Bankruptcy and Institutions: An Empirical Analysis

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Abstract: Using a panel data set of Korean and US firms, this paper estimates a new Altman z-score model (discriminant function) and explores the relationship between bankruptcy threshold and institutions. The z-score bankruptcy threshold in the US with better institutions is found to be higher than that in Korea. The positive relationship between bankruptcy threshold and institutions is confirmed by a simple z-score bankruptcy model, suggesting that the difference in the z-score threshold for bankruptcy depends in part on difference in ownership concentration. Moreover, it examines the bankruptcy codes of Korea and the US to determine whether bankruptcy law in each country is partly responsible for differences in the z-score bankruptcy thresholds. It is found that filing a petition for bankruptcy is easier and debtors' rights are better protected in the US than in Korea, suggesting that laws governing bankruptcies may partly account for the difference in the z-score threshold for bankruptcy.

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1. Introduction

Bankruptcy generally arises due to weak firm performance that results in financial distress. Corporate governance, defined as the legal system for investor protection from expropriation by "insiders", plays an important role in determining firm valuation, efficient allocation of resources, and ownership structures of firms (La Porta et al., 2000).[1] Ample research has documented that better corporate governance improves firm performance. Johnson et al. (2000) and La Porta et al. (2002) show that a high level of minority investor protections increases firms' equity value. In empirical studies, Mitton (2002) for East Asian countries, Gompers et al. (2003) for the US, and Klapper

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[1] Claessens (2006) defines corporate governance in terms of a firm's operations and legal aspect. The former includes performance, efficiency, and growth. The latter includes the legal system and the judicial system. Kaufmann and Kraay (2008) describe governance using rules-based and outcome-based indicators. The former is related to legislation against corruption. The latter is related to law enforcement under a legal system. This paper adopts a definition of corporate governance, i.e., institutions in terms of the legal aspect.

and Love (2004) for emerging markets find that firm valuation and profits are higher under good corporate governance and the quality of institutions is higher in countries with better legal protection of investors.

Not surprisingly, poor corporate governance leads to lower firm valuation and profitability (Joh, 2003; Claessens, 2006), and the ensuing poor profitability aggravates a firm's insolvency and reduces liquid assets, which eventually leads to bankruptcy (Pompe and Bilderbeek, 2005). With weak legal protection of investors, an entrepreneur has more incentive to expropriate, since it is anticipated that his/her stealing costs less.[2] This implies that firms in countries with weak institutions are more likely to inefficiently allocate their resources and to be in financial trouble because minority investors would have less incentive to invest in such firms.

Moreover, weak governance of the firms would signal the financial markets as to their low performance and profitability. Thus, other things being equal, in countries with weaker institutions, entrepreneurs are likely to start tunneling (stealing) and bankrupting the firms at a higher z-score (better financial state), implying that the countries should have a higher z-score threshold under which firms are likely to go bankrupt. On the contrary, firms in countries with weaker investor protection possess higher ownerships (La Porta et al., 1998 and 1999). That is, ceteris paribus, entrepreneurs in countries with weaker institutions are likely to have more concentrated ownership. The higher the share of the largest shareholder, the less likely he/she is to start stealing from the company at a higher z-score because tunneling would affect himself/herself. This implies that the countries should have a lower z-score threshold under which firms are likely to go bankrupt.

Altman's (1968) z-score model is one of the most popular bankruptcy prediction models. It predicts that a firm is likely to go bankrupt if its z-score is lower than the z-score threshold for bankruptcy. This implies that the overall financial state of a firm is an important indicator of bankruptcy and that a firm with a higher z-score is less likely to go bankrupt. The goal of this paper is to examine the relationship between bankruptcy threshold and institutions. To this end, first, following the Altman's method (discriminant function analysis), Altman's z-score model is re-estimated with a panel data set of Korean firms and US firms and the bankruptcy thresholds are obtained for the countries. The estimation results show that the threshold for bankruptcy in Korea with weaker institutions is lower than that in the US.

The reason to re-estimate a new z-score model is that the original Altman z-score

[2] Entrepreneur refers equally to insiders, managers, controlling shareholders, or the largest shareholders because it is assumed in the theoretical model in Section 3 that a single entrepreneur completely controls a firm.

model was designed for the bankruptcy prediction of US firms in 1968 and might not apply to Korean firms or to current US firms. Besides, the financial profiles of the Korean firms presumably differ from those of the US firms that were used in estimating the original Altman z-score model. For instance, Korean firms may possess different characteristics in terms of corporate governance and financial state. As expected, when Altman's z-score model applies to Korean firms in sample, its rate of correct classification (53.5%) for bankruptcy and non-bankruptcy turns out to be substantially lower by about 30% than that for US firms (83.3%).

