2015

Credit Ratings and Firm Litigation Risk

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SUBMITTED TO

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For

SENIOR THESIS

Fall 2014

November 25, 2014

Abstract

This paper looks at whether firms' credit ratings are negatively affected by litigation risk after controlling for known factors that affect credit ratings. The conventional wisdom is that litigation risk and credit ratings have an inverse relationship. However, my hypothesis is that the inverse relationship will not be stable if the model of credit ratings has taken other factors into account. The methodology first constructs a model of litigation risk, and then regress the credit ratings on the measurement of litigation risk. Previous empirical research on litigation risk measurement uses industry proxies as indicators for litigation risk. In this paper, I include firm characteristics and the Beneish M-score (a determinant for earnings manipulation) in addition to the industry proxy to construct an alternative model measuring litigation risk. I find that supplementing the Francis, Philbrick and Schipper (1994a, b; hereafter FPS) industry proxy with measures of firm characteristics improves predictive ability. In the model of credit ratings, I find that the change of litigation risk has a negative correlation with the credit ratings. However, the negative coefficient on the change of litigation risk changes to a positive one after controlling for other variables such as firm size, return on asset, and interest coverage ratio. This finding provides support for the hypothesis that the negative correlation between the credit ratings and litigation risk is not stable. This suggests that credit ratings may not incorporate litigation risk specifically although litigation can lead to firms' financial damage and reputation crisis. However, the negative coefficient on the change of litigation risk remains unchanged when I control for the year fixed effects. I also find a negative correlation between the year 2007 and credit ratings due to financial crisis. The results are not conclusive given the likely simultaneous determination of litigation risk and credit ratings.

Acknowledgements

I gratefully acknowledge the support and guidance of Professor Ananda Ganguly, the Morcos F. Massoud Associate Professor of Accounting and George R. Roberts Fellow at Claremont McKenna College, and most especially my thesis reader. I also want to recognize the help and contribution of Professor Janet Smith, who has provided insightful suggestions and recommendations in the course of Seminar in Research Methods. Without their careful supervision and continuous encouragement, this thesis would not have been possible.

Also, I want to extend my deepest thanks to my parents and friends for listening to complains, offering feedback, and just being there behind me throughout the whole semester and always. The mental support from all these great people has made the completion of this paper faster and nicer.

Finally, my thanks also go out to Claremont McKenna College (CMC), a wonderful liberal arts college that has granted me academic resources, nice facilities, and great snack time if I happen to stay up late in the computer lab. The education and experience that I have gained at CMC is incomparable to anywhere else imaginable.

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Credit Ratings and Firm Litigation Risk

I. Introduction

In this paper, I examine whether firms' credit ratings are negatively affected by litigation risk if other factors such as firm characteristics are included in the model. I first construct a model of litigation risk, and then use the measurement as a variable in the regression of credit ratings. My paper contributes to the literature in two ways. First, I construct a new model to measure the litigation risk by including variables such as Francis, Philbrick and Schipper (1994a, b; hereafter FPS) industry proxy, firm size indicators, the Beneish M-score and firm characteristics. Second, I use the model of litigation risk to obtain the estimated parameters on independent variables to measure the level of litigation risk, which is then used in the model of credit ratings to test the negative correlation between firms' litigation risk and credit ratings. Since I get a highly significant positive coefficient on the level of litigation risk, I also include the change of litigation risk to test for consistency of correlation, and the litigation risk squared to test for whether there is a convergence of the correlation in the long-term, controlling for other related firm characteristics that affect credit ratings.

In the model of litigation risk, I find that supplementing the FPS industry proxy with measures of firm characteristics improves predictive ability according to the increase in the Pseudo-R-Squared. In the model of credit ratings, I find that the change of litigation risk has a negative correlation with the credit ratings. However, the negative coefficient on the change of litigation risk changes to a positive one after controlling for other variables such as firm size, return on asset, and interest coverage ratio. This finding provides support for the hypothesis that the negative correlation between the credit ratings and litigation risk is not stable. This suggests

that credit ratings may not incorporate litigation risk specifically although litigation can lead to firms' financial damage and reputation crisis. However, I find that the negative correlation between the change in litigation risk and credit ratings maintains the same after controlling for the year fixed effects. Also, the year 2007 has a negative association with firms' credit ratings, which could be due to the financial crisis in 2007. The results are not conclusive given the likely simultaneous determination of litigation risk and credit ratings.

Section II provides a literature review that discusses both litigation risk and credit ratings. Section III introduces the research question and the methodology constructed in this paper. Section IV details the sample and provides descriptive statistics of the data. Section V presents the findings from the models and results of regressions. This section also includes a discussion of endogeneity, which could have influenced the regression results. Section VI concludes.

II. Literature Review

a. Discussion of Litigation Risk

Previous study defines the litigation risk as the risk of securities class action lawsuits (Skinner, 1994). According to Skinner, firms' litigation risk generally is resulted from violations of Rule 10b-5. The components of a Rule 10b-5 violation are "(1) a misstatement or omission of (2) a material fact (3) made with intent (4) that the plaintiff justifiably relied on (5) causing injury in connection with the purchase or sale of securities" (Skinner, 1994). Since fraud such as an omission of a statement item or a misrepresentation of financial statements is the major reasons for firms' involvement in lawsuits, I provide below some meaningful findings from other empirical research about the relationship between firms' litigation risk and earnings disclosures.

By examining the timeliness of total earnings news through the evolution of the consensus analyst forecast, scholars discover that timely revelation of fraudulent earnings news deter litigation for both settled and dismissed lawsuits (Donelson et al., 2012). For example, firms which reveal fraudulent earnings news early will lower the likelihood of litigation. Other literature that investigates firm disclosure and litigation risk emphasizes the internal relationship between these two. Donelson also finds that disclosure endogenously leads to litigation against firms. By using simultaneous equations methodology, Donelson was able to show that (1) firms with higher litigation risk are more likely to make early disclosures about impending earnings disappointments (preemption effect), and (2) such disclosures lower the expected lawsuit probability (Field et al., 2005).

Later research has focused more on other factors that potentially affect firms' litigation risk when constructing models of litigation risk measurement. Some studies use a variant of an industry membership called FPS proxy created by Francis, Philbrick and Schipper (1994a, b), who draw firms from four risky industries to study the relationship between litigation and disclosure; these industries are biotech, computer, electronics, and retail industry. For example, many studies use some form of dummy variable for membership in the FPS industries to measure litigation risk (e.g. Brown and Tucker, 2011; Donelson et al., 2010; Hribar et al., 2010). However, Kim and Skinner (2012) point out that the credibility and accuracy of a fixed industry proxy are not convincing since litigation rates in particular industries vary over time. If the changes in the wealth of different industries happen because of the volatile macroeconomic environment, litigation risk is not likely to be sustainable for particular industries or firms. Instead, it is more likely that economic downturns will cause losses in value that vary across industries and through time, and that these losses will lead to litigation (Kim, Skinner, 2012).

