THE DISTRESS RISK PREMIUM AND CROSS-SECTIONAL STOCK RETURNS

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Abstract: This article employs the Fama and Macbeth regressions and portfolio sorting methodologies to analyze the distress risk premium in the Taiwan stock market. The author collects the data of listed non-financial firms from 2008 to 2018. The new method effectiveness evaluation indicates that the Fama-French three-factor model could explain the bankruptcy risk premium in the Taiwan stock exchange. The findings show that firms with higher book-to-market risk earn more substantial returns for the same level of distress risk. The results also figure out the existence of distress risk premium in the Taiwan stock exchange. Specifically, firms with higher bankruptcy risk generate higher returns. The new findings extend the existing literature and provide investment strategies based on distress risk in the Taiwan stock exchange. The findings are also consistent with the risk-return hypothesis and prior literature.

Keywords: Asset pricing, portfolios management, financial distress, Taiwan, stock returns

I. Introduction

In 1992, Fama and French figured out the variation of Beta had little to no ability in explaining cross-sectional equity returns while the firm's characteristics such as firm size and book-to-market value (BM) ratio could do it. Therefore, Fama and French expand the capital pricing asset model by adding the Size of firms, book to market (BM), and Beta to assess the cross-sectional variation of stock returns in the US market [9]. Their results show that stock returns are negatively related to firm Size while positively related to the BM ratio. Moreover, they find that there is an insignificant relationship between the returns of stock and Beta. Later studies also have consistent results with [9]. For instance, there is an inverse relationship between stock returns and firm Size, while stock returns positively relate to book-to-market ratios in the international markets [14, 20].

Z-score factors help investors estimate the expected default risk of companies. This factor typically applies in manufacturing businesses with publicly available financial data, including market price quotations. The Z-score anticipates the bankruptcy situation of businesses shortly accurately. The solvency, liquidity, and profitability ratios are the most significant in forecasting bankruptcy [6]. Z-score effective anticipates bankruptcy precisely up to 94 percent of the samples across different periods in up to two years [6]. Several kinds of research analyze the relationship between book-to-market, Size, default risk, and stock returns. For instance, default risk has a positive relationship with returns [17]. On the other hand, the study of [6] and [11] report an inverse relationship between stock returns and default risks. For instance, higher bankruptcy risk leads to lower stock returns since 1980 [6].
Significantly, the distress factor is unlikely to account for the Size and book-to-market effects [11].

Prior studies document mixed impacts of Size, BM, default risk on equity returns. This study estimates the effects of these factors on stock returns in Taiwan from 2008 to 2018 for the following reasons. Firstly, the Taiwan stock market having microstructures are distinct from most developed markets. Taiwanese stock market has small and short-term investors, and the market is highly liquid [7]. Secondly, the costs of traction in the Taiwanese market were proportional and comparative low for all stocks. Transaction costs are symmetrical through stocks in Taiwan and pretty cheaper than other developed stock markets. In addition, several studies use data from developed markets such as the US, UK, and French markets and emerging markets, including Taiwan and Hong Kong markets.

Following the study of [7, 9, 16], this study performed the Fama-Macbeth [8] regressions to measure the influence of Size, BM and risk premium, and Z-score on stock returns. After applying the dependent sorting method between Z-score and Size in the Taiwan market, the results show that lower Z-score portfolios would generate higher returns than higher Z-score portfolios. Moreover, after controlling for the Z-score portfolio, the results report that a smaller Size portfolio would create higher returns than a more extensive Size portfolio. Besides that, the study also applies dependent sorting between book-to-market and Z-score factors in the Taiwan market. After controlling the Z-score portfolio, the result reports that higher book-to-market portfolios generate higher returns than lower book-to-market portfolios. Moreover, after controlling for the Book-to-market portfolio, stocks with higher Z-score earn higher returns.

This paper is novel because it seeks to measure the relationship between the Size of firms, book-to-market, and Z-score factors on the cross-sectional stock returns. Secondly, I am going to sort stocks into portfolios to estimate the value-weighted returns. Finally, I incorporate the z-score factor into the Fama and French three-factor model, and the result is a substantial size effect in Taiwan and a significant book-to-market effect in both markets.

