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The Determinants of Bankruptcy for Chinese Firms

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Abstract

The global financial crisis in 2008 increased the hit of business failure. The Chinese economy is also affected by the recent global financial crisis given the fact that Chinese economy depends heavily on international trade. Our study tries to find the determinants of bankruptcy in Chinese firms. Both logit and survival model analyses provide consistent results on the determinants in predicting distressed firms in China. Our results suggest that firms with liquidity problems and firms experiencing decline in profits are more likely to file for bankruptcy. In addition, we find that, compared to state-owned enterprises, collectively-owned enterprises, private-owned enterprises, and foreign owned businesses are more likely to file for bankruptcy. This conclusion is robust after controlling for regional differences. The findings of this study show that the financial variables developed by Altman (1968) and Ohlson (1980) perform reasonably well in determining business failures of Chinese firms. In addition, our bankruptcy prediction rates are 89% and these rates are similar to those of previous U.S. studies.

Key Words: China, bankruptcy, logit analysis, and survival model

The Determinants of Bankruptcy for Chinese Firms

I. Introduction

The global financial crisis in 2008 increased the hit of business failure. For example, Thurston (2009) documents that the number of bankruptcies in Puerto Rico reached at a starling rate in February 2009 with a 28% increase in overall bankruptcy filings and a 29% increase in commercial bankruptcy filings due to local and global recessions that exert pressure on island businesses and personal finances. Most notably, even major U. S firms such as Chrysler and General Motors filed for bankruptcy (Warburton 2010). The Chinese economy is also affected by the recent global financial crisis given the fact that Chinese economy depends heavily on international trade. After the Composite Index of Shanghai Exchange climbing to a meteoric peak with 6,124 points on October 16, 2007, the stock market in China quickly collapsed in 2008 (Yao and Luo 2008). Therefore, China was also experiencing a surge of bankruptcy (Wang and Campbell 2010). An interesting question is to examine which factors contribute to business failure. This study examines the effectiveness of a set of financial variables used previously by Altman (1968) and Ohlson (1980) in predicting Chinese business failure. The findings of this study have implications to decision makers because many stakeholders such as bankers, investors, auditors, management, and the general public are interested in identifying the potential failing firms.

Most of the current literature in predicting business failures uses data from United States firms (Kwak et al. 2006; Mansi et al. 2010). Little research has been done to investigate the determinants of bankruptcy for Chinese firms. We use Chinese financial data to analyze bankrupt firms in the Chinese capital market environment which may not

be the same as that of the U.S. capital market due to historical, cultural, and political differences. For example, Chinese government policies affect the financial outcomes of firms directly and indirectly and usually only state-owned enterprises (hereafter SOEs) are protected by the government.[2]

Our paper differs from previous research (for example, Wu and Lu, 2001; Wang and Campbell 2010) examining firm bankruptcy in China in several important ways. First, our determination of bankruptcy is based on the survey data, which clearly specify the status of firm such as on-going operations or bankruptcy. A recent Chinese bankruptcy study by Wang and Campbell (2010) treated delisted firms as bankruptcy firms, which restrict the generalizability of the prediction models given that the use of delisted firms is inaccurate in bankruptcy studies. Second, this study extends the literature by empirically testing whether our model using Chinese financial data performs as effectively as it did using U.S. financial data. China's Enterprise Bankruptcy Law (EBL) shares many common features with Chapter 11 of the U.S. Bankruptcy Code.[3] China's Enterprise Bankruptcy Law is similar to Chapter 11 of the U.S. bankruptcy law by allowing incumbent managers to operate the firm and execute the work-out plan. The enactment of "Bankruptcy Law" highlighted the importance of using profit as a measure of operating efficiency. We also employ both logit and survival model approaches for bankruptcy analyses and these approaches enable us to generate consistent and unbiased results in the determination of a

[2] SOEs are business entities established by central and local governments (National Bureau of Statistics of China).

[3] The Chinese Enterprise Bankruptcy Law was first passed in 1986. On June 1, 2007, the new Enterprise Bankruptcy Law replaced the 1986 law. China's Enterprise Bankruptcy Law allows now filings to be voluntary or involuntary, favors a debtor-in-possession structure and reorganizations over liquidations, and includes the features for creditors to file proofs of claims and receive distributions.

firm's bankruptcy risk. Finally, we include Chinese ownership types into the testing models to control for cultural and social differences between China and U.S. capital markets. Our results improve our understanding of Chinese corporate governance issues that could potentially affect the likelihood of firm bankruptcy.