Korean firms and US firms operate in different institutional environments both with respect to property rights protection in general and in terms of specific bankruptcy procedures. Institutional quality in the US is higher than in Korea, that is, corporate governance of US firms for investor protection is stronger than that of Korean firms.[3] Hence, it is likely that ceteris paribus, the overall performance of Korean firms is lower, and that their ownership concentration is higher than that in US firms.[4]

Second, the corporate governance models of Johnson et al. (2000) and La Porta et al. (2002) showing the positive relationship between institutions and firm performance is extended to a simple bankruptcy model where a bankruptcy condition is defined as the complete expropriation of retained earnings, i.e., negative or zero expected profits. The model observes how the entrepreneur's optimal decision on expropriation varies with a firm's financial state (retained earnings) and describes that the z-score threshold for bankruptcy should be higher in countries with weaker legal protection of investors and, more generally, weaker institutions. This contradicts the empirical finding that the z-score bankruptcy threshold in Korea with weaker institutions is lower than that in the US.

To resolve the contradiction, ownership concentration in the model is endogenized to institutions, instead of taking its exogenous assumption. More importantly, it requires that ownership concentration be inversely related to institutions, in order to ensure the positive relationship between bankruptcy threshold and institutions. Running an ordinary least square (OLS) regression with the World Bank's Worldwide Governance Indicators (WGI) and the Enterprise Survey data, the inverse relationship

[3] It is observed in Worldwide Governance Indicators (WGI) across countries that among six governance indicators, rule of law, which is chosen as a representative variable for institutions, is higher in the US than in Korea. Its average in the US (1.53) is more than twice as high as in Korea (0.73) over the sample period $2002 \sim 2005$. More details for WGI data are described in Section 3 and summarized in Table 9.

[4] It is observed from the sample that average ownership concentration of 500 firms in Korea (28.14%) is higher than that of 413 firms in the US (22.68%). For more information about sample selection for US firms, see Alexeev and Kim (2012).

is confirmed, which suggests that the difference in the z-score bankruptcy threshold between Korea and the US is likely due in part to the difference in ownership concentration.

Bankruptcy is also in relation to legal procedures and countries possess bankruptcy procedures that differ in the rights and control given to debtors and creditors. Therefore, the bankruptcy codes of Korea and the US are investigated to determine whether laws governing bankruptcies in each country are partly responsible for differences in the z-score thresholds. Main findings are that filing a petition for bankruptcy is easier and debtors' rights are better protected in the US than in Korea.

In the US, bankruptcy is generally referred to as "liquidation", which is a case filed under Chapter 7, or "reorganization", which is a case filed under Chapter 11 of the United States Bankruptcy Code.[5] Both types of cases start with the filing of a petition with the bankruptcy court. Liquidation is where a bankruptcy trustee is assigned to a corporation (debtor) by the court, and the trustee liquidates the debtor's nonexempt assets and pays creditors in accordance with the provisions of the bankruptcy code. Reorganization is where a debtor automatically is assumed to be the "debtor in possession" (DIP) without the appointment of a case trustee, and the debtor seeks to reduce the debt or to postpone the time for repayment in order to remain in business.[6] The main difference between Chapter 7 and Chapter 11 is that, in the latter, the debtor performs the duties of a trustee, keeps possession and control of the assets, and operates the business.

In Korea, bankruptcy codes similar to Chapter 7 and Chapter 11 in the US allow a petition for liquidation or reorganization to be filed by the debtor or creditors and introduce the DIP system.[7] Under the provisions of the law of bankruptcy, the debtor's remaining assets are sold and the proceeds of such assets are distributed to creditors, whereas under reorganization protection, the debtor, presumed capable of surviving, may be relieved by adjusting the claims of creditors.

The main differences in the bankruptcy law of Korea and the US are as follows: (1) "Qualification of Filing a Petition for Relief" - in the US, the debtor may file a petition for bankruptcy, regardless of its financial state; (2) "Appointment of Trustee" - a debtor may be automatically appointed by the court as a trustee; (3) "Automatic Stay" - filing a petition automatically stops most collection actions against the debtor

[5] Chapter 7 and Chapter 11 are based on "Bankruptcy Basics" in the US Courts (available at http://www.uscourts.gov/FederalCourts/Bankruptcy/BankruptcyBasics.aspx).