This means that the FPS industry proxy should not be the only variable to measure litigation risk since it is hard to identify and categorize firms and industries that always have higher possibility of litigation risk.

Other than an industry membership proxy, there are firm and industry characteristics that make particular firms and industries generally more likely to be involved in litigation (e.g. Kim, Skinner, 2012). Some models of litigation risk include firm characteristics such as market capitalization, stock volatility and stock turnover based on the hypothesis that fraud in Rule 10b-5 litigation depends on the size of the change in stock price, the magnitude of trading volume during the period of the susceptible fraud, and the stock price of public listed firms (Jones and Weingram, 1996a). Jones and Weingram (1996a) also find that a bigger amount of financial damages makes firms more likely to become a target for plaintiffs' attorneys, which indicates that market value is strongly associated with litigation risk as well. Studies interpret a positive correlation between equity-based managerial motivations and the probability of a lawsuit (such as for financial statement misrepresentation and fraud) as evidence that equity-based compensation leads to misbehaviors of the administrative bodies (Low 2006). Further research find that firms that operate in high litigation risk environments provide more equity-based compensation to their CEOs (Jayaraman, Milbourn, 2009). CEOs who have performance-based compensation have incentives to be involved in aggressive financial reporting and other types of opportunistic behavior that increases likelihood of lawsuits (Dechow et al., 1996). Previous research also includes several proxies for the nature of the firms' investment opportunities, such as Working Capital, Market-to-Book ratio, Research &Development intensity, and ratio of Property Plant & Equipment to total assets, which affect corporate policies such as executive compensation, capital structure, and payout policy that could affect litigation risk (Smith and

Watts, 1992). Kim and Skinner (2012) also include the ratio of goodwill to assets to measure the extent of the firms' Merger & Acquisition activities, which likely increases litigation risk.

While corporate governance and insider trading variables are also possible indicators of the optimism of management that increase firms' exposure to litigation, there are problems and limitations to include these variables in litigation risk measurement. First, it is not clear whether prior securities litigation is caused by opportunism in the management team instead of being driven by unexpectedly negative outcomes. While it is obvious that extreme forms of opportunism such as earnings management lead to litigation, these lawsuits are from a relatively small part of the population of securities class action suits. Second, corporate governance and insider trading data are not fully disclosed and publicly available compared to data on firm characteristics which constrains sample sizes and perhaps leads to a biased sample selection (Kim, Skinner, 2012).

b. Discussion of Credit Ratings from Credit Agencies

Major credit rating agencies, including Fitch, Moody's, and Standard & Poor's have become an important subject of investigation and legislation given their complex structure of rating systems and conflict of interest, which are criticized by many regulative bodies and legislative bodies (Zhou, Kumar, 2012). For example, rating agencies have been criticized for their credit rating analysis and organization administration after the scandal of Enron and the mortgage crisis during the financial distress in the early 2000s. Zhou and Kumar (2012) state that the First Amendment rights to freedom of speech are frequently used for credit agencies to protect themselves against civil liability for their ratings. As information intermediaries on behalf of bondholders, credit agencies collect and process issuers' financial information, as well as

produce estimates of default risk in the form of ratings (Gorton, Winton, 2003). Since the rating agencies perform undisclosed investigations and are paid by bond issuers instead of investors, many scholars are concerned about the possibility that importance of reputation, litigation and competition will be incentives for a conflict of interest (Kraft, 2008). Kraft gives the following examples in her paper: reputational concerns could be a motivation for rating agencies to expend effort to learn more in a setting in which the agency optimally chooses coarse ratings without sufficient evidence; the impact of legal liability can lead to "misrating" on the rating agency's behavior; and the higher legal liability induces the rating agency to reduce the number of ratings. If the legal liability increases asymmetrically, which means that higher legal liability only for ratings deemed later to be too high, the rating agency would then increase its downward bias in ratings to respond (Goel, Thakor, 2010).

III. Methodology and Research Question

a. Research Question

Given the conflict of interests and the "black box" of agencies' rating systems, I want to investigate the correlation between firms' litigation risk and credit ratings through a regression that controls for other firm characteristics. There is little research that has done an explicit analysis of the correlation between firms' litigation risk and credit ratings. If we assume rating agencies are efficient information processing intermediaries, the conventional wisdom is that higher litigation risk will result in a lower credit rating since a higher litigation risk increases the probability of lawsuits, which either increases financial damage or decreases expected return on the business operations of firms. However, the negative correlation between litigation risk and

credit ratings will not be stable if credit agencies only use a rough indicator of litigation risk which is easily affected by other factors considered in the rating system. Also, credit agencies may only put little weight on litigation risk relative to other factors influencing the rating result. Thus, the litigation risk will not be negatively correlated with the credit rating or the correlation may not be statistically significant if the model includes other known factors that affect credit ratings.

b. Measuring Litigation Risk

To construct a model of litigation risk, I include FPS industry proxy, firm characteristics, and firm size indicators as variables in the measurement. Since previous studies find that the firms' earning disclosure is correlated with litigation risk, I also include the Beneish M-score in the model of litigation risk, which measures the likelihood of earnings manipulation. I will explain the rationale for using each variable in detail in the following paragraphs.

The model of litigation risk is:

$$Sued=\beta0+\beta1(FPSPROXY)+\beta2(MKVALT)+\beta3(BKMK)+\beta4(WC)+\beta5(FINRK)+\beta6(VOLATILITY)+\beta7(PE)+\beta8(GP)+\beta9(RDINTEN)+\beta10(BMSCORE)+\beta11(BIG)+\beta12(SMALL)+\varepsilon$$

A number of papers use some variant of the FPS industry proxy for litigation risk. For example, Field (2005) uses industry membership to measure litigation risk but develops their own measure by looking at industry litigation rates during the period before the sample test period (1988-1994) and sorting industries according to whether they had litigation rates above or below the median. In my paper, I use a dummy variable for membership in the FPS industry to measure litigation risk.

Fama and French (1992) use market capitalization and book-to-market ratios to explain cross-sectional variation on market returns. In my paper, I use these two variables to indicate the market risk, which is defined as "the risk of losses in on- and off-balance sheet positions arising from movements in market prices" (Fama, French, 1992). The market capitalization is measured as the total market value (MKVALT). Book-to-market equity ratio is measured as the book value per share (BKVLPS) multiplied by common shares outstanding (CSHO), then divided by the market value. I also included the working capital, which was calculated as the difference between the total current asset (ACT) and the total current liability (LCT).

