# A Comparison of the Determinants of Stock Returns in the 1987 and 2008 Stock Market Meltdowns

Jia Wang [a], Gulser Meric [b], Zugang Liu [c], Ilhan Meric [d]

[a,b] Rowan University, USA
[c] Penn State University, Hazleton, USA
[d] Rider University, USA

In this paper, we study and compare the determinants of stock returns in the 1987 and 2008 stock market meltdowns with the multivariate regression analysis technique. We find that technical insolvency risk and bankruptcy risk were significant determinants of stock returns in the 2008 market meltdown. Investors were also somewhat concerned with bankruptcy risk in the 1987 market meltdown. However, technical insolvency risk was not a significant determinant of stock returns in the 1987 meltdown. Our findings indicate that stocks with higher betas, larger market cap, and greater return volatility lost more value in both meltdowns. We find the market-to-book ratio to be a significant determinant of stock returns in the 2008 meltdown but not in the 1987 meltdown. We find stock illiquidity to be a significant determinant of stock returns in the 1987 meltdown but not in the 2008 meltdown. With data for two most important stock market meltdowns in U.S. history since the Great Depression, we test several extant theories related to the determinants of stock returns.
*JEL classification*: G12; G14
*Keywords*: 1987 and 2008 stock market meltdowns, determinants of stock returns, technical insolvency risk, bankruptcy risk

## 1. Introduction

Until 2008, the 1987 stock market meltdown was the most important stock market meltdown in U.S. history since the Great Depression. In the 1987 meltdown, U.S. stocks lost 27.6% of their value from October 6 to October 19, 1987. The 1987 stock market meltdown has been studied extensively in the literature (see, e.g., Roll, 1988; King and Wadhwani, 1990; Amihud et al., 1990; Seyhun, 1990; and Wang et al., 2009). The U.S. stock market also experienced a severe meltdown in 2008. U.S. stocks lost 49% of their value from May 19 to November 20, 2008. However, the 2008 stock market meltdown has not yet been studied sufficiently. The 2008 stock market meltdown was an unprecedented event in U.S. history that provides an ideal setting to test the determinants of stock returns when companies face a severe credit market crunch. In this paper, we make a contribution to the literature by studying and comparing the determinants of stock returns in the 1987 and 2008 stock market meltdowns, and by testing several extant hypotheses related to the determinants of stock returns.

Bankruptcy risk is a serious concern to investors in stock market crashes (see: Wang et al., 2009). In this paper, we demonstrate that bankruptcy risk was a more important determinant of stock returns in the 2008 meltdown than in the 1987 meltdown. In empirical studies, debt, profitability, and liquidity ratios are generally used as bankruptcy risk variables when studying the determinants of stock returns (see, e.g., Mitton, 2002; Baek et al., 2004; Bonfim, 2009; and Wang et al., 2009). In this paper, in addition to these variables, we also use Ohlson's (1980) bankruptcy prediction model to investigate if bankruptcy prediction score was a significant determinant of stock returns in the 1987 and 2008 stock market meltdowns.

Technical insolvency is described as a situation in which a firm is temporarily unable to service its debts (see: Keown et al., 2008). Technical insolvency may lead to bankruptcy. In the 2008 stock market meltdown, many firms faced technical insolvency due to liquidity shortage. The recessionary economy and foreclosures lowered real estate values sharply. Banks that held large amounts of mortgage backed assets substantially reduced the amount of bank credit to business firms, which

resulted in a serious liquidity shortage for business firms and increased their technical insolvency risk. In this paper, we demonstrate that, although it was not a significant concern to investors in the 1987 stock market meltdown, technical insolvency risk was a significant determinant of stock returns in the 2008 meltdown.

Lo and MacKinlay (1990) argue that large firm stock returns respond faster to new information compared with small firm stock returns and large firm stock returns lead small firm stock returns. Richardson and Peterson (1999) and Wang et al. (2009) find empirical support for the Lo-MacKinlay hypothesis. Wang et al. (2009) demonstrate that large firm stock returns respond faster than small firm stock returns and large firm stock returns lead small firm stock returns in stock market crashes. In this paper, we provide additional empirical support for the Lo-MacKinlay hypothesis by demonstrating that large firm stock returns responded faster to both 1987 and 2008 stock market meltdowns compared with small firm stock returns, and large firm stock returns led small firm stock returns in the downward direction in both meltdowns.

The Capital Asset Pricing Model (CAPM) argues that high beta stock returns move faster than low beta stock returns in both down and up markets. Wang et al. (2009) find that stocks with a higher beta lose more value in stock market crashes. In this paper, we provide additional empirical support for this hypothesis by demonstrating that high beta firms lost more value compared with low beta firms in both 1987 and 2008 stock market meltdowns.

Wang et al. (2009) find that stocks with more return volatility prior to stock market crashes lose more value in stock market crashes. In this paper, we provide empirical support for this finding by demonstrating that stocks with more return volatility prior to the 1987 and 2008 stock market meltdowns lost more value in both meltdowns.

In Fama and French's (1992, 1993) multi-factor asset pricing model, the market-to-book ratio (MKBK) is a determinant of stock returns. They show that the stocks of low MKBK firms tend to earn higher returns. They argue that low MKBK firms might be in financial distress and investors would demand a larger risk premium from the stocks of these firms. This issue is controversial in the literature. Petkova and Zhang (2005) find empirical support for the Fama-French hypothesis by documenting that investors consider low MKBK firm stocks to be riskier in "bad" times. However, Lakonishok et al. (1994) find no evidence that low MKBK firm stocks underperform high MKBK firm stocks in "bad" times. In the Wang et al. (2009) study, MKBK is not a significant determinant of stock returns in most stock market crashes and it is significant with contradictory signs in two crashes. In this paper, we find that MKBK was a significant determinant of stock returns in the 2008 meltdown as predicted by the Fama-French model. However, as in the Wang et al. (2009) study, our findings also indicate that MKBK was not a significant determinant of stock returns in the 1987 stock market meltdown.