Although this paper has novel contributions, the data limitations restrain the author from analyzing the long-term effects of distress on the Taiwan stock market. Further research may rely on this study to examine the distress risk premium before and after the Covid-19 pandemic on the global stock exchange. Later research may also test whether financial constraints or investment frictions drive the distress risk.

The paper proceeds as follows. Chapter 2 summarizes literature reviews that help us to develop the research hypotheses. Chapter 3 shows data collection and research methodology. Chapter 4 analyzes the empirical results. Finally, chapter 5 provides a conclusion and recommendations.

II. Literature Review

Fama and French [9] challenge the capability of estimating the equity returns of the CAPM. They find out that the cross-sectional average returns from 1963 to 1990 are not entirely explained by the variation of the US stock indexes. Moreover, their study indicates the significant effects of book-to-market (BM) and Size on stock returns. They conclude a positive and significant relationship between stock returns and book-to-market ratio while firm Size has a negative and significant impact on stock returns. The study of [20] applies the Fama and French three factors model across 20 countries, and they also confirm significant and consistent impacts of Size, BM, and stock returns.

Various studies document that smaller stocks generally earn higher returns than more extensive stocks over long time horizons. For instance, there is a negative relationship between returns and
size firms [7, 12, 18, 19]. Moreover, firm Size is also a proxy for risk because smaller companies are more likely to have a greater risk than larger companies. Moreover, there is higher information asymmetry within penny stocks [19]. Therefore, investors may require higher returns to invest in small stocks.

The book-to-market ratio helps to explain the expected stock returns. For instance, the study of [3, 9, 10] suggests that the book-to-market ratio effectively predicts Chinese stock returns. The study of [2] suggests that retain earnings and BM reliably predict stock returns from 1964 to 2017 in the US market. They also indicate that both retain earnings and dividend yield have a positive relationship with stock returns.

Many researchers examine the relationship between default risk and returns. For instance, the study of [17] examines the effect of bankruptcy risk on stock returns, and the results show that higher bankruptcy risk firms would generate higher returns than less distressed firms. As a result, the author proposes the hypothesis as follow:

H1: There is an inverse relationship between the Z-score factor and stock returns.
This study also focuses on financial distress factors and BM, the Size of firms, risk premium. The prediction of financial distress is an essential issue in finance that attracted many studies around the world. The prior study shows that the relationship between default risk and returns is negative and significant [6]. Moreover, if the market does not fully incorporate available financial distress information, there are persistent biases in securities pricing. Therefore, most insolvent firms earn lower subsequent returns when this negative information is not eventually embedded in prices. There is an inverse relationship between default risk and stock returns [11]. They also document that financial leverage and distress factors reduce the strength of factors in explaining the cross-sectional returns.

On the other hand, various studies [4, 17] report a positive and statistically significant relationship between default risk and returns. Default risk is a priced risk factor, and they show that SMB and HML are strongly related to default risk [4]. Moreover, smaller companies have a higher default risk than more significant firms, and default risk falls when firm size increases [4]. In this study, the question is how equity returns fluctuate when default risk and size factors increase. Hence, the author proposes the following hypothesis:

H2: After dependent sorting by Size and Z-score, the portfolios contain stocks with Higher Z-score, and bigger firm Size outperforms the portfolios containing lower Z-score and smaller Size. The study of [4] also concludes that book-to-market impact exists in the two quintiles with the highest default risk. The difference of returns between growth (low BM) and value (high BM) stocks is almost 30 percent, with the highest default risk and decreases 12.7 percent for the stock in the second-highest default risk quintile. Furthermore, high BM stocks have a much higher default risk than low BM stocks, and there is an inverse relationship between default risk and book-to-market. The reason could be that value stocks have much higher default risk than growth stocks, and there is a monotonic relation between BM and default risk.
This study aims to test the volatility of expected returns when book-to-market and Z-score factors jointly fluctuate. Thus, the author proposes the following hypothesis:

H3: After dependent sorting by BM and Z-score, the portfolios containing higher Z-score and higher BM outperform those with lower Z-score and lower BM.
III. Data and Research Methodology

3.1 Data
This study follows [7] to collect market data of all public companies from the Taiwan Economic Journal (TEJ) database and merge it with data from financial statements. The author also follows [7, 9] to exclude financial firms because the high leverage that is quite normal for financial firms does not have the same meaning for non-financial firms. Moreover, I also follow [7, 9] to remove observations that have missing data that are required to calculate variables. The Taiwan Capitalization Weighted Stock Index (TAIEX) is chosen as a proxy for the market returns. Moreover, the ten years government bond rate is chosen as a representation of the risk-free rate. After collecting all data, I perform data processing by using winsorizations from 1% to 99% to decrease the impacts of outliers on regression results. The final sample includes 794,665 firm-month observations.