[6] The appointment of a trustee occurs only in a few cases.

[7] The bankruptcy code of Korea is based on the "Debtor Rehabilitation and Bankruptcy Act," (available at http://www.law.go.kr/lsInfoP.do?lsiSeq=84103#0000 (Korean version) or http://www.moleg.go.kr/english/korLawEng?pstSeq=52645 (English version).

or debtor's property; (4) "Debtor-in-Possession (DIP) Financing" - it is easier to borrow additional funds for reorganizing from financial institutions; and (5) "Collective Labor Agreement" - an existing collective labor agreement may be revoked. This suggests that the difference in the z-score bankruptcy threshold between the countries may be also partly attributed to the difference in the bankruptcy rules.

This paper is organized as follows. Section 2 discusses estimations of a new Altman z-score model and bankruptcy thresholds for Korean and US firms. Section 3 presents a bankruptcy model and examines the relationship between bankruptcy threshold and institutions. Section 5 provides the conclusion.

2. Empirical Analysis

2-1. Data and Discriminant Function Analysis

The data on Korean firms come from Korea Investors Service-Financial Analysis System (KIS-FAS) and Maekyung Annual Corporation Reports (MKACR) on firms listed on the Korea Stock Exchange (KSE) from 1991 to 2001. The initial data set contains 5,557 observations, which cover 669 firms. Firms are divided into two groups: default firms and non-default firms.[8] In order to obtain the final dataset firms that belong to non-manufacturing industries are excluded from each group. Additionally, in the default group, firms whose default year is not identified in the data are dropped. In the non-default group, firms that have been in business only for 1 year or 2 years are removed. This leads to the final panel data set of 108 default firms (703 Obs.) and 392 non-default firms (3,622 Obs.). From this final panel data, the cross-section sample (86 firms), comprised of 43 default firms and 43 non-default firms are taken for use in estimating a new Altman z-score model via multiple discriminant analysis (MDA).

The initial panel data on US firms are collected from the database COMPUSTAT North America, which provides information about annual income statements and balance sheets for "actively" and "inactively" publicly traded firms from 1990 through 2003. The raw data set contains 5,513 firms (77,182 Obs.), which are comprised of 2,523 inactive firms and 2,990 active firms.[9] From the data set, firms are dropped whose headquarters are located in countries other than the US or that are identified as foreign firms, and missing values in the variables of Altman z-score model are also

[8] See also Alexeev and Kim (2008) and Alexeev and Kim (2012) about these data. Definition of default follows Alexeev and Kim (2008)'s that a firm has "filed for bankruptcy", is "bankrupt", is "out of operation", has a "termination of lending" or has "anything similar in its corporate history".

[9] See also Alexeev and Kim (2012) about these data. "Active" firms are in business, whereas "inactive" firms have been deleted from the database due to bankruptcy (reorganization), liquidation, acquisition, merger, or others.

Table 1
Distribution of firms in the final panel data for Korea and the US

	Panel A: Korea		Panel B: the US	
Group	Number of firms	Number of observations	Number of firms	Number of observations
Default	108	703	84	364
Non-Default	392	3,622	1,222	9,838
Total	500	4,325	1,306	10,202

removed. Additionally, inactive firms are further narrowed down to default firms, only those classified as liquidation and reorganization under Chapter 7 and Chapter 11, respectively. This reduces the number of firms in the inactive group to 210 (1,015 Obs.). Finally, firms whose asset size is less than 10 million dollars or greater than 1 billion dollars on average are eliminated from the initial data set as outliers.[10] This leaves the total number of firms to 1,306 (10,202 Obs.), inactive firms to 84 (364 Obs.), and active firms to 1,222 (9,838 Obs.) in the final panel data set. From this data set, 60 firms in the cross-section sample, consisting of 30 default firms and 30 non-default firms, are extracted for the estimation of a new Altman z-score model.

Table 1 summarizes the final panel data sets on Korean and US firms. Based on these data, a sample for estimating the multiple discriminant function (Altman's z-score model) for Korea and the US is selected.