Amihud et al. (1990) determine that the illiquidity contributed significantly to the decline in stock prices in the 1987 crash. Wang et al.'s (2009) finding for the 1987 stock market crash gives support to Amihud et al.'s (1990) earlier finding. In this paper, we also find illiquidity to be a significant determinant of stock returns in the 1987 stock market meltdown. However, our finding indicates that illiquidity did not affect stock returns significantly in the 2008 stock market meltdown.

Our paper is organized as follows. Section 2 describes our data and explains our methodology. Our regression results for the 2008 and 1987 stock market meltdowns are presented in Section 3. Section 4 summarizes our findings and concludes the paper.

## 2. Data and Methodology

### 2.1. Data

Our 2008 and 1987 samples are comprised of common stocks of U.S. firms. We obtain the stock return data from the Center for Research in Security Price (CRSP) database. To reduce the chance that missing data might affect our analysis, we require that a firm has valid CRSP stock return data for the estimation period. Companies with negative book equity are not included in the samples. To ensure that the results are not driven by small company stocks, following Jegadeesh and Titman

(2001), stocks priced below $5 are eliminated from the samples. To reduce the effect of outliers on the regression results, all variables are winsorized at the 99% and 1% levels.

The financial statement data are obtained from the COMPUSTAT database using the fiscal-year-end financial statements of the firms prior to the stock market meltdown year. Firms with missing data are excluded from the samples. Following Fama and French (2001) and Gadarowski et al. (2007), we also exclude utilities (SIC code 4900-4999) and financial firms (SIC code 6000-6999) from the samples. We exclude utilities because their financial decisions are affected by regulation and financial firms because their financial ratios are not comparable to those of industrial firms.

The Pearson correlation coefficients between the explanatory variables for the 2008 and 1987 samples are presented in Table 1. The correlation coefficients for the 2008 sample are presented in the upper diagonal half and the correlation coefficients for the 1987 sample are presented in the lower diagonal half of the correlation matrix.

**Table 1**
**Pearson Correlation Coefficients**

**2008 Stock Market Meltdown**

| | OSCR | LATA | CLCA | TDTA | ROA | BETA | SIZE | MKBK | ILLQ | SDPR |
|---|---|---|---|---|---|---|---|---|---|---|
| OSCR | | -0.309 (<0.001) | 0.475 (<0.001) | 0.611 (<0.001) | -0.513 (<0.001) | 0.048 (0.044) | -0.169 (<0.001) | 0.150 (<0.001) | 0.076 (0.002) | 0.077 (0.001) |
| LATA | -0.405 (<0.001) | | -0.447 (<0.001) | -0.413 (<0.001) | -0.119 (<0.001) | 0.261 (<0.001) | -0.145 (<0.001) | 0.199 (<0.001) | -0.025 (0.294) | 0.225 (<0.001) |
| CLCA | 0.501 (<0.001) | -0.448 (<0.001) | | 0.361 (<0.001) | -0.010 (0.678) | -0.148 (<0.001) | 0.245 (<0.001) | 0.125 (<0.001) | -0.039 (0.100) | -0.203 (<0.001) |
| TDTA | 0.727 (<0.001) | -0.345 (<0.001) | 0.348 (<0.001) | | -0.117 (<0.001) | -0.070 (0.004) | 0.181 (<0.001) | 0.054 (0.024) | -0.015 (0.541) | -0.182 (<0.001) |
| ROA | -0.587 (<0.001) | 0.211 (<0.001) | -0.178 (<0.001) | -0.359 (<0.001) | | -0.223 (<0.001) | 0.215 (<0.001) | 0.072 (0.003) | -0.032 (0.189) | -0.167 (<0.001) |
| BETA | 0.000 (0.999) | 0.138 (<0.001) | -0.170 (<0.001) | -0.024 (0.316) | 0.087 (<0.001) | | -0.221 (<0.001) | -0.032 (0.188) | -0.078 (0.001) | 0.347 (<0.001) |
| SIZE | -0.298 (<0.001) | -0.106 (<0.001) | 0.286 (<0.001) | -0.042 (0.078) | 0.155 (<0.001) | -0.227 (<0.001) | | 0.240 (<0.001) | -0.323 (<0.001) | -0.514 (<0.001) |
| MKBK | -0.087 (<0.001) | 0.204 (<0.001) | 0.036 (0.140) | -0.106 (<0.001) | 0.316 (<0.001) | 0.143 (<0.001) | 0.189 (<0.001) | | -0.057 (0.018) | 0.003 (0.904) |
| ILLQ | 0.186 (<0.001) | 0.008 (0.742) | -0.038 (0.116) | 0.027 (0.255) | -0.080 (<0.001) | -0.006 (0.789) | -0.522 (<0.001) | -0.112 (<0.001) | | 0.095 (<0.001) |
| SDPR | 0.231 (<0.001) | 0.146 (<0.001) | -0.111 (<0.001) | 0.094 (<0.001) | -0.175 (<0.001) | 0.322 (<0.001) | -0.515 (<0.001) | 0.091 (<0.001) | 0.479 (<0.001) | |

**1987 Stock Market Meltdown**

Notes: This table shows the Pearson correlation coefficients between the explanatory variables used in the regressions. The upper diagonal half of the correlation matrix shows the correlation coefficients for the 2008 stock market meltdown. The lower diagonal half of the correlation matrix shows the correlation coefficients for the 1987 stock market meltdown. The figures in parentheses are the significance levels of the correlation coefficients. Abbreviations of variable names: OSCR-Ohlson's (1980) bankruptcy prediction score; LATA-Liquid assets/total assets ratio; CLCA-Current liabilities/current assets ratio; TDTA-Total debt/total assets ratio; ROA-Net income/total assets ratio; BETA-Capital Asset Pricing Model (CAPM) beta; SIZE-Logarithm of the firm's market capitalization; MKBK-Market value/book value ratio; ILLQ-Stock illiquidity ratio calculated using the methodology in Avramov et al. (2006); SDPR-Standard deviation of daily stock returns one year prior to the market meltdown year.