I follow [7, 9, 12] to calculate book-to-market by the formula the book value of equity divided by the current month’s market value of equity. I follow [6] to calculate Z-score. The Z-score anticipates the financial health of a firm the probability of a firm starting bankruptcy. The Altman Z-score model is a follow:

\[
Z\text{score} = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + X_5
\]

In which:
\( X_1 \): Working capital / Total assets.
\( X_2 \): Retained Earnings / Total assets.
\( X_3 \): Earnings before interest and taxes / total assets.
\( X_4 \): Market value equity / Book value of total debt.
\( X_5 \): Sales / Total assets.

3.2 Methodology
3.2.1 Fama and French three-factor model
In order to investigate the relationship between market premium, book-to-market, firm Size, and equity returns, I follow [9] to regress the cross-sectional regression model at the individual stock level. Specifically, I regress monthly excess stock returns on the market value, book-to-market, and risk premium. However, the study of [9] suggests that the relation between Beta and returns disappears from 1963 to 1990, even when they solely use Beta to examine equity returns. Their result rejects the explanation of CAPM, and they recommend that market value, book-to-market provide a better estimation of the cross-section of US stock returns. Therefore, the author prefers to test firm Size, book-to-market, and Z-score in this research.

\[
MODEL 1: \text{ER}_{i,t} = \alpha_i + \beta_1\text{RM}_{pt} + \beta_2\text{SZ}_{pt} + \beta_3\text{BM}_{i} + \epsilon_{i,t} \quad (1)
\]

Where \( \text{ER}_{i,t} \) is the estimated excess returns calculated by the monthly returns on portfolio minus the risk-free rate in month t. \( \text{SZ} \) and \( \text{BM} \) are the logarithms of market equity and the logarithm of book-to-market value.

Prior studies suggest that the size effect is concentrated in the smallest firms, which also happened among those with the highest default risk [7, 17]. Therefore, the author constructs model 2 to test the relationship between Size and Z-score factor on stock returns.

\[
MODEL 2: \text{ER}_{i,t} = \alpha_i + \beta_1\text{SZ}_{i,t} + \beta_2\text{ZSCORE}_{i,t} + \epsilon_{i,t} \quad (2)
\]
Where ER<sub>i,t</sub> is the estimated returns calculated by the monthly returns on portfolio minus the risk-free rate in month t. Sz and Z-score are the logarithms of market equity and default risk.

According to the study of [16], there is a relationship between default risk and BM. I propose model 3 to examine the impacts of BM and Z-score on equity returns.

MODEL3: ER<sub>i,t</sub> = α<sub>t</sub> + β<sub>1</sub>BM<sub>i,t</sub> + β<sub>2</sub>ZSCORE<sub>i,t</sub> + ε<sub>i,t</sub> (3)

Following the research of[7, 9, 12], the difference in returns between small and big stocks can be explained by their default risk. In the remaining stocks in the market, where there is an insignificant impact of Size on stock returns, the difference in default risk between small and big stocks is minimal. Therefore, the author constructs model 4 to test the impacts of Size, BM and distress risk on the cross-sectional stock returns.

MODEL4: ER<sub>i,t</sub> = α<sub>t</sub> + β<sub>1</sub>SZ<sub>i,t</sub> + β<sub>2</sub>BM<sub>i,t</sub> + β<sub>3</sub>ZSCORE<sub>i,t</sub> + ε<sub>i,t</sub> (4)

3.2.2 Portfolio sorting methods

Following [9], the author sorts stocks to firm Size each year t from January 2008 to December 2018. Therefore, there are six portfolios, consisting of three Z-score groups at time t with up, medium, and down and two Size groups at time t with B (big Size) and S (small Size). The DS portfolio includes the stocks having the smallest size and the lowest Z-score. On the other hand, the UB portfolio explained that the stocks have the most considerable firm size and the highest Z-score. The author rebalances six portfolios (DS, MS, US, DB, MB, and UB).