Previous literature argues that high assets and investment in working capital increase rating change (Sufi, 2009). Thus, I include the level of working capital measured as the difference between the total current assets and the total current liabilities. I also include the indicator of financial risk, stock volatility and price/earnings ratio to predict the firm's future performance. The PP&E over total assets ratio indicates the fixed cost and the risk of financial distress for a company, which predicts the information of financial risk. I also include stock volatility, calculated by the difference between the annual closing price (PRCC_F) at time (t) and the annual closing price (PRCC_F) at time (t-1) divided by the annual closing price (PRCC_F) at time (t-1). The stock price over earnings ratio was calculated by dividing the annual closing price (PRCC_F) over basic earnings per share excluding extraordinary items (EPSPX). The stock volatility and P/E ratio indicate the satisfaction of investors and shareholders, decreasing the leverage of a company. These three factors thus reduce agency risk and information risk.

Cantor and Packer (1995) contend that the higher the profit, the lower the likelihood of financial distress and default, which leads to firms' higher ratings. Thus, I include the gross profit (GP) in my model. Firms which practice R&D activities reduce their risk of debt

significantly. Previous literature also shows that goodwill over asset ratio indicates the likelihood of a firm's future involvement in a merger and acquisition (Kim, Skinner, 2012). Thus I include the research and development expense (XRD) over total assets ratio, which indicates the stability of firms' corporate governance. I also include two binary variables as indicators for big firms and small firms since I think the top 25% and the bottom 25% of firms (in terms of firm size) will be expected to have an effect on the level of litigation risk.

Finally, I include the Beneish M-Score which looks to determine whether a company has manipulated its earnings. This model consists of eight ratios that capture either financial statement distortions resulted from earnings manipulation (DSR, AQI, DEPI and Accruals) or indicate a predisposition towards engagement in earnings manipulation (GMI, SGI, SGAI, LEVI). The predictive ratios focusing on financial statement distortions capture unusual accumulations in receivables (DSR, indicative of revenue inflation), unusual expense capitalization and declines in depreciation (AQI and DEPI, both indicative of expense deflation), and the extent to which reported accounting profits are supported by cash profits (Accruals).The Beneish M-Score has been shown to correctly identify 76% of manipulators on an out of sample basis (Beneish, 1999).

The original M-Score formula is:

M-Score = -4.84 + 0.92*DSRI + 0.528*GMI + 0.404*AQI + 0.892*SGI + 0.115*DEPI – 0.172*SGAI + 4.679*TATA – 0.327*LVGI

Where,

Factor	Name	Formula	Basis
DSRI	Days' Sales in Receivables	Receivables / Total Sales	This Year /

	Index		Last Year
GMI	Gross Margin Index	Gross Profit / Total Sales	Last Year / This Year
AQI	Asset Quality Index	(Non-Current Assets – PP&E) / Total Assets	This Year / Last Year
SGI	Sales Growth Index	Total Sales	This Year / Last Year
DEPI	Depreciation Index	Depreciation / (Depreciation + Net PP&E)	Last Year / This Year
SGAI	SG&A Expense Index	SG&A / Revenues	This Year / Last Year
TATA	Total Accruals to Total Assets	(Working Capital – Cash) – Depreciation/ Total Assets	This Year / Last Year
LVGI	Leverage Index	Total Debt / Total Assets	This Year / Last Year

The total sale is measured as the average net sales. The total debt is measured as the sum of debt in current liabilities and the total long-term debt. In this original model, Beneish found that firms that scored greater than -2.22 were more likely to be earnings manipulators.

Dependent Variable

Regarding the dependent variable, I include a binary variable to indicate if the firm has been involved in a lawsuit since 1995. I obtained data on filings of the *Securities Class Action Clearinghouse* (SCAC). The SCAC provides detailed information relating to the prosecution, defense, and settlement of federal class action securities fraud litigation. The SCAC team maintains a Filings database of more than 3,800 securities class action lawsuits filed since the passage of the Private Securities Litigation Reform Act of 1995. The database has concentrated resources on the data gathering methodologies. The SCAC does not track lawsuits filed in state

court where there is no parallel federal civil class action, nor does it track SEC enforcement proceedings when there is no parallel federal civil class action (SCAC website).

c. Measuring the Relationship between Credit Ratings and Litigation Risk

After constructing a model of litigation risk, I estimate the firms' predicted litigation risk over the time period given the coefficients and constant that I find in the regression. Then I calculate the difference in litigation risk between the first year recorded and the last year recorded for each firm in sample. Since the regression of credit ratings on the predicted litigation risk finds a highly significant positive coefficient on the independent variable, I also include the change of litigation risk from the previous year to the current year to see if the positive correlation still exists. Another independent variable is the litigation risk squared since I want to test if there is a convergence of the correlation in the long-term. I use the current credit ratings from Standard & Poor Quality Ratings on the CRSP/Compustat merged database.

The model of credit ratings is:

$$Ratings=\beta0+\beta1\ (LITIGATIONR) +\beta2\ (CHANGELITIGATIONR) + \beta3\ (LITIGATIONR2) +\beta4\ (FIRMSIZE) +\beta5\ (CAPSTRUC) +\beta6\ (ROA) +\beta7\ (ROE) +\beta8\ (OANCF) +\beta9\ (INTCOV) +\varepsilon$$

I include several control variables other than litigation risk, which can potentially affect the credit ratings. The first control variable is firm size. Firm size is an indicator of economies of scale in both aspects of production and organization, thus the size of a firm is expected to affect the investment opportunity and future growth (Smith, Watts 1992). Altamuro (2009) argues that larger companies are more likely than smaller firms to get a high credit rating due to their good

reputation and diversification. I measure the firm size by the log of the samples' total assets, which is also included as one of the variables in the Altamuro (2009) paper.

The way of financing for finance business operations affects the financial structure of firms. Thus, capital structure measured as debt to equity ratio indicates the financial risk, the creditor risk, and the growth opportunities. Kisgen (2006) confirms that ratings react differently to the leverage since there is a trend of downgrade after lowering leverage due to the decision of capital structure of a firm. Thus, I measure the capital structure as a ratio of total debt (long-term debt DLTT + debt in current liabilities DLC) over equity (SEQ).

To control for the impact of financial risk, I include the return of asset (ROA) as a proxy for profitability, which was calculated as net income (NI) over total assets (AT). I also include the return on equity (ROE), which was calculated as net income (NI) /total shareholders' equity (SEQ). Both ROA and ROE are important measurements of firms' performance and future profitability, thus these two ratios largely affect the decisions of shareholders and the ratings from credit agencies.

In order to measure the health of ongoing business, I include the operating cash flow (OANCF). Another control variable is the interest coverage calculated as earnings before interest and taxes (EBIT) divided by the interest or related expense (XINT) for long-term debt. Both the health of operating activities and the ability to pay back creditors are important indicators for credit agencies to be aware of when creating ratings.

Dependent Variable

I use the S&P Quality Ranking as a dependent variable, which is an appraisal of past performance of a stock's earnings and dividends and the stock's relative standing as of a company's current fiscal year-end. Growth and stability of earnings and dividends are key elements in establishing Standard & Poor's quality rankings for Common or Ordinary Stock. In the sample, firms have ratings of A+, A, A-, B+, B, B-, C, D, I range them from 1 to 8, where 1 is the lowest rating and 8 is the highest.