The bankruptcy prediction variable OSCR (Ohlson's bankruptcy prediction score) is highly correlated with the technical insolvency risk variables LATA (liquid assets/total assets ratio) and CLCA (current liabilities/current assets ratio) and with the bankruptcy risk variables TDTA (total debt/total assets ratio) and ROA (net income/total assets ratio). Therefore, OSCR is not used in the same regression with the insolvency risk and bankruptcy risk variables to avoid multicollinearity.

The technical insolvency risk variables LATA and CLCA are also highly correlated. Therefore, we also use them in separate regressions. The variance inflation factor (VIF) test (see Belsley et al., 1980) indicates that there is no significant multicollinearity problem in the 1987 and 2008 regressions.

The t test was used to test the equality of the means of the explanatory variables in the 1987 and 2008 samples. The test results are presented in Table 2. The F test was used first to test the equality of the variances of the variables in the two samples. The test indicates that the variances of most variables in the two samples are statistically different except those of TDTA (total debt/total assets ratio) and SIZE. Therefore, the t test assuming unequal variances was used to compare the means of the variables with significantly different variances in the 1987 and 2008 samples. The standard t test was used, which assumes equal variances, in the tests for TDTA and SIZE.

**Table 2**
**Test of Equality of Variable Mean Values in the 2008 and 1987 Samples**

| Variable | 2008 sample | 1987 sample | t-statistic |
|---|---|---|---|
| OSCR | -5.191 (1.748) | -3.983 (1.583) | -21.32*** |
| LATA | 0.177 (0.187) | 0.121 (0.131) | 10.05*** |
| CLCA | 0.550 (0.323) | 0.491 (0.245) | 6.14*** |
| TDTA | 0.179 (0.170) | 0.232 (0.163) | -9.38*** |
| ROA | 0.047 (0.091) | 0.047 (0.060) | 0.02 |
| BETA | 1.593 (1.139) | 1.472 (0.859) | 3.52*** |
| SIZE | 13.779 (1.616) | 11.927 (1.663) | 33.25*** |
| MKBK | 3.185 (2.928) | 2.068 (1.485) | 14.17*** |
| ILLQ | 0.063 (0.298) | 0.700 (1.489) | -17.44*** |
| SDPR | 0.025 (0.007) | 0.024 (0.008) | 0.73 |
| N | 1,737 | 1,729 | |

Notes: The figures in parentheses are the standard deviations. *** Significant at the 1% level. Abbreviations of variable names: OSCR-Ohlson's (1980) bankruptcy prediction score; LATA-Liquid assets/total assets ratio; CLCA-Current liabilities/current assets ratio; TDTA-Total debt/total assets ratio; ROA-Net income/total assets ratio; BETA-Capital Asset Pricing Model (CAPM) beta; SIZE-Logarithm of the firm's market capitalization; MKBK-Market value/book value ratio; ILLQ-Stock illiquidity ratio calculated using the methodology in Avramov et al. (2006); SDPR-Standard deviation of daily stock returns one year prior to the market meltdown year.

The results indicate that only ROA (net income/total assets ratio) and SDPR (standard deviation of daily stock returns in the year prior to the meltdown year) have equal mean values in both samples, that is, firms had similar total asset profitability ratios and similar daily return volatility before the meltdown in both 1987 and 2008 samples. The mean values of all the other variables appear to be significantly different in the two samples. Firms in the 2008 sample have significantly higher OSCR (Ohlson's bankruptcy prediction score), LATA (liquid assets/total assets ratio), CLCA (current liabilities/current assets ratio), BETA, SIZE, and MKBK (market-to-book ratio) values. Firms in the 1987 sample have significantly higher TDTA (total debt/total assets ratio) and ILLQ (stock illiquidity ratio) values.

### 2.2. Methodology

We use the following three multivariate linear regression models in the analysis:

*Model 1:*

$$HPR_t = a_0 + a_1 OSCR + a_2 BETA + a_3 SIZE + a_4 MKBK + a_5 ILLQ + a_6 SDPR + a_7 IND + e_t \quad (1)$$

*Model 2:*

$$HPR_t = b_0 + b_1 LATA + b_2 TDTA + b_3 ROA + b_4 BETA + b_5 SIZE + b_6 MKBK + b_7 ILLQ + b_8 SDPR + b_9 IND + v_t \quad (2)$$

*Model 3:*

$$HPR_t = c_0 + c_1 CLCA + c_2 TDTA + c_3 ROA + c_4 BETA + c_5 SIZE + c_6 MKBK + c_7 ILLQ + c_8 SDPR + c_9 IND + z_t \quad (3)$$

where $a_0$ , $b_0$ , and, $c_0$ are the constants, $a_1$ to $a_7$ , $b_1$ to $b_9$ , and $c_1$ to $c_9$ are the regression coefficients, and $e_t$ , $v_t$ , and $z_t$ are the error terms in the Model 1, Model 2, and Model 3 regression equations, respectively.

*Dependent Variable:*

$HPR_t$ = Holding period return for the stock market meltdown period studied.