In order to examine the combined effects of BM and Z-score on equity returns, this study conducts dependent sorting stocks by BM and Z-score. The author also constructs six portfolios, which is the combination of two Z-score groups and three BM groups following 30% and 70% at time t with H (high), M (medium), and L (low). In other words, the DL portfolio includes the stocks having the highest book-to-market ratio and the lowest Z-score, and the UL portfolio explained that the stocks have the highest Z-score and the lowest book-to-market ratio. Six portfolios (DL, DM, DH, UL, UM, and UH) are rebalanced every month.

UMD is the different returns of portfolio meant to follow risk factors in returns related to bankruptcy risk ratio and firm Size, and the author also follows [9] to choose three portfolios to construct UMD. The monthly returns of UMD are the difference between the average of the returns on the three lowest Z-score portfolios (DS, DM, DB) and the average of the returns on the three highest Z-score portfolios (the US, UM, UB) with the same weighted-average SZ ratios.

UMD can be calculated as follows:

\[
UMD = \frac{(Up_{zscore_{Small size}} + Up_{zscore_{Medium size}} + Up_{zscore_{Big size}})}{3} - \frac{(Down_{zscore_{Small size}} + Down_{zscore_{Medium size}} + Down_{zscore_{Big size}})}{3}
\]  

(5)

High minus low (HML) is a portfolio meant to follow risk factors in returns related to book-to-market and Z-score, and the author chooses three portfolios to construct HML.

HML is the difference between the simple average monthly returns on the highest BE/ME portfolios (DH and UH) and the average monthly returns on the two low-BE/ME portfolios (UL and DL). HML is thus the difference between the returns on high and low-BE/ME portfolios with about the same weighted average Z-score. HML can be formed as follow:

\[
HML = \frac{(Down_{zscore_{High BM}} + Up_{zscore_{High BM}})}{2} - \frac{(Down_{zscore_{Low BM}} + Up_{zscore_{Low BM}})}{2}
\]  

(6)

Small minus big (SMB) is a portfolio meant to follow risk factors in returns related to firm Size and Z-score, and the author also follows [9] to choose three portfolios to construct SMB.
SMB is the difference between the simple average monthly returns on the most significant firm size portfolios (DB and UB) and the average monthly returns on the minor firm size portfolios (DS and US). SMB is thus the difference between the returns on big and small firm size portfolios with about the same weighted average Z-score. SMB can be formed as follow:

\[
SMB = \frac{(\text{Down}_z\text{score}_\text{SmallSZ} + \text{Up}_z\text{score}_\text{SmallSZ})}{2} - \frac{(\text{Down}_z\text{score}_\text{BigSZ} + \text{Up}_z\text{score}_\text{BigSZ})}{2}
\]  

(7)

IV. Empirical Results

4.1 Descriptive statistics.

Table 1 describes the statistical summary consist of the number of observations (N), mean (Mean), and standard deviation (Std Dev) of each variable such as LNBM, Z-score, Ret, LNSZ in Taiwan in the period from 2008 to 2018. The Taiwan sample has 794,665 firm-month observations with four factors. Besides that, it shows the minimum and maximum of each variable. First, the LNBM is negative, with a mean of -6.8882 in the country. The negative LNBM shows the market values of stocks to grow higher than the book value of stocks. Secondly, the mean Z-score in Taiwan is 2.6089, and the lowest value is -0.3500. The Taiwan stock market has 501 companies at Z-score below 1.8, proving that most companies are at high risk of bankruptcy. According to Altman (1968), Z-score has been divided into three levels. Including one situation, if Z-score <=1.81, the enterprise has severe financial distress. In the second situation, if Z-score > 2.99, the enterprise does not have distress risk. In the final situation, if 1.81 < Z-score =< 2.99, the company has a small distress problem in a short time. Especially, Zscore = 0 means that the probability of bankruptcy is 50 percent. Thirdly, the returns in Taiwan are 0.96, and it has the highest value of 0.4930. Furthermore, finally, the LNSZ is positive with a standard deviation of 1.3422 in Taiwan. Besides that, the lowest value is two-thirds the highest value.