Multiple discriminant analysis (MDA) is "a procedure for estimating the position of an individual on a line that best separates classes or groups" (Cooley and Lohnes, 1962).[11] That is, it finds a discriminant function that maximizes the ratio of among-groups sums of squares to the within-groups sums of squares.[12] It is a linear combination of the predictors that provides the best discrimination of cases into a category, which is usually defined by a binary variable.[13] Using MDA, Altman (1968) estimates

[10] Even though some default firms satisfy the aforementioned average condition of the asset size, their asset size can be less than 10 million dollars or greater than 1 billion dollars in a particular year such as the year before default. In such a case, the firms are also removed because they are out of range in the year prior to default.

[11] Multiple discriminant analysis assumes that: (1) predictors are multivariate and normally independently distributed (no multi-collinearity); (2) their variance-covariance matrices are identical across groups; (3) they have a multiple linear relationship; and (4) each case is mutually exclusive. According to the central limit theorem, the linear function of variates is likely to be normal, so the multiple discriminant function is also likely to satisfy the multivariate normal distribution (Cooley and Lohnes, 1962).

[12] For example, in the case of two groups, its coefficients are associated with the eigenvector that maximizes the ratio. Also, Fisher (1936) showed that "it maximizes the ratio of the difference of the group means to the standard deviations within groups". That is, it estimates the coefficients that maximize the ratio ($\frac{D^2}{V}$) where D is the difference between the means of predictors in groups and V is the variance of z index (score) within groups.

[13] Wilks' lambda criterion, which is defined as $\Lambda = \frac{|W|}{|T|}$ where W is the within-groups sums-of-squares matrix and T is the total sums-of-squares matrix, is used to test the significance of the

the z-score model (discriminant function) for the bankruptcy prediction of US firms. The model is defined as a linear combination of five financial variables, which represent the overall index (Z) for a firm's financial state, and it is used to predict its group membership.[14] That is, the Altman z-score model produces a score index containing overall financial information of a firm and classifies the firm's likelihood of bankruptcy based on the score.

Following his procedures, a new Altman z-score model is re-estimated. However, there are two distinctions between the variables in the new model for Korean firms and those in Altman's. First, instead of the earnings before interest and taxes (EBIT) to total assets ratio, the earnings before interest, taxes, depreciation, and amortization (EBITDA) to total assets ratio is introduced.[15] Second, the model has a constant term, implying that the discriminant function is unstandardized.

2-2. Sample Selection and Estimation for Korean Firms

Sample selection for discriminant analysis follows Altman's method that matches non-default firms to default firms in terms of asset size and year. The initial sample (86 Obs.) for estimating a new Altman z-score model is chosen from 108 default firms (703 Obs.) and 392 non-default firms (3,622 Obs.) in the final panel data set presented in Table 1. The sample is obtained using the following three procedures.

First, for the default group, one observation in the year prior to default is extracted from each default firm, which provides a total of 108 observations. For the non-default group, the same number of observations (108 Obs.) are singled out by closely matching non-default firms to the already selected 108 default firms in terms of asset size in a given year. Second, small firms whose asset size is below 35 million won (the unit of Korean currency) and large firms whose asset size is above 3.5 billion won are eliminated from the pairs as potential outliers. Finally, among the remaining observations, 43 observations from default firms are randomly selected taking into account the distribution of the number of firms in each year, i.e., selecting more observations in

discriminant function as a whole.

[14] Based on 66 US manufacturing firms and 5 financial variables, Altman (1968) develops the z-score model as follows: $Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 0.999X_5$ where $X_1 = \frac{Working\ Capital}{Total\ Assets}, X_2 = \frac{Retained\ Earnings}{Total\ Assets}, X_3 = \frac{EBIT}{Total\ Assets}, X_4 = \frac{Market\ Value\ of\ Equity}{Book\ Value\ of\ Total\ Debt}$, $and\ X_5 = \frac{Sales}{Total\ Assets}$. The estimated coefficients differ from those in his paper, which is known to specify incorrect coefficients. The modified Altman z-score model is obtained from "Return on Investment Manual" by Robert Rachlin (1997). Alexeev and Kim (2008) also use the revised coefficients of Altman's z-score model.

[15] Taking into account that a higher EBIT increases a firm's ability to pay its interest and tax with its income, the sign of the estimated coefficient of the ratio EBIT to total assets is expected to be positive in the discriminant function. However, it turns out to be negative, so that the ratio is replaced by EBITDA to total assets.