Using 1999-2007 Chinese firm level financial data, our logit and survival model analyses provide consistent results on the determinants of distressed firms in China. The regression results suggest that firms with current liquidity problems and firms experiencing decline in profits are more likely to file for bankruptcy. In addition, we find that as compared to SOEs, the collectively-owned enterprises, private-owned enterprises, and foreign owned businesses are more likely to file for bankruptcy. The relatively low incidence of bankruptcy in SOEs may be explained by the fact that SOEs benefit from a series of government preferences. For example, SOEs are given preferences to access cheaper land, lower interest bank loans, and cheaper energy sources.[4] So the government policies in China create a favorable competitive environment for SOEs relative to other types of business firms.

Our paper is organized as follows. The next section reviews previous bankruptcy studies relevant to this study. The third section describes data collection and research methodology. The fourth section presents our logit and survival model analysis results. The fifth section reports and discusses the regression results. Conclusion follows in the last section with limitations of our paper and future research avenues.

[4] Bloomberg Business Week, May 21 –May 27, 2012

II. Literature Review

Altman (1968) did a seminal work in bankruptcy studies by using multiple discriminant analysis (MDA). Later, Ohlson (1980) used a logit model which does not require any assumptions about the prior probability of bankruptcy or the distribution of predictor variables, which is a limitation of Altman's study. Besides Altman (1968) and Ohlson (1980), researchers in accounting and finance developed other methods to predict firms' financial distress. For example, Clark and Ofek (1994) included abnormal stock returns as a measure of financial distress. Sung et al. (1999) used a decision tree approach for a bankruptcy prediction model. Shin and Lee (2002) used a genetic algorithm (GA) in a bankruptcy prediction model, but computational costs of this model can be too expensive and there is no guarantee of optimality. Freed and Glover (1986) proposed linear programming (LP) to minimize misclassifications in linear discriminant analysis. Recently, Kwak et al. (2006) proposed a Multiple Criteria Linear Programming (MCLP) model to data mining for bankruptcy prediction using U.S. data. Despite a variety of models available, past literature (Boritz et al. 2007; Charitou et al. 2004) indicates most international failure prediction studies rely on the models constructed by Altman (1968) and Ohlson (1980).

This study uses a set of financial variables developed by Altman (1968) and Ohlson (1980) to predict Chinese business failure. In addition to the classical logit model, we employ a survival model with the intent of generating consistent and unbiased results in the determination of firms' bankruptcy risk. Shumway (2001) summarizes the following econometric advantages of a survival model over a static logit model. First, survival models incorporate time-varying covariates that enable the financial data to reveal a firm's

changing health over time. Second, survival models produce more efficient out-of-sample forecasts by utilizing much more data. For example, if firms in the sample have an average of 10 years of observations, then about 10 times more data are available to estimate the survival model than the static logit model. [5]

The Chinese firm level data not only allow us to look at the effects of financial variables on bankruptcy, but also allow us to provide evidence regarding the impact of business ownerships on the likelihood of business failure by comparing SOEs vs. private and foreign-owned enterprises. The Chinese capital market may not be the same as that of U.S. due to social, cultural, and political differences. Chinese economy has become more market-oriented since China started its breathtaking economic reform in the late 1970s. The most dramatic change is the introduction of private enterprises and foreign-controlled enterprises into what had been completely dominated by SOEs in a planned economy (Szamosszegi et al. 2011).[6] The rise of other business enterprises and the introduction of market-based pricing have shifted Chinese economy from a planned to a market-oriented system.[7] China has two stock exchanges in Shanghai and Shenzhen. Hundreds of Chinese

[5] Although survival analysis accommodates more information of individual firms through multi-period analysis, the selection bias is inherent in the survival model because the selection of sample firms is biased from the beginning.

[6] Private enterprises are the economic units invested in or controlled by natural persons who hire workers for profit-making activities. Private enterprises include private limited liability corporations, private share-holding corporations, private partnership enterprises and private sole investment enterprises. Foreign-controlled enterprises are defined as follows "All industrial enterprises registered as the joint-venture, cooperative, sole (exclusive) investment industrial enterprises and limited liability corporations with funds from foreign funds or fund from Hong Kong, Macao and Taiwan (Source: National Bureau of Statistics of China)."

[7] For example, the size of China's private enterprises ranges from 11 to 30 percent in 2009 based on various indicators such as gross industrial output value, value added by industrial enterprises, investment in fixed assets, employment in urban areas, and taxes paid by industrial enterprises (National Bureau of Statistics of China 2010)

firms have their listings in foreign stock exchanges. The dynamic transition leaves many questions to explore. For example, does China's reliance on private enterprises and market-oriented system shrink the role of SOEs in affecting the economic growth? Or does the economic reform make SOEs more or less likely to go out of business?