Table 1. Descriptive Statistics OF LNBM, LNSZ, Z-score, and ret In Taiwan in the period from 2008-2018

Table 1 shows descriptive statistics of four factors as the book to market is common equity divided by fiscal-year-end price times number of shares outstanding (BM), Z-score, Ret, and firm Size (SZ). Besides that, LNBM means the logarithm of BM, and LNSZ is the logarithm of SIZE [9]. Returns are monthly returns that are taken from companies in the TSE. Z-score is the measure of bankruptcy risk from Altman (1968). A reducing Z-score means that the enterprise will easily face bankruptcy.

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Mean</th>
<th>STD.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNBM</td>
<td>794,665</td>
<td>-6.8882</td>
<td>0.6697</td>
<td>-9.9493</td>
<td>-5.1062</td>
</tr>
<tr>
<td>Z-score</td>
<td>794,665</td>
<td>2.6090</td>
<td>3.0506</td>
<td>-0.3500</td>
<td>25.9700</td>
</tr>
<tr>
<td>Ret</td>
<td>794,665</td>
<td>0.0096</td>
<td>0.0961</td>
<td>-0.2970</td>
<td>0.4930</td>
</tr>
<tr>
<td>LNSZ</td>
<td>794,665</td>
<td>15.4084</td>
<td>1.3423</td>
<td>12.1188</td>
<td>19.9121</td>
</tr>
</tbody>
</table>

4.2 CorrelationMatrix.

Table 2 presents a Pearson correlation matrix for all test variables. Using two-tailed tests, all correlations in Table 2 are significantly different from zero at least at the 1 percent level.

PEARSON CORRELATION COEFFICIENTS
Table 2 report the relationship among four variables, and it will explain how to level of influence about each of the variables. With correlation coefficient, the four factors are not linearly related to each other. Because the correlation coefficient of all factors together is less than 0.8. The LNBM is negative with Z-score. The book value of the company is lower than market value; they quickly face bankruptcy. The LNSZ is positive with Z-score. It means the companies with small Sizes have much higher default risk than firms with big Sizes, and default risk falls when Size increases. These results align with [14, 17]. Besides, firm Size and BM are inversely correlated, and these results are consistent with [7, 9, 12].

4.3 Fama-Macbeth regression:

Table 3. Fama – Macbeth Regression Results
Table 3 denotes the firm’s market capitalization, its book-to-market ratio, and the Z-score is the bankruptcy risk coefficient. T-values are estimated to Newey and West (1987) the errors are determined standard. The R² is adjusted for degrees of freedom.

<table>
<thead>
<tr>
<th>Model</th>
<th>LNBM</th>
<th>LNSZ</th>
<th>Z-score</th>
<th>R-squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>0.0042</td>
<td>-0.0023</td>
<td></td>
<td>0.0155</td>
</tr>
<tr>
<td></td>
<td>(3.29)</td>
<td>(-3.94)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 2</td>
<td></td>
<td></td>
<td>-0.0029</td>
<td>-0.0003</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(-5.26)</td>
<td>(-1.87)</td>
</tr>
<tr>
<td>Model 3</td>
<td>0.0067</td>
<td></td>
<td></td>
<td>0.0005</td>
</tr>
<tr>
<td></td>
<td>(20.64)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 4</td>
<td>0.0063</td>
<td>-0.0016</td>
<td>0.0005</td>
<td>0.0043</td>
</tr>
<tr>
<td></td>
<td>(17.19)</td>
<td>(-5.37)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3 describes four regression models in Taiwan from 2008 to 2018. The LNBM is positive with returns, and LNSZ is negative with returns in all models. This result is consistent with Fama and French’s previous research. Specifically, the coefficient of the Z-score is negative in model 2 while it is positive in models 3 and 4. This finding is consistent with [7, 9, 12]. Model 2 shows that Size and Z-score have a negative relationship with stock returns. These findings demonstrate that when the Z-score decrease by 1% then stock return increase by 0.03%. When an enterprise has a smaller size, its default risk will increase, consistent with [11]. In model 3, the book-to-market ratio and Z-score are outstandingly positive, which means increases 1% of book-to-market in the Taiwan market will increase 0.05% risk of bankrupting companies.

