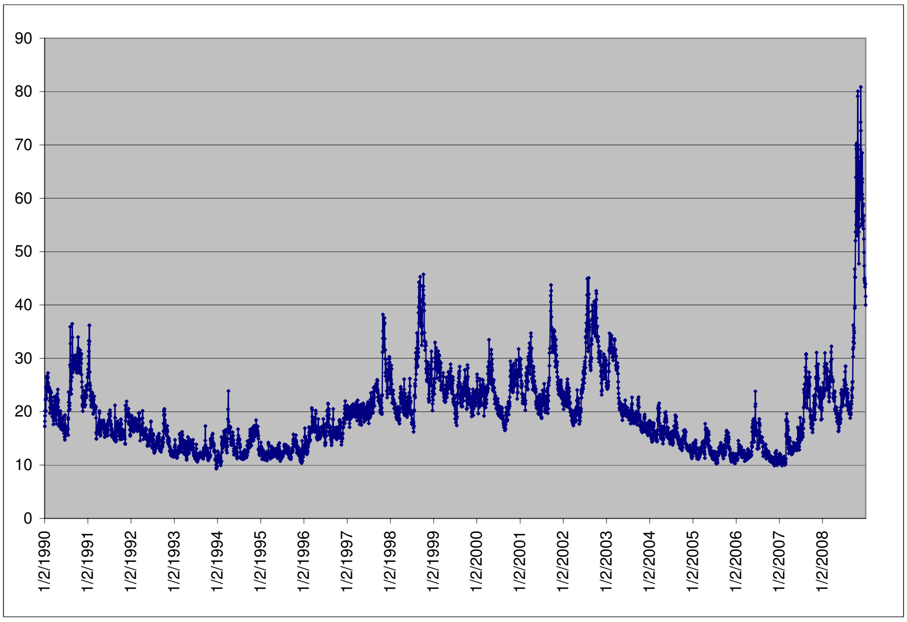


Figure 3.2: CBOE Volatility Index Level

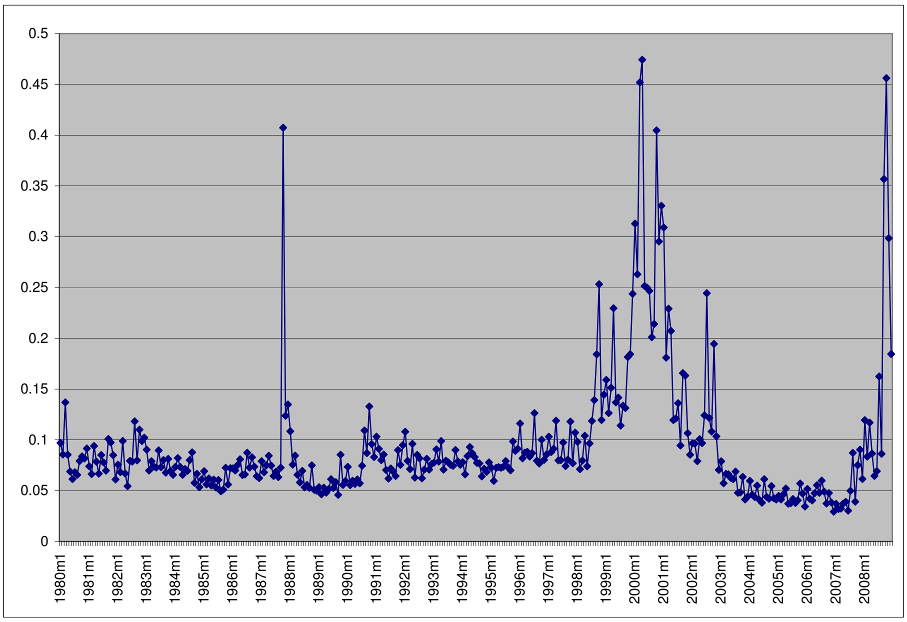


Figure 3.3: CLMX Idiosyncratic Volatility

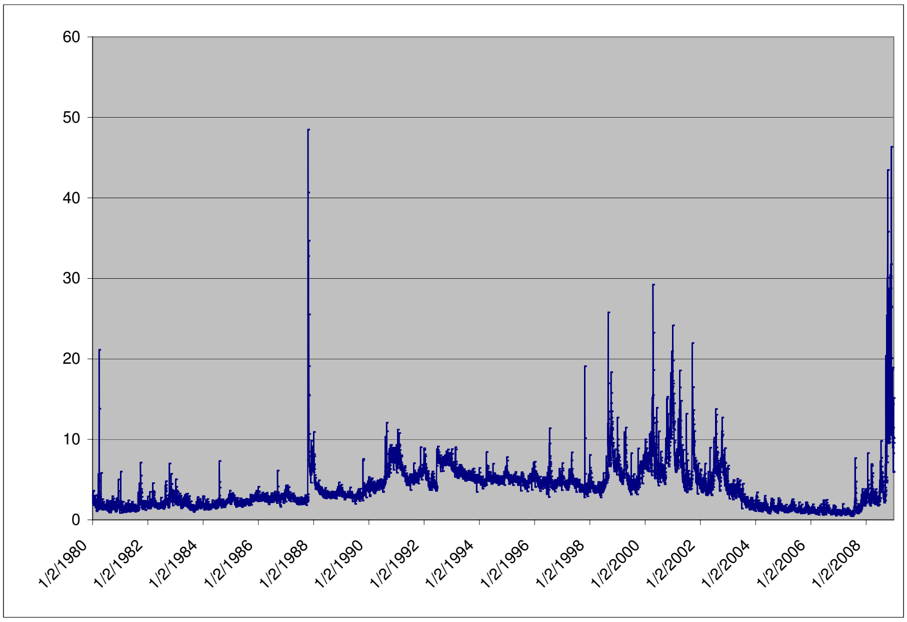


Figure 3.4: Percent of Stocks with at least 10% Movement in a Single Day