To the best of our knowledge, there are no clear answers for these questions. The impact of Chinese regulatory environment on the performance of SOEs is clearly a two-edged sword. On one hand, SOEs face unprecedented challenges. The economic reform brings intense pressure and competitions to SOEs due to the rise of the foreign-controlled business and private sectors. The SOEs have been shrinking through substantial downsizing and restructuring (Ralston et al. 2004).[8] China's admission to the WTO in 2001 has facilitated the de-regulation of formerly protected sectors such as financial institutions, telecommunications, automobiles, pharmaceuticals, and petrochemicals (China Business Review 2002). Furthermore, the enactment of "Bankruptcy Law" in the 1990s highlighted the importance of using profit as a measure of efficiency and laid the infrastructure to punish business failure (Steinfeld 1998). On the other hand, SOEs are operated in a favored position due to the preferential government policies. SOEs benefit from a series of government policies in China. Specifically, stated-owned enterprises have preferential access to production inputs and capital. For example, SOEs are in a favored position to access cheap bank capital. Beyond the huge advantage in raising funds, SOEs receive favorable tax treatment (Szamosszegi et al. 2011). A recent study by Szamosszegi, Anderson and Kyle (2009) investigates the

[8] China's National Bureau of Statistics show that the overall share of industrial outputs from SOEs has declined from 57 percent to 34 percent over the last decade (National Bureau of Statistics of China 2010).

benefits received by the listed SOEs using data from the Hong Kong Stock Exchange. SOEs today dominate aviation, railways, steel, telecom, finance, petroleum, highways, insurance, postal services, and electricity.[9] In comparison, private and foreign-owned firms are more competitive but operated in a less favorable environment where external financing is difficult to obtain. Chen Jun, vice chairman of the Zhejiang Chamber of Commerce of Beijing, says "state banks rarely give loans to private enterprises and the resulting credit crunch leads many private enterprises to go bankrupt".[10] Ironically, despite disadvantages with their operating environments, private and foreign-owned enterprises are more productive than SOEs. For example, private enterprises are more than twice as productive as SOEs.[11] In the last decade private enterprises have grown more rapidly than SOEs but with a disproportionately small share of credit from bank.[12] Foreign businesses and firms outside of mainland China are exposed to foreign culture and, therefore, they are more likely to run the business with more advanced management styles. Foreign-owned enterprises accounted for 12 percent of the national total investment and 17 percent of gross industrial output (National Bureau of Statistics 2003: 459, 469).

III. Data Collection and Research Design

Data collection process

[9] Bloomberg Business Week, May 21 –May 27, 2012

[10] Bloomberg Business Week, May 21 –May 27, 2012

[11] Private enterprises are 70 percent more productive than SOEs and collective enterprises are nearly as productive as private enterprises (Economic Survey of China 2005). Collective enterprises are economic entities where assets are owned collectively (National Bureau of Statistics of China).

[12] According to McKinsey Global Institute (2006) report, wholly state-owned enterprises account for 23 percent of GDP but 35 percent of corporate loans outstanding.

Our dataset are purchased from the National Bureau of Statistics (NBS). The Annual Survey of Industrial Production includes all state-owned firms and private firms with at least 5 million Yuan in annual sales from 1999 to 2007. For each year, we look for the operational status indicating bankruptcy to identify bankrupt firms. We are unable to identify the bankrupt firm in 2001 and 2004 as the survey data combined bankrupt firms with other exit firms and labeled them "cancellation". To ensure a clean sample for testing, we delete observations in year 2001 and 2004. We checked the data for consistency and excluded observations with missing or inconsistent information (e.g., negatively reported Total Assets). To exclude extreme values, we winsorized the lower and upper 1% of the thirteen financial ratios. Each financial ratio is calculated using accounting variables from one year prior to bankruptcy to ten years prior to bankruptcy to be included in our bankruptcy models. We used annual accounting data in our study. To emulate the real world bankruptcy situation, for each experimental firm, we collected 10 times matching control firms based on size, year, and two-digit industry code. Our final experimental group is 394 bankrupt firms from 1999 to 2007 (excluding 2001 and 2004) to be included in both logit and survival analyses. Finally, we obtain a sample of 193,566 firm-year observations.

Determinants of Bankruptcy

In prior literature such as Altman (1968) and Ohlson (1980), bankruptcy is predicted by financial indicators. Based on the implications of these financial variables, we classify them into the following four factor groups.