4.4 Portfolio strategy in Taiwan:

Table 4. Bivariate Sorting Portfolios Between Size and Z-score.
The study also follows [9,10] to sort stocks to firm Size each year t from January 2008 to December 2018. The author constructs six portfolios, which consists of two Z-score groups at time t with up and down and three Size groups go along with 30% and 70% at time t with B (the
most considerable Size), M (medium size), and S (the smallest size). The DS portfolio includes the stocks having the smallest Size and the lowest Z-score. On the other hand, the UB portfolio explained that the stocks have the most significant firm size and highest Z-score. The author rebalances six portfolios (DS, DM, DB, US, UM, and UB).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>T-value</th>
<th>Std.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS</td>
<td>0.0166</td>
<td>8.31</td>
<td>0.0522</td>
</tr>
<tr>
<td>DM</td>
<td>0.0098</td>
<td>4.93</td>
<td>0.0517</td>
</tr>
<tr>
<td>DB</td>
<td>0.0055</td>
<td>2.89</td>
<td>0.0498</td>
</tr>
<tr>
<td>US</td>
<td>0.0138</td>
<td>6.59</td>
<td>0.0548</td>
</tr>
<tr>
<td>UM</td>
<td>0.0080</td>
<td>4.25</td>
<td>0.0492</td>
</tr>
<tr>
<td>UB</td>
<td>0.0052</td>
<td>2.94</td>
<td>0.0462</td>
</tr>
<tr>
<td>UMD1</td>
<td>-0.0028</td>
<td>-3.61</td>
<td>0.0200</td>
</tr>
<tr>
<td>UMD2</td>
<td>-0.0018</td>
<td>-2.87</td>
<td>0.0160</td>
</tr>
<tr>
<td>UMD3</td>
<td>-0.0003</td>
<td>-0.46</td>
<td>0.0179</td>
</tr>
<tr>
<td>SMB1</td>
<td>0.0111</td>
<td>12.64</td>
<td>0.0229</td>
</tr>
<tr>
<td>SMB2</td>
<td>0.0086</td>
<td>9.27</td>
<td>0.0243</td>
</tr>
<tr>
<td>SMB</td>
<td>0.0098</td>
<td>12.91</td>
<td>0.0199</td>
</tr>
<tr>
<td>UMD</td>
<td>-0.0016</td>
<td>-3.33</td>
<td>0.0127</td>
</tr>
</tbody>
</table>

Computing a consequence of the Z-score factors with the firm Size of the six portfolios (DS, MD, BD, US, UM, and UB), the research uses the OLS model with the outcome described in table 4.

After dependent sorting by SZ and the lowest Z-score, DS, DM, DB portfolio returns are 0.0166, 0.0098, and 0.0055. In this portfolio, firm Size is increasing, the returns of the portfolio will decrease. After Sorting by SZ and the highest Z-score, US, UM, UB portfolio returns are 0.0138, 0.0080, and 0.0052. In this portfolio, firm Size is increasing, and the portfolio returns will decrease, consistent with [21].

The study further performs the bivariate sorting by Z-score and the most petite SZ, and the returns of DS, US portfolio is 0.0166 and 0.0138. In this portfolio, Z-score is falling, and the portfolio returns will rise, consistent with [16, 21]. Sorting by Z-score and the biggest SZ, returns of DB, UB portfolio are 0.0055 and 0.0052. In this portfolio, Z-score is reducing, and the portfolio returns will up, consistent with [11].

Besides that, the mean of SMB is 0.0098 and follows the formula 7. The findings suggest that investors long the smaller stocks and sell the stock with a higher Z-score. The mean of UMD is -0.0016, which means that investors may generate 0.16% arbitrary profit from buying the lower Z-score stocks and selling the higher Z-score stocks.

Therefore, the empirical results reject hypothesis H1: After dependent sorting by Size and Z-score, the portfolio containing stocks with Higher Z-score and bigger Size outperformed the portfolio containing stocks with lower Z-score smaller Size.