Figure 3.5: Average CEF Discounts: All Categories

Figure 3.6: CEF Discounts, Equity Funds

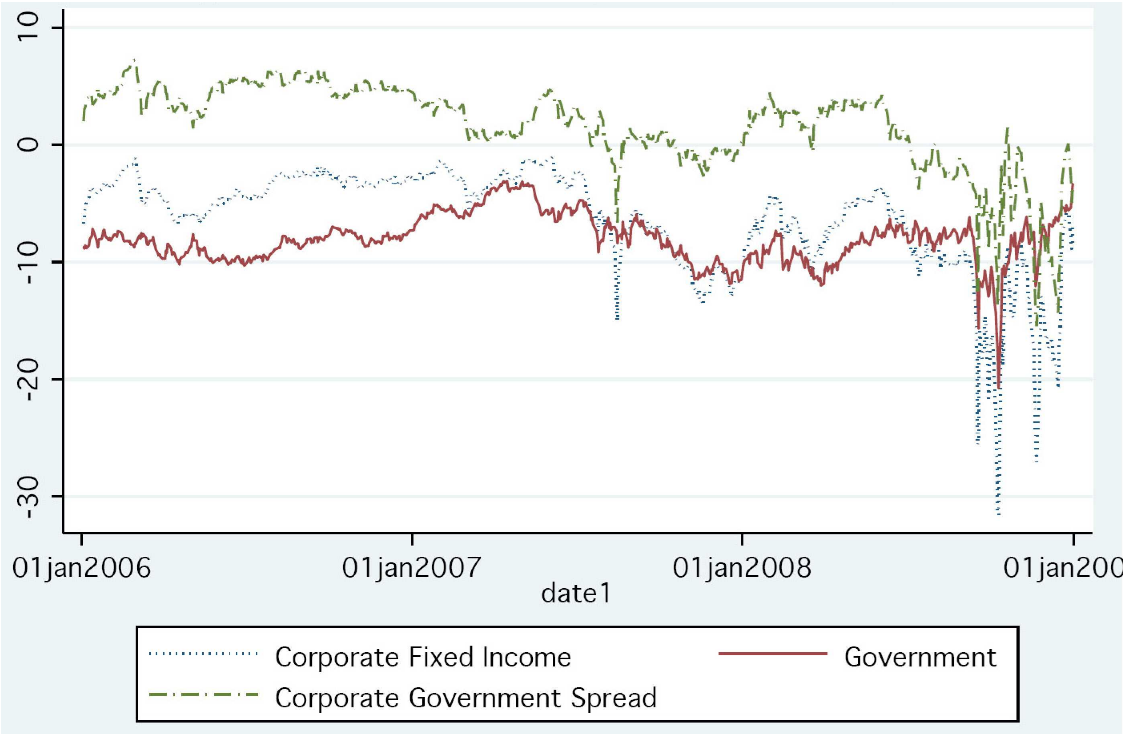


Figure 3.7: CEF Discounts, Bond Funds and Spread

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