1. Liquidity

Liquidity is a prime concern of bankruptcy. When firm liquidity worsens, it may

ultimately lead to business failure. Following Altman (1968) and Ohlson (1980) studies, we use *WCA_TA* (Working Capital divided by Total Assets), *TL_TA* (Total Liabilities divided by Total Assets), *CL_CA* (Total Current Liabilities divided by Total Current Assets), *OENEG* (equal to 1 if TL_TA is greater than one), *FU_TL* (Funds from Operations divided by Total Liabilities), and *BV_TD* (Book Value of Equity divided by Total Debt) to capture liquidity. Of the six liquidity indicators, *WCA_TA* and *BV_TD* are the two from Altman's (1968) model. Variables *WCA_TA* and *CL_CA* are used to measure short-term liquidity, while *TL_TA*, *OENEG*, *FU_TL*, and *BV_TD* are used to measure long-term solvency. The lower the current ratio and equity to debt ratio, and/or the higher debt to asset ratio, the higher the possibility of being bankrupt.

2. Profitability

Ohlson (1980) finds that profits deteriorate as firms move from nonbankruptcy to bankruptcy status. As documented by Altman (1968) and Ohlson (1980), we use *TP_TA* (the ratio of Earnings before Interest and Taxes to Total Assets), *NI_TA* (Net Income divided by Total Assets), *INTWO* (equal to 1 if net income for the past two years is negative), and *CHGIN* (Change in Net Income, divided by the sum of absolute net income for the last two years) to proxy for firm profitability. *TP_TA* ratio is the measure of firm profits apart from any tax and leveraging factors. It is an important predictor of firm bankruptcy given the fact that a firm's existence depends on the earning power of its assets (Altman 1968). Ohlson (1980) uses *NI_TA*, *CHGIN*, and *INTWO* to measure firm profits net of income taxes. As

suggested by Ohlson (1980), poorer performance measures increase the probability of business failure.

3. Operational efficiency

   Inefficient use of assets could be a contributing factor of business failure. Altman (1968) posits that the ratio of Sales to Total Assets (*SALE_TA)* reflects the ability of a firm's assets in generating sales revenues. We use this asset turnover ratio to evaluate the effectiveness of a company in managing its assets. The higher the *SALE_TA* ratio, the better the management's capability to generate revenues.

4. Firm characteristics

   Size (*SIZE*) is measured as the logarithm of total assets. Ohlson (1980) finds smaller firms have higher risk of being bankrupt. In addition, we use the ratio of Retained Earnings to Total Assets (*RE_TA*) to examine the impact of firm life cycle on the likelihood of bankruptcy. Young firms have a higher chance of being classified as bankrupt than more established firms, since young firms have not had enough time to build cumulative profits (Altman 1968). The ratio of retained earnings to total assets captures the extent to which assets have been paid for by cumulative profits.

This study uses the above thirteen financial statement measures to evaluate the predictive ability of financial distress for bankruptcy decisions. An alternative approach in measuring distressed firms is the use of Altman (1968)'s Z score.[13] Altman's Z-score can

[13] Altman (1968) utilized a statistical technique called discriminate analysis to develop a financial distress metric, called Z-score. The current form of the model is expressed as the follows:
Z=1.2X1+1.4X2+3.3X3+0.6X4+0.999X5

be used as a strategic and performance management tool (Calandro, 2007), but the use of an index or a variation of Z-score, as with Chen et al. (2009), instead of a portfolio of financial ratios may result in loss of information, and the index could be biased based on the time period used to estimate the coefficients. The use of a Z-score single variable for financial distress may not capture as much information about financial conditions as a portfolio of financial statement ratios. Thus we use a portfolio of the thirteen variables in our main models to identify the potential factors that contribute to business failure. As a sensitivity check, we compare Altman's Z-score between bankrupt and non-bankrupt firms.