IV. Data and Descriptive Statistics

a. The Model of Litigation Risk

I obtained data on firm characteristics from CRSP/Compustata merged database from year 2003 to 2013. I searched the entire database in order to get a large sample and diverse distribution of industries in the sample. Thus, I got a total number of 9,658 firms. Excluding the firms that do not have sufficient data regarding firm characteristics that I use in the model of litigation risk, I got 7,519 firms left with sufficient data. Table 1, Panel A provides the definition of data and the calculation method of variables in the model of litigation risk.

Table 2, Panel A presents the descriptive statistics in the model of litigation risk. The mean of the market value is U.S. $3948.17. Using the market value of firms, the first quartile which is the market value below or equal to U.S. $89.2101 is marked “1” in the binary variable of small firm indicator. Similarly, the last quartile which is the market value above or equal to U.S. $1748.702 is marked “1” in the binary variable of big firm indicator. Table 2, Panel A (1) provides correlation between variables in the model of litigation risk.

Previous literature suggests that the FPS industries tend to have litigation rates that exceed the overall rate (Skinner et al. 2012). To include the FPS industry proxy, I used a binary variable to show the industry membership. Firms included in FPS industries are marked "1" as highly risky industries. According to the FPS industry membership, highly risky industries include: biotech firms (classified as firms in SIC codes 2833-2838 and 8731-8734), computer firms (classified as firms in SIC codes 3570-3577 and 7370-7374), electronics firms (classified as firms in SIC codes 3600-3674), and retail firms (classified as firms in SIC codes 5200-5961).

The Beneish M-Score determines whether a company has manipulated its earnings. The mean of -3.80 indicates that on average sample firms do not have intention of manipulating earnings given Beneish's estimation that a score above -2.22 indicates earnings manipulation. Table 1, Panel B provides the detail of the variables in calculating the BM-Score.

I obtained data on filings of securities class action lawsuits from the Stanford Law School *Securities Class Action Clearinghouse*. The data started in 1995 and continue through the present. I includeed lawsuits filed against public companies since the data on firm characteristics is only applied to publicly traded firms (listed on the NYSE, AMEX, or NASDAQ), excluding the IPO allocation, mutual fund, and analyst lawsuits. The binary sued variable indicates whether the firm has been since 1995 when filings data became available. I also collected the number of lawsuits that one firm had in the given time period of the database used as one of the variables for measuring the relationship between credit ratings and litigation risk. Table 3, Panel A and Panel B provide the number of lawsuits by year and sector.

b. The Model of Credit Ratings

I used the credit ratings from Standard & Poor Quality Ranking in the current period provided by CRSP/Compustat merged dataset. The S&P Quality Ranking provides an indicator of past performance of a firm's stock earnings and performance as of a firm's current fiscal year-end. Growth and stability of earnings and dividends are key elements in establishing the rating for Common/Ordinary stock. Table 1, Panel C provides the definition of variables in the model of credit ratings, including the control variables definition.

The S&P Quality Rating has score as A+, A, A-, B+, B, B-, C, D. Thus, I ranked the rating into a scale of eight. In my sample, eight is the best rating as A+ and one is the worst rating as D. The litigation risk is an independent variable measured by the predictions using the parameters gained from the litigation risk model. I also included the change of litigation risk from this year to last year's level and the litigation risk squared to test for convergence. The control variables are firm size, capital structure measured as the debt to equity ratio, return on asset, return on equity, operating cash flow, and interest coverage ratio.

V. Results

a. Litigation Risk Probit Regression

I report descriptive statistics in Table 2. Panel A reports means and medians for the variables used in the model of litigation risk. Mean market value for these firms is U.S. $3948m with the book-to-market ratio of 7.73. Both the working capital and the BM-score have a negative skewness. The mean BM-score is -3.8, indicating the mean does not show a sign of earnings manipulation.

Panel A (1) of Table 2 reports correlations among the variables in the model of litigation risk. The indicator of litigation is positively correlated with the market value (0.168), change in market value (0.074), working capital (0.065), gross profit (0.166), R&D intensity (0.065), big firm indicator (0.173) and FPS proxy (0.180). The indicator is negatively correlated with book-to-market ratio (-0.003), firm financial risk (-0.048), stock volatility (-0.005), price/earnings ratio (0.010), BM-score (-0.013), and small firm indicator (-0.170). The market value and gross profit drive litigation risk the most because of the large positive correlation. The firm size indicator suggests that the bigger the firm, the more likely it is to be involved in lawsuits. On the other hand, the smaller the firm, the less likely it is to be involved in lawsuits. FPS proxy is positively correlated with market value (0.022), change in market value (0.013), working capital (0.051), gross profit (0.017), and R&D intensity (0.276). It is negatively correlated with book-to-market ratio (-0.003), firm financial risk (-0.146), stock volatility (-0.003), and price/earnings ratio (-0.009), big firm indicator (-0.039) and small firm indicator (-0.003). It is consistent that the FPS dummy variable is associated with variables that drive litigation risk.

Table 4 reports the results of binomial probit regression of the lawsuit dummy variable on the FPS dummy variable, big firm indicator, small firm indicator, and the other firm characteristics variables. The first model uses only the FPS industry dummy (Model 1). The coefficient on this variable is positive and highly significant, indicating that FPS industry membership increases the probability of litigation. Though the coefficient on the FPS variable is significantly correlated to firms' litigation risk in this model, overall goodness of fit and predictive ability are low according to the Pseudo-R-squared of 2.86%.

The next models (denoted 2-4) that report probit regressions include the market value, book-to-market ratio, working capital, firm financial risk, stock volatility, price to earnings ratio,

gross profit, research & development intensity, BM-score, big-firm indicator, small-firm indicator and the FPS proxy dummy variable. Market value and working capital are positively associated with litigation risk, indicating that higher market capitalization and operational liquidity lead to higher litigation risk. Book-to-market value is negatively associated with litigation risk, implying that overvalued firms are likely to be involved in lawsuit cases. The firm financial risk is measured as the proportion of the tangible assets. The negative coefficient is consistent with the hypothesis that tangible assets serve as a cushion if a firm is involved in financial distress. Though the stock volatility is negatively associated with litigation risk, the magnitude is small and the coefficient is not statistically significant. A higher price to earnings ratio suggests that investors are expecting higher earnings growth in the future compared to firms with a lower P/E ratio, thus it is negatively associated with litigation risk. Both gross profit and R&D intensity have positive coefficients, indicating that higher profits and investment in future research and development are positive signals to creditors and investors, thus decreasing litigation risk. The Beneish M-score has less impact on litigation risk compared to firm size indicator. However, according to the coefficients, big firms are more likely to have higher risk whereas small firms are not. FPS Proxy is also positively associated with litigation risk and is statistically significant in these models, with a marginal effect of 0.152 in Model 4. It indicates that FPS industry membership increases the probability of litigation by 15.2%. At a 1% significance level, firm financial risk decreases the probability of litigation by 11.2% and R&D intensity increases the probability of litigation risk by 7.88%. Big firm indicator increases the litigation by 9.90% and small firm indicator decreases the litigation risk by 13.7%.

b. Credit Ratings OLS Regression

I report descriptive statistics in Table 2. Panel B reports means and medians for the variables in the model of credit ratings. Mean firm size for these firms is U.S. $2.46m with debt-to-equity ratio of 0.524. Both capital structure and return on assets have a negative skewness. Mean interest coverage ratio is 44, indicating that most firms in my sample, regardless of industry, are generating sufficient cash to cover its interest payments.