*Bankruptcy Prediction Variable:*

OSCR = Bankruptcy prediction score computed using Ohlson's (1980) bankruptcy prediction model.

*Technical Insolvency Risk Variables:*

LATA = Liquid Assets Ratio [(Cash + Marketable Securities) / Total Assets)].

CLCA = Current Liabilities / Current Assets.

*Bankruptcy Risk variables:*

TDTA = Debt Ratio (Total Debt / Total Assets).

ROA = Return on Assets (Net Income / Total Assets).

*Control Variables:*

BETA = *CAPM beta* of the stock, computed with monthly returns data for the five-year period prior to the stock market meltdown year. A minimum of two years of data is required for inclusion of a firm in the sample.

SIZE = Logarithm of the firm's market capitalization at the end of the year prior to the stock market meltdown year.

MKBK = Market-to-Book Ratio (Market Value of Common Equity / Book Value of Common Equity).

$$\text{ILLQ} = \textit{Illiquidity Ratio} = \frac{\sum_{i=1}^{T} \frac{|r_i|}{Volume_i}}{T} * 1{,}000{,}000$$

where $r_i$ stands for stock i's daily returns. $Volume_i$ is the daily volume in dollars. $T$ is the number of days in the estimation period. 1,000,000 is used to scale the number. We require that each stock must have at least ten trading days each month. ILLQ is calculated using the methodology in Avramov et al. (2006).

SDPR = Standard deviation of daily returns in the year prior to the meltdown year.

IND = Industry dummy variable. The industry groupings for the dummy variable are determined by using Fama and French's [see French (2008)] industry portfolios. The dummy variable takes the value of one if the firm belongs to an industry included in the industry portfolio represented by the dummy variable, zero otherwise.

In Model 1, Ohlson's (1980) bankruptcy prediction score (OSCR) is used as the main explanatory variable along with the control variables to determine if bankruptcy prediction score is a significant determinant of stock returns. In Model 2, OSCR is replaced with one technical insolvency risk variable (LATA) and two bankruptcy risk variables (TDTA and ROA) to study if these variables are significant determinants of stock returns. Since the technical insolvency risk variables LATA and CLCA are highly correlated, CLCA replaces LATA in Model 3.

OSCR (Ohlson's bankruptcy prediction score) is computed by using Ohlson's (1980) following

bankruptcy prediction model[1]:

$$\begin{aligned} \text{OSCR} = & -1.32 - 0.407 * \frac{\text{total assets}}{\text{GDP price index level}} + 6.03 * \frac{\text{total liabilities}}{\text{total assets}} \\ & -1.43 * \frac{\text{working capital}}{\text{total assets}} + 0.076 * \frac{\text{current liabilities}}{\text{current assets}} - 1.72 * 1_{\text{total liabilities}>\text{total assets}} \\ & -2.37 * \frac{\text{net income}}{\text{total assets}} - 1.83 * \frac{\text{funds from operations}}{\text{total liabilities}} + 0.285 * 1_{\text{if net loss for last two years}} \\ & -0.521 * \frac{\text{net income}_t \text{-net income}_{t-1}}{|\text{net income}_t| + |\text{net income}_{t-1}|} \end{aligned} \quad (4)$$

A high OSCR figure would indicate that the firm has a high probability of bankruptcy. Therefore, we predict a significant negative sign for the coefficient of this variable in the Model 1 regression, that is, we predict that firms with a higher bankruptcy prediction score would lose more value in a stock market meltdown.

Technical insolvency risk is the risk that a firm may be temporarily unable to meet its maturing obligations. Our first technical insolvency risk variable is LATA. It is calculated by finding the sum of cash and marketable securities and dividing it by total assets. LATA is also used as an explanatory variable in the stock market crash regressions of Baek et al. (2004) and Wang et al. (2009). Firms with a larger amount of liquid assets as a percentage of total assets would have a greater ability to meet their maturing obligations and, therefore, they would have less technical insolvency risk. We predict a significant positive sign for the coefficient of this variable in the Model 2 regression, that is, we predict that firms with a higher LATA ratio would lose less value in a stock market meltdown.

Our second technical insolvency risk variable is CLCA, current liabilities divided by current assets. It is the inverse of the current ratio, a ratio commonly used as a measure of liquidity in business firms. This variable measures the ability of a firm to meet its maturing obligations. A high CLCA ratio would indicate that the firm is less able to meet its maturing obligations and that it has a high level of technical insolvency risk. The CLCA ratio is one of the variables included in Ohlson's (1980) OSCR bankruptcy prediction equation (Equation #4). We predict a significant negative sign for the coefficient of this variable in the Model 3 regression, that is, we predict that firms with a higher CLCA ratio would lose more value in a stock market meltdown.

Our first bankruptcy risk variable is TDTA, total debt divided by total assets. It is commonly used as a measure of bankruptcy risk in previous studies (see, e.g., Mitton, 2002; Baek et al., 2004; Bonfim, 2009; Wang et al., 2009). It is one of the ratios included in Ohlson's (1980) OSCR bankruptcy prediction equation (Equation #4). A high TDTA ratio indicates that the firm has a high bankruptcy risk. Therefore, we predict a significant negative sign for the coefficient of this variable in our regressions, that is, we predict that firms with a higher TDTA ratio would lose more value in a stock market meltdown.