IV. Empirical Results

Table 1 (panel A and panel B) shows the descriptive statistics of Chinese bankrupt and non-bankrupt control firms between 1999 and 2007. Turning first to the measures of liquidity, the means of Total Liabilities divided by Total Assets (*TL_TA)*, indicator variable *OENEG* equal to 1 if *TL_TA* is greater than one, and Total Current Liabilities divided by Current Assets (*CL_CA)* in bankrupt firms (*TL_TA* = 0.72, *OENEG* = 0.19, and *CL_CA* = 1.61) are much higher than in non-bankrupt control firms (*TL_TA* = 0.63, *OENEG* = 0.08, and *CL_CA* = 1.16). T-statistics indicate that the differences are significant (t = 9.28 with *TL_TA*, t = 15.35 with *OENEG*, and t =2.56 with *CL_CA)*. The

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Where Z = Z-Score;
X1 = Working capital divided by total assets;
X2 = Retained earnings divided by total assets;
X3 = Earnings before interest and taxes divided by total assets;
X4 = Market value of equity divided by total liabilities;
X5 = Sales divided by total assets;

results show that bankrupt firms have liquidity problems and they are unable to pay their incoming debts. Next, relative to non-bankrupt control firms, bankrupt firms have worse ratios of firm profitability. Means of Net Income divided by Total Assets (*NI_TA*), Retained Earnings divided by Total Assets (*RE_TA*), Total Profits divided by Total Assets (*TP_TA*), indicator variable *INTWO* equal to 1 if Net Income for the past two years is negative, and change in Net Income relative to Total Assets *(CHGIN*) in bankrupt firms are 0.02, -0.03, 0.06, 0.23, and -0.08, respectively, which are significantly lower than those in non-bankrupt firms. Again, t-tests suggest that such differences are statistically significant. Moreover, as shown in Table 1, the mean of Sales to Total Assets in bankrupt firms (*SALE_TA* = 1.43) is much lower than that of non-bankrupt firms (*SALE_TA* = 2.06), suggesting that bankrupt firms are less efficient in managing their assets relative to non-bankrupt firms. Overall, our findings suggest that Chinese bankrupt firms maintain higher debt ratios and have poorer firm performance. This is consistent with the literature documented in previous studies.

We also compare Altman's Z-score between bankrupt and non-bankrupt firms. The results show that Altman's Z-score is much lower in bankrupt firms (mean Z-score = 2.66) than non-bankrupt firms (Z-score = 3.96), significant at the 1 percent level. Our evidence on Z-scores in Chinese firms also supports Altman's interpretations that companies with Z-scores above 2.9 are considered to be healthy (Safe Zone), companies with Z-scores below 1.23 are considered to be financially distressed (Distress Zone), and companies with Z-scores between 1.23 and 2.9 are considered to be in a grey area (Grey Zone).

Insert Table 1 here

Table 2 separately shows the distribution of bankrupt firms by year and by ownership. We can see that bankruptcy reaches the highest point in 2003, comprising 29.49% of the sample firms. This number is much higher than that of the U.S. around same time period because of the non-mature Chinese capital market structure. Our survey data classify ownership as the follows: SOEs, collectively owned, private with shareholding, private with personal capital, companies in Hong Kong, Macao, and Taiwan (HKMT), foreign-owned businesses, and others. SOEs (ownership 1) and private-owned enterprises (ownership 4) are the two biggest types of ownership in filing for bankruptcy.

Insert Table 2 here

Table 3 presents Pearson Correlations of financial variables. Some of the variables are highly correlated, which is not surprising given that we use multiple variables to capture liquidity and firm profitability. We find that Total Liabilities/Total Assets (*TL_TA*) is positively correlated with Total Current Liabilities/Total Current Assets (*CL_CA*). In addition, *TL_TA* is negatively associated with Net Income/Total Assets (*NI_TA*) and Retained Earnings/Total Assets (*RE_TA*). Notably, Working Capital/Total Assets (*WCA_TA*) is highly correlated with *TL_TA* (coefficient = - 0.64) and *RE_TA* (coefficient = 0.46). The findings in Table 3 are consistent with the notion that firms with liquidity problems are more likely to have poor firm performance.

Insert Table 3 here

Table 4 presents the results of logit and survival model using the defined financial variables. In an attempt to determine whether the context of organizational cultures in China could affect the probability of failure, we include the type of ownership. We also include year, industry, and region dummies to control for firm fixed-effects. Logit model 1 and survival model 4 predict bankruptcy with Altman's five variables only. The results of Table 4 show that the coefficients of Earnings Before Interest and Taxes/Total Assets (*TP_TA*) are significantly negative across the two models (coefficient on *TP_TA* = -1.394 in model 1 and coefficient on *TP_TA* = -1.791 in model 4), suggesting that the likelihood of bankruptcy is higher for firms with lower profits. In addition, we find that the coefficients on Sales/Total Assets (*SALE_TA*) are negative, significant at the 10 percent level, but the magnitude is relatively small (coefficient on *SALE_TA* = -0.07 in model 1 and coefficient on *SALE_TA* = -0.085 in model 4). These findings indicate that poor firm performance and inefficient use of assets increase the likelihood of bankruptcy.