Panel B (1) of Table 2 reports correlations among the variables in the model of credit ratings. The ratings have a positive correlation with every variable; and only the correlations of change in litigation risk and capital structure are not statistically significant at better than 1% level.

Table 5 reports the results of regression of the credit ratings on the litigation risk measured in the previous model, change in the litigation risk, the level of litigation risk squared and other control variables. Model 1 uses only the level of litigation risk. Surprisingly, the coefficient on this variable is positive and highly statistically significant. Then I include the change in the level of litigation risk of one year with respect to the previous year and the litigation risk squared to see if the results change. It turns out that the change in litigation risk has a negative association with the litigation risk and is statistically significant at 5% significance level. Since the level of litigation risk is effectively a zero or one variable in terms of values. This means that it is mean reverting and is negatively correlated with change in litigation risk. Thus, I only include the change in litigation risk in the Model 3. I also include other control variables in Model 3 such as firm size, capital structure measured as debt-to-equity ratio, return on asset, return on equity, operating cash flow, and interest coverage ratio. The change in litigation risk has a positive coefficient in Model 3 but is not statistically significant. All the control variables are positively associated with litigation risk. The coefficient of capital structure is the only one that is not statistically significant in the regression.

According to the marginal effects, at a 1% significance level, the additional increase in firm size increases the ratings by 61.9%; the additional increase in return on asset increases the ratings by 7.01%; the additional increase in operating cash flow increases the ratings by 0.004%; and the additional increase in the interest coverage ratio increases the ratings by 0.0027%. Firm size, ROA, operating cash flow, and interest rate coverage are significantly correlated with credit ratings in a positive sign. The coefficient on ROE is significant at 10% level. However, I do not find significance of the coefficient on the capital structure.

Without controlling for other firm characteristics and with a single variable of litigation risk, the credit rating is highly significant correlated with litigation risk in a positive sign. In order to test for the consistency of this relationship, I include change in litigation risk and litigation risk squared. I find that the change in litigation risk is negatively associated with credit rating at a 5% significance level. The highly significant and positive correlation between the litigation risk squared and credit ratings suggests that the relationship can be exponential instead of linear.

c. Discussion of Fixed Effects

In my sample, there are 7,519 firms and data of firm characteristics observed from year 2003 to 2013. Since the change in a firm's fiscal years and the differences among firms can cause an effect on the credit ratings as dependent variable, I want to investigate the fixed effects of firms and that of years.

First, I generated a panel data for both firms' SIC codes and fiscal years. However, it is not applicable to create a dummy variable for each firm due to the large number of observations. Furthermore, I expect that there would not be many changes in coefficients on independent

variables in the model of credit ratings since the results have already applied to a population of firms. On the other hand, the industry fixed effects, which I included as a FPS proxy in the measurement of litigation risk, is more relevant to credit ratings because it describes the difference in economic environment and job functions.

After creating a dummy variable for firms, I was able to control the year fixed effect in the credit ratings model. There are no big changes in the coefficient of the independent variables included in the model in terms of magnitudes and signs. Nevertheless, the negative correlation between the change in litigation risk and credit ratings remains the same after including other factors in the model, which is contrary to what I found in the model of credit ratings without controlling for year fixed effects. I also find that the year 2007 has a negative coefficient with the ratings, which contradicts to the positive coefficient of all other fiscal years. It is not surprising since firms tend to have financial problems and downward performance during the financial crisis in year 2007 and 2008, thus decreasing their ratings provided by agencies.

d. Discussion of Endogeneity

There is a problem of endogeneity in this paper because of an endogenous influence between firms' litigation risk and credit ratings. The credit ratings as a dependent variable is correlated with the change in litigation risk as an independent variable. And the change in litigation risk also has an effect on the credit ratings of firms. Another source of endogeneity of this model can come from omitted variable. Though I have controlled for other factors in the model of credit ratings, there can be potentially other omitted variables that significantly affect credit ratings. In this case, the shift of sign on the coefficient of the change in litigation risk can be affected by an omitted variable that is strongly correlated with credit ratings as well as the

change in litigation risk. The problem of endogeneity can introduce bias in the regression coefficient of the OLS regression of credit ratings.

One of the ways to address the problem of endogeneity is to find instrumental variables. In the model of credit ratings, an effective instrumental variable will be a variable that we can be fairly certain that it has an effect on the independent variable i.e. the change in the litigation risk but not on the dependent variable i.e. the credit ratings. A best instrumental variable should be randomly selected but satisfied all the conditions mentioned above (University College London: Environmental Econometrics).

Some possible instruments include the compensation for CEOs and geographic location which implies information about population, average income level and socioeconomic status. However, I find that most firms choose their incorporated location because of other factors such as tax environment, cost saving, and logistics access. Another possibility is firm size. It makes more sense to measure it as market capitalization, which means I need to drop the market value variable in the model of litigation risk, which is a highly significant variable in the probit regression. Developing an instrumental variable approach to deal with potential endogeneity is beyond the scope of this paper, but it is a worthwhile avenue for future research.

VI. Conclusion

In this paper, I provide two empirical models: one is an alternative model of litigation risk, and the other is a model of credit ratings on the change of litigation risk, controlling for other relevant variables. I define litigation risk as the risk of private securities class action lawsuits. According to previous studies, litigation rates in the four FPS industries

(biotechnology, computers, electronics, and retail) are consistently higher than those in other industries. I find that FPS proxy measure is highly correlated with litigation risk since the coefficient on this variable is both economically and statistically significant. However, the ability of this variable to predict litigation is modest given a small Pseudo-R-squared of 2.86%. When the FPS variable is augmented with measures of firm characteristics such as market value, working capital, stock volatility and R&D intensity, predictive ability increases markedly, suggesting that the inclusion of the firm characteristics can result in significant improvements in model performance.