Our second bankruptcy risk variable is return on assets (ROA) calculated as net income divided by total assets. ROA is one of the ratios included in Ohlson's (1980) OSCR bankruptcy prediction equation (Equation #4). Mitton (2002) and Baek et al. (2004) use ROA as one of the determinants of stock returns in their studies of the 1997-1998 emerging stock markets crisis. Bonfim (2009) finds that bankruptcy risk is significantly negatively related to ROA. Wang et al. (2009) also use asset profitability (defined as EBIT/Total Assets) as a determinant of crash stock returns and they find a significant positive sign for the variable in most stock market crashes. We also predict a significant positive sign for ROA in our regressions, that is, we predict that firms with a higher ROA ratio would be considered to have less bankruptcy risk and, therefore, they would lose less value in a

[1] The variable "funds from operations" is not available in the COMPUSTAT database for 1986. Therefore, we use the sum of "income before extraordinary items" plus "depreciation and amortization" as a proxy for "funds from operations" in the calculation of OSCR for the 1987 crash.

stock market meltdown.

We use several control variables in the regressions. These variables are commonly used in most previous cross-sectional studies of stock returns. Since the holding period return is used as the dependent variable, we use the CAPM beta (BETA) as a control variable in the regressions. We compute each stock's beta by using the market index model with historical monthly returns for the five-year period prior to the meltdown year. The model is estimated using the Scholes and Williams (1977) correction for nonsynchronous trading. The CAPM posits that the returns of stocks with a high beta would move faster compared with the returns of low beta stocks in both down and up markets. Wang et al. (2009) find that stocks with a higher beta lose more value in stock market crashes. We also predict a significant negative sign for the coefficient of BETA in our regressions, that is, we predict that stocks with a higher beta would lose more value in a stock market meltdown.

In their three-factor asset pricing model, in addition to BETA, Fama and French (1992, 1993) use SIZE and market-to-book ratio (MKBK) as determinants of asset returns. In our regressions, in addition to BETA, we also use SIZE and MKBK as control variables. We define SIZE as the logarithm of the firm's market capitalization. MKBK is computed as the market value of the firm's equity divided by its book value.

Lo and MacKinlay (1990), Richardson and Peterson (1999), and others find that large firm stock returns lead small firm stock returns and large firm stock returns respond faster to new information compared with small firm stock returns. Wang et al. (2009) determine that large firm stock returns lead small firm stock returns in the downward direction in stock market crashes. We also predict a significant negative sign for the coefficient of the SIZE variable in our regressions, that is, we predict that large cap firms would lose more value in a stock market meltdown.

Fama and French (1992, 1993) show that the stocks of low MKBK (market-to-book ratio) firms tend to earn higher returns compared with the stocks of high MKBK firms. They argue that low MKBK firms might be in financial distress and investors would demand a larger risk premium from the stocks of these firms. Therefore, we predict a significant positive sign for the coefficient of the MKBK variable in our regressions, that is, we predict that investors would stay away from the stocks of financially distressed low MKBK firms and the stocks of these firms would lose more value in a stock market meltdown.

Amihud et al. (1990) demonstrate that stock illiquidity was a significant determinant of stock prices in the 1987 crash. In our regressions, we also use stock illiquidity (ILLQ) as one of our control variables. ILLQ is computed using the methodology in Avramov et al. (2006). Amihud (2002) finds a significant cross-sectional positive return-illiquidity relationship. Wang et al. (2009) also find a significant positive return-illiquidity relationship in stock market crashes. We predict a significant positive sign for the coefficient of ILLQ in our regressions, that is, we predict that stocks with a high ILLQ statistic would lose less value in a stock market meltdown.

Wang et al. (2009) find that stocks with more return volatility prior to a stock market crash experience greater price decreases in the crash. In our regressions, we include the standard deviation of daily returns (SDPR) during the year prior to the meltdown year as a measure of stock return volatility. We predict a significant negative sign for the coefficient of SDPR in our regressions, that is, we predict that stocks with more return volatility prior to a stock market meltdown would lose more value during the meltdown.

Industry classification is a commonly used dummy variable in cross-industry regressions. Mitton (2002), Baek et al. (2004), and Wang et al. (2009) use industry dummies in their stock market crash regressions. We also use industry dummy variables to control for the industry effect in our regressions. French and Fama [see French (2008)] divide industries into five portfolios. The first portfolio, CNSM, includes the consumer durables and non-durables industries. The second portfolio, MANF, includes the manufacturing and energy industries (utilities are not included in our study). The third portfolio, HITC, includes the business equipment, telephone, and television transmission industries. The fourth portfolio, HLTH, includes the healthcare, medical equipment, and pharmaceutical industries. The fifth portfolio, OTHR, includes all the other industries (financial

firms are not included in our study).

We use the Fama-French CNSMR, MANUF, HITEC, and HLTH industry portfolios as dummy variables in our regressions to control for the industry effect. The effect of the fifth industry portfolio (OTHR) is reflected by the intercept term in the regressions. The dummy variable takes the value of one if the firm belongs to an industry included in the portfolio represented by the dummy variable, zero otherwise.

## 3. Regression Results

### 3.1. 2008 Stock Market Meltdown

The regression results for the 2008 stock market meltdown are presented in the first three columns of Table 3. The holding period return (HPR) for the May 19-November 20 period is the dependent variable in all three regressions. The F values indicate that the regressions are statistically significant at the 1% level. The regression results confirm our hypothesis that technical insolvency risk and bankruptcy risk were significant determinants of stock returns in the 2008 stock market meltdown.