4.5 Factor Testing Results.

Based on the prevalent risk factors of book-to-market and size factors, the study [9, 10] used six portfolios to sort book-to-market and Size. The authors find that CAPM can explain the average returns of stocks, and the level of sensitivities measures the returns of security compared to market risk factors and risk factors such as book-to-market and Size. The author uses the model which is formed as follow:
Model 1: \( R_{i,t} - R_f = \alpha_i + \beta_i(R_{m,t} - R_f) + \beta_sSMB_t + \beta_hUMD_t + \varepsilon_{i,t} \)

Model 2: \( R_{i,t} - R_f = \alpha_i + \beta_i(R_{m,t} - R_f) + \beta_sHML_t + \beta_hUMD_t + \varepsilon_{i,t} \)

Where:
- \( R_{i,t} \): is the returns on portfolio I in year t.
- \( R_f \): is the risk-free rate.
- \( \beta_i \): is the market beta factor exposures of portfolio i.
- \( \varepsilon_{i,t} \): is the error term.
- \( \alpha_i \): is the unconditional mean returns of portfolio i.
- \( R_{i,t} - R_f \): is the excess returns for month t on a value mark et portfolio of stocks.
- \( HML \): is the returns on the portfolio constructed to mimic book-to-market risk factors in returns. (High minus Low).
- \( UMD \): is measured each month by taking the difference between the highest Z-score (U) and the lowest Z-score (D) over 12 month-returns (Up minus Down).

In model 2, two risk factors are added to imitate indistinguishable risks related to book-to-market and firm Size, precisely related to average stock returns. UMD is short for Up minus Down; the UMD measures the historical excess returns of the highest Z-score that went up to minus the lowest Z-score that lost value. High minus low (HML) is the difference between high book-to-market-equity and low book-to-market-equity on returns and represents the risk factor of returns related to BE/ME with a similar weighted-average Size.

**Table 5. Factors Testing**

<table>
<thead>
<tr>
<th></th>
<th>Intercept</th>
<th>RMRF</th>
<th>UMD</th>
<th>SMB</th>
<th>HML</th>
<th>( R^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>0.5303</td>
<td>1.5258</td>
<td>-0.3125</td>
<td>0.7127</td>
<td></td>
<td>0.17</td>
</tr>
<tr>
<td></td>
<td>(3.5344)</td>
<td>(10.165)</td>
<td>(-3.0350)</td>
<td>(5.4577)</td>
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<td></td>
</tr>
<tr>
<td>Model 2</td>
<td>0.6057</td>
<td>1.5865</td>
<td>-1.4432</td>
<td>-0.1958</td>
<td></td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>(3.7213)</td>
<td>(9.7449)</td>
<td>(-9.3886)</td>
<td>(-1.8677)</td>
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</table>

Firstly, the market risk premium factor in the two models positively correlates with the rate of returns on the portfolio. All correlation coefficients between the market risk premium variable and the rate of returns on the portfolio are statistically outstanding at the 1% level. Results in this research are entirely consistent with [13]. The results indicate that returns of stocks are positively correlated with a market risk premium.

In model 1 and model 2, the SMB is positive with returns, and HML is negative with returns consistent with [13]. In model 1, the mean of UMD is -0.3125, so investors should buy stocks of the lowest Z-score and firm size portfolios and sell stocks of the highest Z-score and firm size portfolios with returns of 0.3125%. However, in model 2, the mean of UMD is -1.4432, so investors should also buy stocks of the lowest Z-score and firm size portfolios and sell stocks of the highest Z-score and firm size portfolios with returns is 1,4432%.

V. Conclusion

This article employs the three-factor model to analyze the distress risk in the Taiwan stock market. The empirical findings that the three-factor model could explain the bankruptcy risk premium in the Taiwan stock exchange. The findings show that firms with higher book-to-market earn more substantial returns for the same level of distress risk. The results also figure
out the existence of distress risk preference in the Taiwan stock exchange. Specifically, firms with higher bankruptcy risk generate higher returns.

The new findings extend the existing literature and provide investment strategies based on distress risk in the Taiwan stock exchange. For instance, investors should short the stocks with higher default risk while buying stocks with lower distress risk. Even though the study has a marginal contribution, the data limitations restrain the author from analyzing the long-term impacts of the distress risk on the Taiwan stock market. Further research may rely on this study to examine the distress risk anomaly before and after the Covid-19 pandemic on the global stock exchange. Later research may also test whether financial constraints or investment frictions drive the distress risk anomaly.

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References