The main contribution of this paper includes constructing a new model that measures litigation risk and examines the negative relationship between firms' litigation risk and credit ratings. By supplementing the FPS industry proxy with measures of firm characteristics, the predictive ability of the model measuring litigation risk improves. This suggests that industry membership is not the only factor that affects firms' litigation risk. When we assess firms' litigation risk to predict their likelihood of involvement in lawsuits, it is important to consider both systematic risk from industry and macro-economic environment and firm-specific risk measured by firm characteristics such as market capitalization, book-to-market ratio and stock volatility. In the model of credit ratings, I find that the change of litigation risk has a negative correlation with the credit ratings. However, the negative coefficient on the change of litigation risk changes to a positive one after controlling for other variables such as firm size, return on asset, and interest coverage ratio. This is surprising because litigation risk in and of itself can cause severe financial damage and reputational crisis. The result implies that the credit ratings of firms from a credit agency may not incorporate a single factor specifically, such as litigation risk.

Analysts or investors need to look at different factors that significantly affect firms' credibility instead of relying completely on the credit ratings provided by agencies.

I used the suggested model of litigation risk to generate the level of litigation risk over the years in the sample. I also calculated the change in the litigation risk from this year to the previous year's level and the litigation risk squared to see if there is a convergent effect. The result of the regression suggests that the change in the litigation risk is negatively correlated with the credit ratings. I excluded the level of litigation risk since it is effectively a zero one variable, which is mean reverting. Nevertheless, I find that the negative correlation shifts to a positive one when I control for the variables that can potentially affect credit ratings such as firm size, capital structure, and return on equity. Furthermore, I created a year dummy variable to control for the year fixed effects. I find that the negative correlation between the change in litigation risk and credit ratings sustains even after including other factors that potentially affect credit ratings in the model, which is contrary to what I find in the previous model of credit ratings without controlling for year fixed effects. I also find that the year 2007 has a negative coefficient with the ratings, which contradicts to the positive coefficient of all other fiscal years. It is not surprising since firms tend to have financial damages and downward performance during the financial crisis in year 2007 and 2008, thus downgrading their ratings provided by agencies. The shifting sign can also be aroused due to the problem of endogeneity, which could possibly be caused by omitted variables. The issue of endogeneity needs to be further addressed in future research.

Appendix

Table 1
Variable Definition
This table provides definitions of the variables used in the regression.
For all non-stock return and volatility, the year t represents the fiscal year of the company.

Panel A. Variables of measurement of litigation risk

Variable	Definition
SUED	Defined as a binary variable that 0 represents no lawsuit in the past, 1 represents lawsuit existed in the past
CHANGEMKVALT	The change of market value of a firm from time t-1 to time t
MKVALT	Market value for single issue companies is common shares outstanding multiplied by the month-end price that corresponds to the period end date
BKMK	Book-to-market equity ratio is measured as the book value divided by the market value. The book value is defined as the multiplication of the book value per share and common shares outstanding
WC	Working capital is measured as the difference between the total current asset and the total current liability. The total current asset is the sum of: (1)cash and short-term investments (2)current assets (3)inventories (4)receivables; The total current liability is the sum of: (1)accounts payable (2)current liabilities (3)debt in current liabilities (4)income taxes payable
FINRK	The information in financial risk is measured as the total net property, plant, and equipment divided by the total assets
VOLATILITY	The stock volatility is calculated by the difference between the annual closing price at time t and the annual closing price at time t-1 divided by the annual closing price at time t-1
PE	The price/earnings ratio is calculated by dividing the annual closing price over basic earnings per share excluding extraordinary items
GP	According to U.S. and Canadian GAAP definition, the gross profit is the difference of sales/turnover (net) less cost of goods sold
RD INTEN	The intensity of research and development is calculated by dividing the research and development expense over Total assets. The research and development expense includes software expenses, amortization of software costs, and company-sponsored research and development
FPSPROXY	A binary variable as indicator of FPS industry membership in the sample
BIG	A binary variable as indicator of big firms, which is the first quartile of firms in terms of the market value
SMALL	A binary variable as indicator of small firms, which is the last quartile of firms in terms of the market value
BMSCORE	The Beineish M-score determines whether a company has manipulated its earnings. The formula is M-Score = -4.84 + 0.92*DSRI + 0.528*GMI + 0.404*AQI + 0.892*SGI + 0.115*DEPI – 0.172*SGAI + 4.679*TATA – 0.327*LVGI. (Factors defined in Panel B)

Panel B. Variables of the BM-Score formula

(All the index is defined as the ratio of this year over last year)

Variable	Definition
DSRI	Days' sales in receivables index is measured as the receivables divided by total sales
GMI	The gross margin index is measured as the gross profit over total sales
AQI	Asset quality index is measure as (noncurrent assets-PP&E) over total assets
SGI	Sales growth index is measured as total sales
DEPI	Depreciation index is measured as depreciation divided by (depreciation + net PP&E)
SGAI	Selling, General & Administrative expense index is measured as SG&A/revenues. The SG&A represents all commercial expenses of operation incurred in the regular course of business pertaining to the securing of operating income
TATA	Total accruals to total assets is measured as (working capital-cash)-depreciation/total assets
LVGI	The leverage index is measured as total debt over total assets. The total debt is calculated as the debt in current liabilities plus the total long-term debt

Panel C. Variables of the credit rating regression

Variable	Definition
RATINGS	S&P Quality Ranking is an appraisal of past performance of a stock's earnings and dividends and the stock's relative standing as of a company's current fiscal year-end. Growth and stability of earnings and dividends are key elements in establishing Standard & Poor's quality rankings for Common/Ordinary Stock. In the sample, firms have ratings of A+, A, A-, B+, B, B-, C, D, I range them from 1 to 8, where 1 being the lowest rating and 8 being the highest rating
LITIGATIONR	Measurement of litigation risk from the regression
CHANGELITIGATIONR	The change of litigation risk measured by the model from time t-1 to time t
LITIGATIONR2	The level of litigation risk squared
FIRMSIZE	The firm size is measured by the log of the samples' sales/turnover (net). The sales/turnover (net) represents gross sales reduced by cash discounts, trade discounts, and returned sales and allowances for which credit is given to customers
CAPSTRUC	The capital structure is a ratio of total debt (long-term debt + debt in current liabilities) over equity. The shareholders' equity represents the common and preferred shareholders' interest in the company
ROA	The return on asset is measured as the ratio of net income over total assets. The net income represents the fiscal period income or loss reported by a company after subtracting expenses and losses from all revenues and gains
ROE	The return on equity is measured as net income over total shareholders' equity
OANCF	The operating activities net cash flow represents the net change in cash from all items classified in the operating activities section on a cash flow statement
INTCOV	The interest coverage is calculated as earnings before interest and taxes (EBIT) over interest or related expense

Table 2
Descriptive statistics.
This table presents descriptive statistics used in the regression.