The logit model at column (2) and survival model at column (3) report Ohlson's nine variables regression. We find that the coefficients on *CL_CA* (Current Liabilities divided by Current Assets), *INTWO* (equal to 1 if Net Income for the past two years is less than zero, and 0 otherwise) and *OENEG* (equal to 1 if Total Liabilities exceeds Total Assets, 0 otherwise) are significantly positive, while the coefficients on Net income/Total Assets (*NI_TA*) and change in Net Income (*CHGIN*) are negative in all of the models. Overall, the findings in Table 4 indicate that the five factors derived from financial statements, such as *NI_TA, CL_CA, INTWO, OENEG, and CHGIN* are the important

predictors of bankruptcy.[14] Finally, we use the combined Altman's and Ohlson's variables (logit model 5 and survival model 6). In general, we get qualitatively similar results. Most interestingly, we find that ownership 2 (collectively owned), ownership 3 (privately shareholder owned), ownership 4 (private personal capital), ownership 5 (firms in Hong Kong, Macao, and Taiwan), and ownership 6 (foreign-controlled businesses) in all models exhibit significantly positive coefficients. The results suggest that when compared to SOEs, collectively-owned enterprises, private-owned enterprises, and foreign owned businesses are more likely to file for bankruptcy. The lower incidence of bankruptcy rates in SOEs is not surprising, since SOEs benefit from a series of government preferences as documented in section II.

Taken together, the findings in Table 4 suggest that SOEs and firms with current liquidity problems and poorer accumulated firm profits have higher incidences of bankruptcy. Overall, our bankruptcy prediction rates are round 89% and these rates are similar to those of previous U.S. studies such as Kwak et al.'s (2006) study.

VI. Summary and Conclusions

In this paper we adopt both logit and survival approaches to study the determinants of bankruptcy in China. Using 1999-2007 Chinese bankruptcy data, our results suggest that firms with liquidity problems and firms experiencing decline in profits are more likely to file for bankruptcy. These results are similar to those of previous U.S. bankruptcy

[14] We exclude Funds from Operations/Total Liabilities (FU/TL) in regression tests due to substantial missing observations for this variable. In our sensitivity test, we include this variable with a reduced sample and our major results still hold.

studies. Most notably, we find that as compared to SOEs, collectively-owned enterprises, private-owned enterprises, and foreign owned businesses are more likely to file for bankruptcy. Our conclusion is robust after controlling for industry, year, and regional effects. The findings of our study show that the financial variables developed by Altman (1968) and Ohlson (1980) perform reasonably well in determining business failure in Chinese firms.

Our paper has several limitations. First, we have to exclude 2001 and 2004 data because the definition of cancellation is not clear and it may not be the same as our definition of bankruptcy. Second, prior literature (Shumway 2001; Duffle et al. 2007; Campbell et al. 2008) shows that market information is critical in explaining the default risk of individual firms. However, due to data limitation we are unable to incorporate market return information in predicting business failure. Finally, our sample is subject to selection bias because we collect only bankrupt firms as our experimental group and ten times of non-bankrupt firms to emulate real world. Future studies may include stock return, internal control weakness, and dividend payout ratio as the determinants of bankruptcy.

Table 1: Descriptive statistics of Chinese bankrupt firms between 1999 and 2007

Panel A: Bankrupt firms

Variable	Observations	Mean	Std. Dev.	Min	Max
SIZE	394	4.78	1.21	1.76	7.60
TL_TA	394	0.72	0.36	0.01	2.80
OENEG	394	0.19	0.39	0.00	1.00
WCA_TA	394	0.00	0.44	-2.46	0.99
CL_CA	394	1.61	3.54	0.00	43.49
NI_TA	394	0.02	0.15	-1.37	0.85
FU_TL	183	0.60	5.64	-3.25	75.25
TP_TA	394	0.06	0.18	-1.32	1.09
RE_TA	394	-0.03	0.42	-2.84	0.88
BV_TD	394	1.81	8.18	-0.64	123.50
SALE_TA	394	1.43	2.12	0.00	18.70
INTWO	394	0.23	0.42	0.00	1.00
CHIN	394	-0.08	0.72	-1.00	1.00
Z-SCORE	394	2.66	6.07	-7.54	76.58