1997 and 1998.[16] This simultaneously selects the non-default firms paired with a given default firm.[17] Based on the final 86 observations (firms), the new Altaman z-score model, i.e., discriminant function is estimated as follows.[18]

$$Z = -0.768 + 2.257X_1 + 4.669X_2 + 4.883X_3 + 0.467X_4 + 1.507X_5 \quad (1)$$

A discriminant function classifies cases into their predictive group using a threshold ("cutoff" score) in relation to the discriminant score (z-score) for each case, which is generated by it in predicting the likelihood of bankruptcy.[19] Cooley and Lohnes (1962), hereafter CL, and Altman (1968) use different methods in computing the z-score bankruptcy threshold. CL suggests the following three steps: first, the z-scores of firms in the sample are calculated by the discriminant function; second, all the z-scores in each group are separately averaged; and third, the means (centroids) from each group are combined and averaged. This average score acts as a threshold for classifying a given firm as belonging to the default group or the non-default group. Following these steps, each of the 86 firms in the initial sample is classified into its predictive group. Although the predictive power (84.9%) of the new Altman z-score model is lower than that of the original Altman z-score model (95%) for its own sample, it is statistically significant and quite high. Specifically, 84.9% of firms overall, i.e., 86% of default firms and 83.7% of non-default firms, are correctly classified. Table 2 summarizes the results.

According to Altman, a threshold is computed by the midpoint of the range of

[16] About 59% of the default firms (64/108) declared that status during the financial crisis of 1997 and 1998.

[17] As expected, the average value of the asset size is very similar between the two groups. The asset size of the default firms varies from 35 million won to 3.5 billion won, with an average of about 449 million won. The non-default firms' assets size ranges between 50 million won and 3.5 billion won, with an average of about 457 million won.

[18] The predictive model is estimated using SPSS (Statistical Package for the Social Sciences). The model's robustness is evaluated using Altman's significance tests: (1) test of the significance of an individual variable, (2) test of the relative importance of each variable, and (3) test of the overall discriminating power in terms of multivariate measure. In addition, its validation is tested in three different ways: (1) by applying it to the initial sample and a new sample, (2) by testing for the existence of upward bias due to sampling error via the "split sample" approach (Frank et al. 1965), and (3) by changing half of the observations used in estimating the initial discriminant function, estimating another discriminant function, and comparing its predictive power with that of the initial discriminant function. Finally, it is observed how the initial discriminant function would be different from a new discriminant function that is estimated after eliminating firms that defaulted before 1997 (pre-crisis) and its pairs from the initial sample. In all tests, the initial discriminant function given in Equation 1 shows its significance and validation, which means that its performance is quite robust. The results are available upon request.

[19] Its predictive power depends on the z-score threshold that classifies firms as default and non-default, and that measures Type I error and Type II error. Type I and II errors are where the model misclassifies a defaulted firm as non-defaulted and a non-defaulted firm as defaulted, respectively.

Table 2
Classification for Korean firms in the initial sample (86 Obs.)

Model		*Predictive Group*		
Discriminant Function	*Initial Group*	Default	Non-Default	Total
New Altman z-Score	Default	37 (86.0%)	6 (14.0%)	43 (100%)
	Non-default	7 (16.3%)	36 (83.7%)	43 (100%)
	Correct	37 (86.0%)	36 (83.7%)	**73 (84.9%)**
	Wrong	7 (16.3%)	6 (14.0%)	**13 (15.1%)**

Table 3
Bankruptcy thresholds for Korean firms

Method	Default	Non-Default	Midpoint Threshold	No. of Misclassifications	Observations
	Centroids				
CL	−0.911	0.911	0.000	13 (6)	86
	"Gray Area"				
Altman	−1.201	0.751	-0.141	11 (7)	86

Note: The number of misclassifications for default firms is in parentheses.

two z-scores that leads to the least misclassifications in the "gray area" or "ignorance zone".[20] He suggests the following three steps to compute the threshold. First, the z-scores of all firms in the sample are generated by a discriminant function. Second, the z-scores of all firms, across both groups, are sorted. The lowest z-score in the non-default group is designated the provisional lower bound of the grey area, and the highest z-score in the default group is designated the provisional upper bound. Third, between these two bounds, the range of z-scores that produces the fewest misclassifications is determined, and then, the two values in the interval are averaged to obtain the midpoint threshold.[21]

Although these approaches are different, the total number of misclassifications by the threshold of Altman's method (11 firms including 7 default firms and 4 non-default firms) is similar, but slightly superior to that by the threshold of CL's method (13 firms including 6 default firms and 7 non-default firms). Table 3 summarizes the z-score bankruptcy thresholds that are computed by a new Altman z-score model in Equation 1 via the methods of CL and Altman.