Panel A. Variables in the model of litigation risk

	MKVALT	*BKMK*	WC	*FINRK*	*VOLATILITY*	*PE*	*GP*	*RD INTEN*	*BM-score*
Variables in litigation risk measurement									
Mean	3948.170	7.728	277.856	0.224	1.143	13.225	1046.618	0.054	-3.803
Standard Error	88.946	7.210	15.839	0.001	0.133	0.556	24.089	0.001	0.704
Median	389.975	0.495	38.106	0.132	0.008	14.081	113.424	0.000	-2.133
Standard Deviation	17299.205	1402.261	3080.664	0.237	25.803	108.201	4685.195	0.193	136.892
Sample Variance	299262476.55	1966334.75	9490493.55	0.056	665.770	11707.553	21951052.88	0.037	18739.536
Kurtosis	226.290	37826.811	7005.353	0.604	8089.423	985.879	193.387	940.420	25306.578
Skewness	12.453	194.490	-68.939	1.256	82.079	12.980	12.168	22.135	-148.122
Range	626550.352	273499.264	393844.000	0.996	3000.000	11176.000	130131.000	12.853	27330.015
Minimum	0.001	-769.316	-329795.000	0.000	-1.000	-3479.000	-6887.000	-0.010	-24030.229
Maximum	626550.353	272729.948	64049.000	0.996	2999.000	7697.000	123244.000	12.843	3299.786

Panel A (1). Correlations

	SUED	*MKVALT*	*CHANGEMKTVALT*	*BKMK*	*WC*	*FINRK*	*VOLATILITY*	*PE*	*GP*	*RD INTEN*	*BMscore*	*Big*	*Small*	*FPS proxy*
SUED	1													
MKVALT	0.1637	1												
CHANGEMKTVALT	0.0741	0.5641	1											
BKMK	-0.0028	-0.0012	-0.0007	1										
WC	0.0652	0.2571	0.1582	-0.0002	1									
FINRK	-0.0480	0.0529	0.0257	0.0099	-0.008	1								
VOLATILITY	-0.0053	-0.0048	-0.0026	0.0798	-0.002	0.0179	1							
PE	-0.0097	0.0149	0.0170	-0.0006	0.0026	0.0047	-0.0026	1						
GP	0.1658	0.8747	0.4019	-0.0012	0.1636	0.0473	-0.0042	0.0074	1					
RD INTEN	0.0645	-0.0308	-0.0155	-0.0015	-0.002	-0.128	0.0060	-0.0275	-0.0378	1				
BMscore	-0.0130	0.0019	0.0011	0.0000	0.0002	0.0004	-0.0002	0.0010	0.0016	0.0004	1			
Big	0.1730	0.3574	0.1857	-0.0030	0.1128	0.1746	-0.0122	0.0273	0.3353	-0.092	0.0052	1		
Small	-0.1705	-0.1304	-0.0656	0.0089	-0.050	-0.131	0.0339	-0.0345	-0.1259	0.0963	0.0043	-0.3333	1	
FPS proxy	0.1801	0.0222	0.0128	-0.0034	0.0507	-0.146	-0.0033	-0.0094	0.0166	0.2757	0.0011	-0.0389	-0.0032	1

Panel B. Variables in the credit rating regression

	FIRMSIZE	*CAPSTRUC*	*ROA*	*ROE*	*OANCF*	*INTCOV*
Mean	2.4600	0.5238	-0.0463	-0.0307	394.9673	44.7322
Standard Error	0.0053	0.3446	0.0047	0.0592	13.0409	7.3142
Median	2.4875	0.3517	0.0221	0.0801	27.1815	1.5186
Standard Deviation	1.0337	67.0278	0.9202	11.5062	2536.3815	1422.5660
Sample Variance	1.0685	4492.7196	0.8468	132.3937	6433230.9899	2023694.0205
Kurtosis	0.6012	9131.8455	7925.0196	4935.2396	752.4882	3223.3465
Skewness	-0.3395	-71.6829	-80.7749	4.5688	16.3924	42.6775
Range	8.6695	11380.3737	104.8468	1821.0922	240291.0000	175475.0000
Minimum	-3.0000	-7811.0000	-100.0140	-819.7857	-110560.0000	-54263.0000
Maximum	5.6695	3569.3737	4.8328	1001.3065	129731.0000	121212.0000

Panel B (1). Correlations

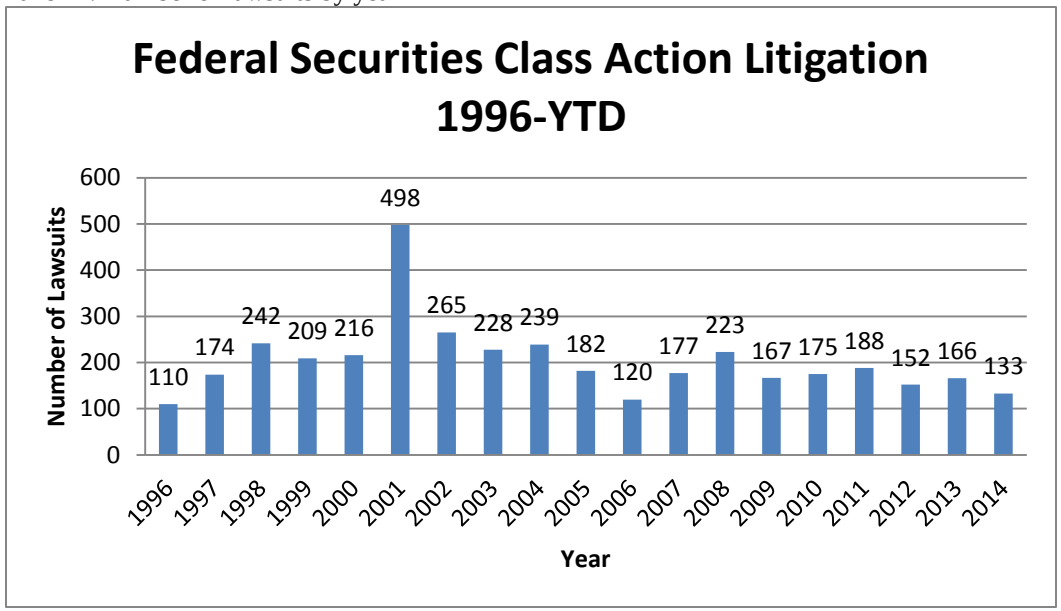
	Ratings	*LITIGATIONR*	CHANGELITIGATIONR	*FIRMSIZE*	*CAPSTRUC*	*ROA*	*ROE*	*OANCF*	*INTCOV*
Ratings	1								
LITIGATIONR	0.0681	1							
CHANGELITIGATIONR	0.0061	0.6902	1						
FIRMSIZE	0.4508	0.1045	0.0055	1					
CAPSTRUC	0.0029	0.0005	-0.0001	0.0035	1				
ROA	0.1146	0.0012	-0.0027	0.1637	0.0010	1			
ROE	0.0130	0.0002	0.0002	0.0165	-0.4529	0.0011	1		
OANCF	0.1790	0.0863	0.0097	0.2794	0.0006	0.0200	0.0031	1	
INTCOV	0.0456	0.0029	0.0011	0.0436	-0.0003	0.0286	0.0029	0.0010	1

Table 3

Lawsuits data set description.