**Table 3**
**Regression Results**

| | 2008 Meltdown | | | 1987 Meltdown | | |
|---|---|---|---|---|---|---|
| Variable | Model 1 | Model 2 | Model 3 | Model 1 | Model 2 | Model 3 |
| Intercept | 0.013 | 0.045 | 0.077 | 0.269*** | 0.275*** | 0.280*** |
| OSCR | -0.019*** | | | -0.004** | | |
| LATA | | 0.089** | | | 0.015 | |
| CLCA | | | -0.070*** | | | 0.009 |
| TDTA | | -0.115*** | -0.112*** | | -0.029* | -0.037** |
| ROA | | 0.229*** | 0.196*** | | 0.067 | 0.074* |
| BETA | -0.016*** | -0.016*** | -0.015*** | -0.012*** | -0.013*** | -0.012*** |
| SIZE | -0.032*** | -0.026*** | -0.025*** | -0.034*** | -0.033*** | -0.033*** |
| MKBK | 0.008*** | 0.005** | 0.007*** | 0.001 | 0.000 | 0.000 |
| ILLQ | 0.009 | 0.011 | 0.010 | 0.020*** | 0.019*** | 0.019*** |
| SDPR | -8.478*** | -8.683*** | -8.748*** | -4.404*** | -4.309*** | -4.272*** |
| CNSM | 0.018 | 0.021 | 0.017 | 0.007 | 0.007 | 0.007 |
| MANF | -0.034** | -0.032* | -0.037** | -0.001 | 0.000 | 0.000 |
| HITC | 0.023 | 0.024 | 0.024 | -0.005 | -0.004 | -0.003 |
| HLTH | 0.018*** | 0.190*** | 0.186*** | -0.006 | -0.005 | -0.003 |
| Adj.R2 | 0.131 | 0.134 | 0.137 | 0.295 | 0.296 | 0.296 |
| F-value | 27.080*** | 23.300*** | 23.970*** | 73.470*** | 61.670*** | 61.680*** |
| Sample | 1,737 | 1,737 | 1,737 | 1,729 | 1,729 | 1,729 |

Notes: The significance levels of the parameter estimates for the variables are indicated with asterisks. *** indicates that the variable is significant at the 1% level. ** indicates that the variable is significant at the 5% level. * indicates that the variable is significant at the 10% level. Abbreviations of variable names: OSCR-Ohlson's (1980) bankruptcy prediction score; LATA-Liquid assets/total assets ratio; CLCA-Current liabilities/current assets ratio; TDTA-Total debt/total assets ratio; ROA-Net income/total assets ratio; BETA-Capital Asset Pricing Model (CAPM) beta; SIZE-Logarithm of the firm's market capitalization; MKBK-Market value/book value ratio; ILLQ-Stock illiquidity ratio calculated using the methodology in Avramov et al. (2006); SDPR-Standard deviation of daily stock returns one year prior to the market meltdown year.

The technical insolvency risk variables LATA (liquid assets/total assets ratio) in Model 2 and CLCA (current liabilities/current assets ratio) in Model 3 are both statistically significant. The coefficient of LATA in Model 2 is significant at the 5% level with a positive sign. It indicates that firms with a higher liquid asset level and greater ability to pay for their maturing obligations lost less value in the 2008 stock market meltdown. The coefficient of CLCA in Model 3 is significant at the 1% level with a negative sign. It indicates that firms with more current liabilities as a percentage

of current assets (i.e., firms with less ability to meet their maturing obligations using current assets) lost more value in the 2008 meltdown. These regression results with the LATA and CLCA variables show that technical insolvency risk was a significant concern to investors in the 2008 stock market meltdown.

The coefficient of the OSCR (Ohlson's bankruptcy prediction score) variable is significant at the 1% level in Model 1 with a negative sign. It indicates that firms with a higher bankruptcy prediction score and greater probability of bankruptcy lost more value in the meltdown. The bankruptcy risk variables TDTA (total debt/total assets ratio) and ROA (return on assets) are also both statistically significant. TDTA is significant at the 1% level both in Model 2 and in Model 3 with a negative sign. This indicates that firms with a higher debt ratio and greater bankruptcy risk lost more value in the 2008 meltdown. ROA is also significant at the 1% level both in Model 2 and in Model 3 with a positive sign. This indicates that firms with higher returns on assets and less bankruptcy risk lost less value in the 2008 meltdown. The results with the OSCR, TDTA, and ROA variables show that bankruptcy risk was a significant concern to investors in the 2008 stock market meltdown.

The CAPM predicts that the returns of stocks with a higher beta would fall faster than the average return for the market portfolio in a down market. The coefficient of BETA is significant in all three regressions at the 1% level with a negative sign. It indicates that stocks with a higher beta lost more value in the 2008 meltdown as predicted by the theory.

Lo and MacKinlay (1990) and Richardson and Peterson (1999) find that large firm stock returns respond faster to new information and that large firm stock returns lead small firm stock returns. Wang et al. (2009) demonstrate that large firm stock returns respond faster and they lead small firm stock returns in the downward direction in stock market crashes. Our findings for the 2008 stock market meltdown confirm Wang et al.'s (2009) findings for stock market crashes. The regression coefficient of SIZE is significant at the 1% level in all three regression models with a negative sign. This indicates that larger firms lost more value compared with smaller firms in the 2008 stock market meltdown.

Fama and French (1992, 1993) argue that low MKBK (market-to-book ratio) firms might be in financial distress and investors would demand a larger risk premium from the stocks of these firms. Because low MKBK firm stocks are riskier, Fama and French (1992, 1993) predict better performance for high MKBK firm stocks in risky periods. Our finding for the 2008 stock market meltdown confirms the Fama-French prediction. The regression coefficient of MKBK is significant at the 1% level in Models 1 and 3 and at the 5% level in Model 2 with a positive sign. This indicates that firms with a lower market-to-book ratio lost more value, and firms with a higher market-to-book ratio lost less value, in the 2008 stock market meltdown.

Amihud et al. (1990) and Wang et al. (2009) find that illiquid stocks lost less value in the 1987 stock market crash. We also find that illiquid stocks lost less value in the 1987 meltdown. However, the coefficient of ILLQ (illiquidity ratio) is not statistically significant in any of our three regression models for 2008. This indicates that stock illiquidity was not a significant determinant of stock returns in the 2008 stock market meltdown, that is, the prices of liquid and illiquid stocks were similarly affected by the financial crisis in 2008.