Both a lower-bound z-score threshold and a midpoint threshold are presented as

[20] He initially finds two bound thresholds, and then suggests a midpoint threshold (2.675) to test how well the model classifies firms. A firm with a z-score above 2.99 is considered unlikely to go bankrupt, whereas a firm with a z-score below 1.81 is considered likely to go bankrupt. The likelihood of bankruptcy is considered uncertain for a firm between the two bounds (called the gray area or ignorance zone).

[21] Altman finds a midpoint threshold, 2.675 in the range of 2.67∼2.68 between the lower bound of 1.81 and the upper bound of 2.99, which best classifies the bankrupt and non-bankrupt firms. It correctly classified about 97% of the firms (66 Obs.) in the sample.

a bankruptcy threshold. However, a lower-bound z-score threshold is mainly taken into account as an indicator of predicting the likelihood of bankruptcy because firms possessing the z-score below the lower bound z-score threshold are clearly bankrupt and the prediction of bankruptcy of a firm whose z-score falls into the ignorance zone is uncertain. More importantly, in the case of cross-country comparison of the bankruptcy threshold, the lower bound z-score threshold is more consistent with a bankruptcy threshold from a theoretical bankruptcy model to be presented in Section 3 than a midpoint threshold.

2-3. Sample Selection and Estimation for US Firms

The initial sample (60 Obs.) for the discriminant function analysis is chosen via the same sample selection process as that performed for Korean firms. First, based on the final panel data set in Table 1, 84 observations (84 firms) are selected from 364 observations (84 firms) in the default group and are matched to firms in the non-default group that have a similar asset size in a given year. Second, among the 84 pairs, 30 pairs (60 observations) are randomly selected.[22] Using these observations, the new Altman z-score model, i.e., discriminant function for US firms is estimated as follows.[23]

$$Z = -1.414 + 2.784X_1 + 0.226X_2 + 1.967X_3 + 0.111X_4 + 0.567X_5 \qquad (2)$$

This correctly classifies 88.3% of its own sample, along with 86.7% of the default firms and 90% of the non-default firms. Table 4 summarizes the results for the classification rate. In addition, it generates the z-score bankruptcy thresholds via CL's and Altman's methods. Table 5 reports them, along with the threshold from the original Altman z-score model. It shows that both the lower bound threshold (-0.308) and midpoint threshold (-0.007) for bankruptcy from a new Altman model are negative and far lower than those from the original Altman model (1.810 and 2.675, respectively).[24]

[22] As expected, the mean of the total assets of the firms in the default group (USD 103 million) is close to that in the non-default group (USD 102 million) and they are statistically indistinguishable.

[23] Similar to the one for Korean firms, the robustness and validation of the discriminant function for the US firms is checked by testing its significance in terms of the univariate and the multivariate, its predictive power for both its own sample and a new sample, the existence of upward bias due to sampling error, and the impact of sample change on the predictive power of a discriminant function. All tests show statistical significance, which implies that its performance is also quite robust. The test results are available upon request.

[24] The new Altman z-score model for the US firms generates three intervals that give the same smallest number of misclassifications (7 Obs.) between lower and upper bounds. Among them, the interval (-0.1741 $\sim$ 0.1591), which misclassifies 4 observations in the default group and 3 observations

Table 4
Classification for US firms in the initial sample (60 Obs.)

Model		*Predictive Group*		
Discriminant Function	*Initial Group*	Default	Non-Default	Total
New Altman z-Score	Default	26 (86.7%)	4 (13.3%)	30 (100%)
	Non-default	3 (10.0%)	27 (90.0%)	30 (100%)
	Correct	27 (86.7%)	26 (90.0%)	**53 (88.3%)**
	Wrong	3 (10.0%)	4 (13.3%)	**7 (11.7%)**

Table 5
Bankruptcy thresholds for US firms

Method (Model)	Default	Non-Default	Midpoint Threshold	No. of Misclassifications	Observations
	Centroids				
CL	−1.003	1.003	0.000	7 (4)	60
	"Gray Area"				
Altman (New)	−0.308	0.899	-0.007	7 (4)	60
Altman (Original)	1.810	2.990	2.675	2 (1)	66

Note: The number of misclassifications for default firms is in the parentheses.