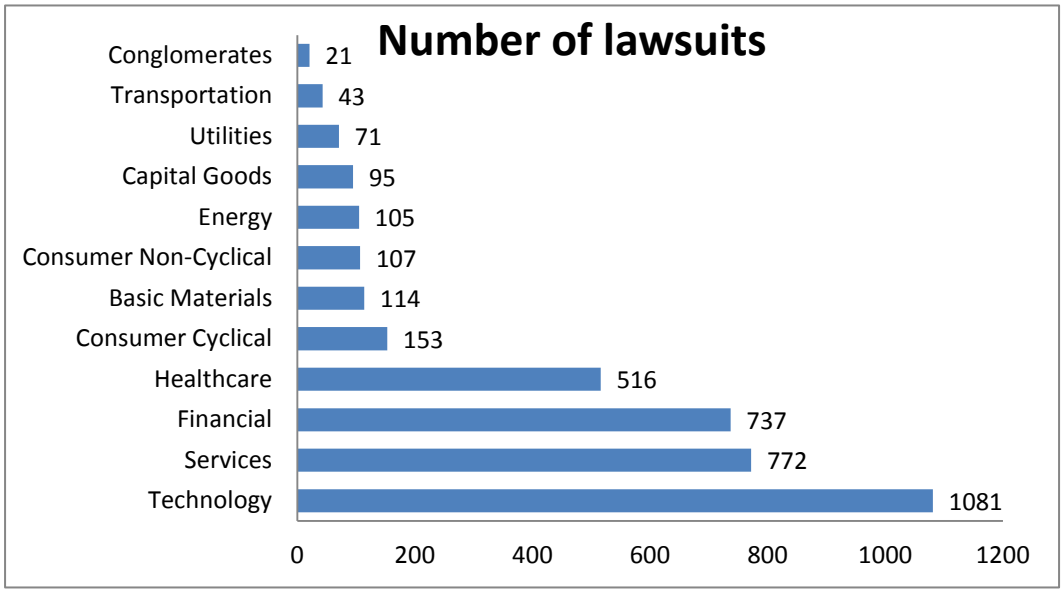
The Securities Class Action Clearinghouse (SCAC) has 3, 864 total Filings on the date of writing.

Panel A: Number of lawsuits by year



(Source: data in the graph collected on the SCAC website)

Panel B: Number of lawsuits by sector



(Source: data in the graph collected on the SCAC website)

Table 4

Models of litigation risk.

This table represents the FPS only model in comparison to the multivariate models with firm characteristics variables. Model 1 is the probit model with the FPS variable. Model 2 adds firm characteristics with specific values, and Model 3 adds variables indicating firm size effect and the earnings management. Model 4 includes all variables. ***,**,and * indicate z-values of 1%, 5%, and 10%, respectively. The z-values are based on robust standard errors that control for heteroskedasticity and serial correlation. Marginal effects of the coefficients are reported below the coefficients in Model 4.

$$Sued=\beta0+\beta1\ (FPSPROXY)+\varepsilon$$

$$Sued=\beta0+\beta1\ (FPSPROXY)+\beta2\ (MKVALT)+\ \beta3\ (BKMK)+\beta4\ (WC)+\beta5\ (FINRK)+\beta6\ (VOLATILITY)+\beta7\ (PE)+\beta8\ (GP)+\beta9\ (RDINTEN)+\varepsilon$$

$$Sued=\beta0+\beta1\ (FPSPROXY)+\beta2\ (BMSCORE)+\beta3\ (BIG)+\beta4\ (SMALL)+\varepsilon$$

$$Sued=\beta0+\beta1\ (FPSPROXY)+\beta2\ (MKVALT)+\ \beta3\ (BKMK)+\beta4\ (WC)+\beta5\ (FINRK)+\beta6\ (VOLATILITY)+\beta7\ (PE)+\beta8\ (GP)+\beta9\ (RDINTEN)$$
$$+\beta10\ (BMSCORE)+\beta11\ (BIG)+\beta12\ (SMALL)+\varepsilon$$

	Model 1		Model 2		Model 3		Model 4	
INTERCEPT	-0.9110	***	-0.9371	***	-0.9425	***	-0.8594	***
							0.0000	***
FPSPROXY	0.5184	***	0.4854	***	0.5620	***	0.4930	***
							0.1518965	***
MKVALT			0.0000049	***			0.0000019	**
							0.0000005	**
BKMK			-0.00202	**			-0.00139	
							-0.00040	
WC			0.0000286	***			0.00000947	**
							2.71E-06	**
FINRK			-0.19347	***			-0.39147	***
							-0.11225	***

VOLATILITY		-0.000454	**			0.000028	
						0.000008	
PE		-0.000126	**			-0.000218	***
						-0.000063	***
GP		0.000040	***			0.000028	***
						0.000008	***
RDINTEN		0.143819	***			0.274727	***
						0.0787736	***
BMSOCDRE				-0.00020	***	-0.00021	**
						-0.00006	**
BIG				0.41641	***	0.32509	***
						0.09905	***
SMALL				-0.5129161	***	-0.538201	***
						-0.1369096	***
Pseudo R2	0.0286	0.0564		0.0748		0.0896	
Observation Count	37827	37827		37827		37827	

Table 5

Models of credit ratings.

This table represents the regression of credit ratings on litigation risk and other control variables. Model 1 is the regression on the level of litigation risk. Model 2 adds the change in litigation risk and the litigation risk squared. Model 3 includes all control variables. ***,**,and * indicate p-values of 1%, 5%, and 10%, respectively. The p-values are based on robust standard errors that control for heteroskedasticity and serial correlation.

$$Ratings=\beta0+\beta1\ (LITIGATIONR)+\varepsilon$$

$$Ratings=\beta0+\beta1\ (LITIGATIONR)+\beta2\ (CHANGELITIGATIONR)+\ \beta3\ (LITIGATIONR2)+\varepsilon$$

$$Ratings=\beta0+\beta1\ (LITIGATIONR)+\beta2\ (CHANGELITIGATIONR)+\ \beta3\ (LITIGATIONR2)+\beta4\ (FIRMSIZE)$$
$$+\beta5\ (CAPSTRUC)+\beta6\ (ROA)+\beta7\ (ROE)+\beta8\ (OANCF)+\beta9\ (INTCOV)+\varepsilon$$

	Model 1		Model 2		Model 3	
INTERCEPT	3.5065	***	4.1471	***	1.9295	***
LITIGATIONR	0.0509	***	0.8519	***		
CHANGELITIGATIONR			-0.00639	**	0.00177	
LITIGATIONR2			0.00220	***		
FIRMSIZE					0.61943	***
CAPSTRUC					0.00011	
ROA					0.07008	***
ROE					0.00103	*
OANCF					0.00004	***
INTCOV					0.00003	***
Adjusted R2	0.0046		0.0678		0.2087	
Observation Count	37827		37827		37827	

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