Wang et al. (2009) find that stocks with a greater return volatility prior to stock market crashes lose more value in the crashes. In this paper, we also find that stocks with a greater return volatility prior to the 2008 stock market meltdown lost more value during the meltdown. The coefficient of SDPR (standard deviation of stock returns for the year prior to the meltdown year) is significant at the 1% level with a negative sign in all three regressions.

The signs and the significance levels of the industry dummy variables may give an idea about which industries were affected the most in the 2008 stock market meltdown. The regression coefficients of the CNSM (consumer goods industries) and HITC (high-tech industries) dummy variables are not statistically significant in any of the three regressions. It indicates that the firms from the industries included in these dummy variables had an average loss in the 2008 stock market meltdown.

The regression coefficients of the MANF (manufacturing industries) dummy variable are significant at the 5% level in Models 1 and 3, and at the 10% level in Model 2 with a negative sign. It indicates that the firms from the industries included in the MANF dummy variable portfolio lost more value compared with the firms from the industries included in the other dummy variable portfolios in the 2008 stock market meltdown. The regression coefficients of the HLTH (healthcare industries) dummy variable are significant at the 1% level in all three models with a positive sign. It indicates that the firms from the industries included in the HLTH dummy variable portfolio lost less value compared with the firms from the industries included in the other dummy variable portfolios in the 2008 stock market meltdown.

**3.2. 1987 Stock Market Meltdown**

The regression results for the 1987 stock market meltdown are presented in the last three columns of Table 3. The holding period return (HPR) for the October 6-19 period is the dependent variable in all three models. The F values indicate that all three regressions are statistically significant at the 1% level.

Unlike in the regressions for the 2008 meltdown, neither of the two technical insolvency risk variables, LATA (liquid assets/total assets ratio) in Model 2 and CLCA (current liabilities/current assets ratio) in Model 3, is statistically significant for the 1987 meltdown. Our results indicate that, because of the bank credit crunch and liquidity shortage, technical insolvency risk was a significant determinant of stock returns in the 2008 meltdown. However, it was not a significant factor affecting stock returns in the 1987 meltdown.

The regression tests for the bankruptcy risk variables OSCR (Ohlson's bankruptcy prediction score), TDTA (total debt/total assets ratio), and ROA (return on assets) indicate that bankruptcy risk was also a significant determinant of stock returns in the 1987 meltdown as in the 2008 meltdown. However, although the coefficients of all three variables also have the predicted signs for 1987, the p-values imply that bankruptcy risk was not as big a problem in the 1987 meltdown as it was in the 2008 meltdown. The coefficient of OSCR is significant only at the 5% level in Model 1. The coefficients of TDTA are significant at the 10% level in Model 2 and at the 5% level in Model 3. The coefficient of ROA is not statistically significant in Model 2 and it is significant only at the 10% level in Model 3.

As in the 2008 meltdown, both BETA and SIZE are significant at the 1% level in all three regression models for the 1987 meltdown. The negative sign of the regression coefficients of these variables indicates that, as in the 2008 meltdown, larger cap stocks and stocks with higher betas lost more value in the 1987 meltdown.

Our results indicate that, although MKBK (market-to-book ratio) was a significant determinant of stock returns in the 2008 meltdown, it was not a significant determinant of stock returns in the 1987 meltdown. The regression coefficient of MKBK is significant in none of the three regression models for 1987. Wang et al. (2009) also find inconclusive results related to the MKBK variable in several stock market crashes including the 1987 crash.

Amihud et al. (1990) and Wang et al. (2009) find that stock illiquidity (ILLQ) had a significant effect on stock returns in the 1987 crash. We also find ILLQ to be a significant determinant of stock returns in the 1987 meltdown. The coefficients of ILLQ are significant at the 1% level in all three regressions with a positive sign. It indicates that stocks with greater illiquidity lost less value in the 1987 meltdown.

We find that, as in the 2008 meltdown, stock return volatility was a significant determinant of stock returns in the 1987 meltdown. The regression coefficient of SDPR (standard deviation of stock returns during the year prior to the meltdown year) is significant at the 1% level in all three regression models for 1987. The negative sign of the regression coefficients indicates that, as in the 2008 meltdown, stocks with greater return volatility prior to the 1987 meltdown lost more value in the meltdown.

Our findings indicate that the firms from the manufacturing industries included in the MANF

dummy variable portfolio lost more value than average and the firms from the healthcare industries included in the HLTH dummy variable portfolio lost less value than average in the 2008 meltdown. However, our regression results show that the stocks of firms from all industry portfolios had similar average losses in the 1987 meltdown. The regression coefficient of none of the industry dummy variables is statistically significant in the 1987 regressions.

**4. Conclusions**

The 1987 and 2008 stock market meltdowns are the most important stock market events in U.S. history since the Great Depression. Although the 1987 stock market meltdown has been studied extensively in the literature, the 2008 stock market meltdown has not yet received sufficient attention. In this paper, we make a contribution to the literature by comparing the determinants of stock returns in the 1987 and 2008 stock market meltdowns and by testing several related extant hypotheses on the determinants of stock returns.

Mitton (2002), Baek et al. (2004), and Wang et al. (2009) show that bankruptcy risk is a significant determinant of stock returns in crisis periods and stock market crashes. In this paper, we also find that bankruptcy risk was a significant determinant of stock returns in the 1987 and 2008 stock market meltdowns. However, the p-value statistics in our regressions indicate that bankruptcy risk had a greater effect on stock returns in the 2008 meltdown than it did in the 1987 meltdown. These results imply that the stock market meltdown that took place as a result of a serious financial crisis in 2008 was a greater bankruptcy risk scare for investors than was the 1987 meltdown.