However, they are higher than the bankruptcy thresholds previously found from the new Altman z-score model for Korean firms (-1.201 and -0.141, respectively).

Recall that the Korean sample includes observations taken during the financial crisis (1997-1998). Thus, the lower z-score threshold in Korea is likely to be partly due to the crisis. To check if there is the influence of the crisis on the thresholds of Korea, firms that defaulted in 1998 and their counterparts (pairs) are excluded from the sample, the discriminant function is re-estimated, and new thresholds are found. As shown in Table 6, the new lower-bound threshold (-1.256) is still lower than the previous ones (-1.201 in Korea and -0.308 in the US) while the midpoint threshold (0.055) appears to be slightly higher than the previous ones (-0.141 in Korea and -0.007 in the US). As noted earlier, for cross-country comparison of the bankruptcy threshold, the lower-bound z-score is taken into account as a threshold in predicting the likelihood of bankruptcy.

The above empirical findings suggest that the lower z-score threshold for bankruptcy in Korea cannot be explained by the impact of the financial crisis and that it may be due to its weaker institutional quality as compared to that in the US. This positive relationship between bankruptcy threshold and institutions is confirmed by a bankruptcy model.

in the non-default group, is chosen.

Table 6
Bankruptcy thresholds for Korean firms by dropping defaulted firms in 1998 and their counterparts

Method	Default	Non-Default	Midpoint Threshold	No. of Misclassifications	Observations
	Centroids				
CL	−0.931	0.931	0.000	11 (5)	70
	"Gray Area"				
Altman	−1.256	0.681	0.055	8 (3)	70

Note: The number of misclassifications for default firms is in parentheses.

3. A Bankruptcy Model

3-1. The Relationship between Bankruptcy and Institutions

Bankruptcy generally arises due to weak firm performance that results in financial distress. Good corporate governance increases market valuation and firm performance, which are higher in countries with better minority investor protections and, generally, better institutions. In light of the positive relationship between institutions and firm performance, other things being equal, US firms with its better institutions are likely overall to outperform Korean firms.

Moreover, bankruptcy may be also affected by different institutional environments, which presumably lead to difference in bankruptcy threshold. That is, bankruptcy threshold in a country with strong institutions is likely to be higher than in a country with weak institutions. Indeed, the bankruptcy thresholds in the US (-0.308 and -0.007) with better institutions appear to be higher than those in Korea (-1.201 and -0.141). Table 7 summarizes the previous empirical findings from the new Altman z-score models.

Table 7
Comparison of bankruptcy thresholds in the multivariate z-score model

		Bankruptcy Threshold		
Model	Country	Lower Bound	Midpoint	Observations
New Altman Model	Korea	-1.201	-0.141	86
	US	-0.308	-0.007	60

To examine this relationship, two popular corporate governance models (Johnson et al., 2000; La Porta et al., 2002) are extended to a simple bankruptcy model and the difference in bankruptcy threshold between the countries is explained by difference in institutional quality.

The model assumes that a single entrepreneur (the largest shareholder or insider) with ownership (α) of a firm completely governs the firm, and that α is exogenously determined. It is also assumed that he/she expropriates from the firm.[25] Expropriation leads to costs for the entrepreneur, so that the net benefit from the expropriation is defined as the total expropriation less the cost, i.e., $S(s,Y) - C(\kappa, S(s,Y))$. $S(s,Y)$ represents the amount of expropriation that is the portion of retained earnings, i.e., $S = sY \leq Y$ where Y denotes retained earnings on a firm's balance sheet to be invested in a new project. $C(\kappa, S)$ represents the cost function of expropriation that quadratically costs an entrepreneur, i.e., $C = \frac{\kappa}{2}S^2$ where κ denotes the degree of institutional quality. Unlike expropriation, it is assumed that investment does not lead to any costs to the firm. Additionally, for the convenience of analysis, it is further assumed that retained earnings are proportionate to total assets (i.e., $\frac{Y}{K} \equiv T$) where K is normalized to one, which implies that $Y = T$.[26] Based on these information, the model is specified as follows.

$$Max_{\{S\}} \quad \left[\alpha T(1-s)R + sT - \frac{\kappa}{2}(sT)^2\right] \quad for \quad 0 \leq s \leq 1 \tag{3}$$

where R is the gross rate of return on investment, which is greater than zero.