Panel B: Non-Bankrupt firms

Variable	Observations	Mean	Std. Dev.	Min	Max	T-value Significance Level
SIZE	3,263	4.83	1.17	1.62	8.04	0.56
TL_TA	3,263	0.63	0.31	0.00	3.84	9.28***
OENEG	3,263	0.08	0.27	0.00	1.00	15.35***
WCA_TA	3,263	0.05	0.38	-1.73	7.49	0.7
CL_CA	3,263	1.16	1.35	0.00	21.73	2.56*
NI_TA	3,263	0.06	0.19	-0.78	3.42	10.86***
FU_TL	1,565	0.13	0.68	-4.58	9.94	1.26
TP_TA	3,263	0.14	0.27	-0.75	3.89	26.62***
RE_TA	3,263	0.07	0.38	-10.72	0.95	2.82*
BV_TD	3,263	2.14	8.56	-0.74	220.75	0.04
SALE_TA	3,263	2.06	3.29	0.00	85.94	15.37***
INTWO	3,263	0.16	0.37	0.00	1.00	11.71***
CHGIN	3,263	0.06	0.61	-1.00	1.00	9.43***
Z-SCORE	3,263	3.96	6.80	-12.69	137.87	3.95 ***

* significant at 10%; ** significant at 5%; ***; and significant at 1% at the two-tailed test.

Variable Descriptions:

Size = Total Assets divided by Gross Domestic Products from 1999 to 2007;
TL_TA= Total Liabilities divided by Total Assets;
OENEG= if TL_TA>**1** then OENEG=**1**; else OENEG=**0;**
WCA_TA=Working Capital divided by Total Assets;
CL_CA=Total Current Liabilities divided by Total Current Assets;
NI_TA=Net Income divided by Total Assets;
FU_TL= Funds from Operations divided by Total Liabilities;
TP_TA= Earnings Before Interest and Taxes divided by Total Assets;
RE_TA = Retained Earnings divided by Total Assets;
BV_TD = Stockholder's Equity divided by Book Value of Total Debt;
SALE_TA = Sales divided by Total Assets;
INTWO= if lag (Net Income) < **0** or lag 2(Net Income) < **0** then INTWO =**1**; else INTWO = **0**;
CHGIN= (Net Income- lag (Net Income))/ [Absolute (Net Income) + Absolute (lag Net Income)]; and
Z-score = Altman's Z-score.

Table 2: Distribution of bankrupt firms by year and ownership

Panel A: Distribution of bankrupt firms by year (2001 and 2004 are deleted).

Year	Number	Percentage
1999	12	3.05%
2000	21	5.33%
2002	55	13.96%
2003	123	31.22%
2005	73	18.53%
2006	63	15.99%
2007	47	11.93%
Total	394	100.00%

Panel B: Distribution of bankrupt firms by ownership

Ownership	Number	Percentage
1	121	30.71%
2	64	16.24%
3	56	14.21%
4	108	27.41%
5	25	6.35%
6	16	4.06%
7	4	1.02%
Total	394	100.00%

Panel C: Distribution of bankrupt firms by ownership

Region	Number	Percentage
East	250	63.45%
Middle	112	28.43%
West	32	8.12%
Total	394	100.00%

Ownership 1: State-owned enterprises;
Ownership 2: Collectively owned;
Ownership 3: Private, share holding;
Ownership 4: Private, personal capital;
Ownership 5: Hong Kong, Macao, and Taiwan (HKMT);
Ownership 6: foreign-owned businesses; and
Ownership 7: others.

Table 3: Pearson Correlation of Bankruptcy Determinants (data ranges are in Table 1)

	SIZE	TL_TA	OENEG	WCA_TA	CL_CA	NI_TA	FU_TL	TP_TA	RE_TA	BEV_TD	SALE_TA	INTWO	CHGIN
SIZE	1.00												
TL_TA	-0.03	1.00											
OENEG	-0.09	0.53	1.00										
WCA_TA	-0.04	-0.64	-0.34	1.00									
CL_CA	0.06	0.26	0.10	-0.50	1.00								
NI_TA	-0.13	-0.24	-0.16	0.17	-0.09	1.00							
FU_TL	-0.03	-0.11	-0.02	0.07	-0.04	0.07	1.00						
TP_TA	-0.22	-0.21	-0.13	0.14	-0.08	0.86	0.07	1.00					
RE_TA	0.13	-0.64	-0.47	0.46	-0.18	0.23	0.07	0.18	1.00				
BEV_TD	0.03	-0.37	-0.08	0.20	-0.11	0.05	0.21	0.04	0.15	1.00			
SALE_TA	-0.33	-0.11	-0.07	0.15	-0.08	0.43	0.11	0.59	0.09	0.01	1.00		
INTWO	0.01	0.25	0.31	-0.25	0.11	-0.27	-0.03	-0.24	-0.33	-0.07	-0.14	1.00	
CHGIN	0.03	-0.06	-0.06	0.05	-0.04	0.25	0.01	0.21	0.05	0.00	0.07	-0.02	1.00