Technical insolvency is the temporary inability of a firm to service its debt obligations. In a previous study, Wang et al. (2009) find that technical insolvency risk was not a significant determinant of stock returns in several previous stock market crashes including the 1987 crash. In this study, we also find that technical insolvency risk was not a significant determinant of stock returns in the 1987 stock market meltdown. However, we demonstrate that because of the serious bank credit crunch and liquidity shortage, technical insolvency risk was a significant determinant of stock returns in the 2008 stock market meltdown.

As in the previous studies on stock market meltdowns (see, e.g., Wang et al., 2009), we find that beta, market cap, and stock return volatility were significant determinants of stock returns in the 1987 and 2008 stock market meltdowns. Stocks with higher betas, larger market cap, and greater return volatility lost more value in both meltdowns. These results imply that investors can minimize losses by staying away from stocks with more return volatility, high betas, and large market caps in stock market meltdowns.

Lo and MacKinlay (1990) and Richardson and Peterson (1999) argue that large firm stock returns respond faster to new information and large firm stock returns lead small firm stock returns. Wang et al. (2009) find that large firm stock returns lead small firm stock returns in stock market crashes and in post-crash market reversals. In this paper, we provide additional empirical evidence for these previous findings by demonstrating that large market cap stock returns responded faster to the 1987 and 2008 stock market meltdowns and that large market cap stock returns led small market cap stock returns in the downward direction in both meltdowns.

Fama and French (1992, 1993) argue that the market-to-book ratio is a determinant of stock returns. Our regression results show that, although it did not affect stock returns significantly in the 1987 meltdown, the market-to-book ratio was a significant determinant of stock returns in the 2008 meltdown. Wang et al. (2009) also find controversial results for the market-to-book ratio with data for several stock market crashes.

Amihud et al. (1990) and Wang et al. (2009) find that stock illiquidity was a significant determinant of stock returns in the 1987 stock market meltdown. We also find that stock illiquidity had a significant effect on stock returns in the 1987 meltdown. However, our findings indicate that stock illiquidity was not a significant determinant of stock returns in the 2008 meltdown. This result implies that the 2008 financial crisis impacted the market values of both liquid and illiquid stocks similarly.

**References**

Amihud, Y., 2002. Illiquidity and stock returns: Cross-section and time-series effects. *Journal of Financial Markets* 5, 31-56.

Amihud, Y., H. Mandelson, and R.A. Wood, 1990. Liquidity and the 1987 stock market crash. *Journal of Portfolio Management* 16, 65-69.

Avramov, D., T. Chordia, and A. Goyal, 2006. Liquidity and autocorrelations in individual stock returns. *Journal of Finance* 47, 427-486.

Baek, J.S., J.K. Kang, and K.S. Park, 2004. Corporate governance and firm value: Evidence from the Korean financial crisis. *Journal of Financial Economics* 71, 265–313.

Belsley, D.A., E. Kuh, and R.E. Welsch, 1980. *Regression Diagnostics: Identifying Influential Data and Sources of Multicollinearity* (John Wiley, New York, NY).

Bonfim, D., 2009. Credit risk drivers: Evaluating the contribution of firm level information and of macroeconomic dynamics. *Journal of Banking and Finance* 33, 281-299.

Fama, E.F. and K.R. French, 1992. The cross-section of expected stock returns. *Journal of Finance* 47, 427-466.

Fama, E.F. and K.R. French, 1993. Common risk factors in the returns on bonds and stocks. *Journal of Financial Economics* 33, 3-56.

Fama, E.F. and K.R. French, 2001. Disappearing dividends: Changing firm characteristics or lower propensity to pay? *Journal of Financial Economics* 60, 3–43.

French, K.R., 2008. http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

Gadarowski, C., G. Meric, C. Welsh, and I. Meric, 2007. Dividend tax cut and security prices: Examining the effect of the Jobs and Growth Tax Relief Reconciliation Act of 2003. *Financial Management* 36, 89-106.

Jegadeesh, N. and S. Titman, 2001. Profitability of momentum strategies: An evaluation of alternative explanations. *Journal of Finance* 56, 699-720.

Keown, A.J., J.D. Martin, and J.W. Petty, 2008. *Foundations of Finance* (Pearson Prentice Hall, Upper saddle River, NJ).

King, M.A. and S. Wadhwani, 1990. Transmission of volatility between stock markets. *Review of Financial Studies* 3, 5-33.

Lo, A.W. and A.C. MacKinlay, 1990. When are contrarian profits due to stock market overreaction? *Review of Financial Studies* 3, 175-206.

Mitton, T., 2002. A cross-firm analysis of the impact of corporate governance on the East Asian financial crisis. *Journal of Financial Economics* 64, 215-241.

Ohlson, J.A., 1980. Financial ratios and the probabilistic prediction of bankruptcy. *Journal of Accounting Research* 18, 109-131.

Richardson, T. and D.R. Peterson, 1999. The cross-autocorrelation of size-based portfolio returns is not an artifact of portfolio autocorrelation. *Journal of Financial Research* 22, 1-13.

Roll, R., 1988. The international crash of October 1987. *Financial Analysts Journal* 44, 19-35.

Scholes, M. and J.T. Williams, 1977. Estimating betas from nonsynchronous data. *Journal of Financial Economics* 5, 309–327.

Seyhun, H.N., 1990. Overreaction or fundamentals: Some lessons from insiders' response to the market crash of 1987. *Journal of Finance* 45, 1363-1388.

Wang, J., G. Meric, Z. Liu, and I. Meric, 2009. Stock market crashes, firm characteristics, and stock returns. *Journal of Banking and Finance* 33, 1563-1574.