SIZE =Total Assets divided by Gross Domestic Products;
TL_TA=Total Liabilities divided by Total Assets;
OENEG= if TL_TA>**1** then OENEG=**1**; else OENEG=**0;**
WCA_TA=Working Capital divided by Total Assets;
CL_CA= Total Current Liabilities divided by Total Current Assets;
NI_TA= Net Income divided by Total Assets;
FU_TL=Funds from Operations divided by Total Liabilities;
TP_TA= Earnings Before Interest and Taxes divided by Total Assets;
RE_TA = Retained Earnings divided by Total Assets;
BEV_TD = Stockholder's Equity divided by Book Value of Total Debt;
SALE_TA = Sales divided by Total Assets;
INTWO= if lag(Net Income) <**0** or lag2(Net Income) <**0** then INTWO=**1**; else INTWO=**0**;
CHGIN= (Net Income- lag (Net Income))/ [Absolute (Net Income) + Absolute (lag Net Income)];

Table 4: The Determinants of Bankcrupcy

Table 4: Determinants of bankruptcy using Logit and Survival models

	1	2	3	4	5	6
	logit: Altman	survival: Altman	logit: Olsen	survival: Olsen	logit: combined	survival: combined
WCA_TA	-0.200	0.182	0.295	-0.133	0.298	0.480
	(0.204)	(0.179)	(0.244)	(0.232)	(0.213)	(0.255)*
RE_TA	-0.173		0.001	-0.365		-0.089
	(0.104)*		(0.133)	(0.269)		(0.172)
TP_TA	-1.394		-2.983	-1.791		-3.551
	(0.273)***		(1.484)**	(0.376)***		(1.547)**
BV_TD	0.005		0.008	-0.000		0.003
	(0.007)		(0.007)	(0.007)		(0.008)
SALE_TA	-0.070		-0.085	-0.074		-0.092
	(0.039)*		(0.045)*	(0.043)*		(0.050)*
size		-0.066	-0.151		-0.020	-0.115
		(0.040)	(0.056)***		(0.032)	(0.050)**
TL_TA		0.175	0.368		0.225	0.359
		(0.273)	(0.317)		(0.293)	(0.337)
CL_CA		0.060	0.060		0.109	0.119
		(0.010)***	(0.012)***		(0.020)***	(0.021)***
NI_TA		-0.784	2.914		-1.310	3.273
		(0.377)**	(1.658)*		(0.540)**	(1.853)*
INTWO		0.132	0.096		0.163	0.142
		(0.189)	(0.189)		(0.220)	(0.220)
OENEG		0.731	0.686		0.854	0.819
		(0.184)***	(0.184)***		(0.201)***	(0.209)***
CHGIN		-0.287	-0.285		-0.256	-0.258
		(0.076)***	(0.081)***		(0.092)***	(0.090)***
Ownership 2	0.255	0.198	0.262	0.287	0.224	0.296
	(0.107)**	(0.104)*	(0.123)**	(0.101)***	(0.100)**	(0.121)**
Ownership 3	0.237	0.257	0.361	0.047	0.065	0.169
	(0.128)*	(0.157)	(0.152)**	(0.094)	(0.115)	(0.118)
Ownership 4	0.842	0.786	0.926	0.363	0.326	0.491
	(0.099)***	(0.100)***	(0.114)***	(0.105)***	(0.096)***	(0.119)***
Ownership 5	0.412	0.549	0.560	0.253	0.400	0.391
	(0.138)***	(0.142)***	(0.148)***	(0.146)*	(0.157)**	(0.161)**
Ownership 6	0.419	0.614	0.641	0.359	0.520	0.538
	(0.176)**	(0.153)***	(0.148)***	(0.145)**	(0.195)***	(0.175)***
Ownership 7	1.132	1.206	1.330	1.422	1.566	1.699
	(0.205)***	(0.315)***	(0.290)***	(0.269)***	(0.366)***	(0.354)***
Year	Yes	Yes	Yes	Yes	Yes	Yes
Region	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-3.103	-3.273	-2.523	-1.837	-2.291	-1.440
	(0.223)***	(0.297)***	(0.474)***	(0.231)***	(0.305)***	(0.513)***
AIC	1367.676	1346.928	1325.006	2428.738	2409.214	2384.558
Correctly predicted	89.17%				89.26%	89.26%
Observations	3593	3593	3593	3621	3621	3621

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

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