An entrepreneur chooses the optimal rate of expropriation, s^*, that maximizes his/her expected payoff from investment. The optimal solution is presented in Equation 4 where a higher value of κ means better legal protection from expropriation by an entrepreneur, so that it reduces inefficient resource allocation by lowering expropriation from minority shareholders, due to the higher cost of stealing.[27]

$$s^* \quad = \quad \frac{1-\alpha R}{\kappa T} \tag{4}$$

A firm is defined as bankrupt if its expected profits, $\Pi = T(1-s^*)R$ are less than or equal to zero. Since s^* cannot be greater than one, and T and R are positive,

[25] Johnson et al. (2000) and La Porta et al. (2002) show that the higher level of corporate governance raises the expected payoff and firm valuation by reducing expropriation by an entrepreneur. Unlike these models, Friedman et al. (2003), with a stochastic dynamic model, show that the effect of debt on an entrepreneur's behavior depends on the rate of return on the investment. When the rate of return is between certain bounds, i.e., there is a moderate negative shock, an entrepreneur supports firms via borrowing ("issuing debt") and expropriating less. They call this case "propping".

[26] Recall that Altman's z-score model contains the ratio of retained earnings to total assets in the variables. The ratio is introduced instead of the level of retained earnings, in order to develop a univariate z-score model for bankruptcy.

[27] There are two possible corner solutions. One is where the entrepreneur decides to expropriate nothing, i.e., $s^* = 0$, and the other is where the entrepreneur decides to expropriate all retained earnings, i.e., $s^* = 1$ ("looting"), which implies that a firm is declared bankrupt. See also Alexeev and Kim (2012).

bankruptcy occurs in the model only when expected profits are equal to zero. That is, when the optimal rate of expropriation is equal to one, i.e., $s^* = 1$, the firm goes bankrupt. For instance, when a firm's retained earnings are lower than or equal to a certain low level, an entrepreneur is likely to completely expropriate the retained earnings and the firm goes out of business. This suggests that financial distress (low z-score) can be one of the sources of bankruptcy.

For the sake of simplicity, a univariate Altman z-score model is considered that includes only a retained earnings ratio, i.e., $Z = \beta T$ where $\beta > 0$. Using the bankruptcy condition, retained earnings in bankruptcy (T^b), i.e., $T^b = \frac{1-\alpha R}{\kappa}$ is derived from Equation 4. Subsequently, by multiplying both sides by the coefficient (β) of the z-score model, T^b is transformed to a univariate z-score (Z^b) as shown in Equation 5. Z^b plays a role as an indicator of the z-score threshold for bankruptcy, suggesting that a firm with a z-score less than or equal to Z^b is declared bankrupt.

$$Z^b = \frac{\beta(1-\alpha R)}{\kappa} \tag{5}$$

Equation 5 describes the relationship between z-score bankruptcy threshold and institutional quality. Differentiating Z^b with respect to κ, Equation 6 shows that, other things being equal, better institutions lower the z-score threshold for bankruptcy.[28] This contradicts the empirical findings shown in Table 7 that the threshold of the z-score for bankruptcy is higher in the US with better institutions than in Korea.

$$\frac{\partial Z^b}{\partial \kappa} = -\frac{\beta(1-\alpha R)}{\kappa^2} < 0 \tag{6}$$

This contradiction may result from inconsistency in the comparison of the bankruptcy threshold from the univariate bankruptcy model with the bankruptcy threshold from the multivariate Altman z-score model. Thus, the Altman z-score models for Korea and the US are re-estimated using only the retained earnings ratio, and the z-score bankruptcy threshold for each country is computed. This makes the empirical threshold from the univariate Altman z-score model more comparable to the theoretical threshold from the univariate bankruptcy model in Equation 5.

The new empirical bankruptcy thresholds for Korea and the US are summarized in Table 8. Even in a univariate model, the lower-bound and midpoint z-score thresholds for bankruptcy in the US (-0.375 and 0.164) are higher than those for Korea (-0.637 and 0.046). Accordingly, the theoretical finding in Equation 6 still contradicts the empirical finding from the univariate z-score model.[29]

[28] As noted earlier, since s^* is bounded by zero and one, the numerator $1 - \alpha R$ should be positive.

[29] As in the comparison of thresholds from the multivariate z-score model between Korea and the

Table 8
Bankruptcy thresholds in the univariate model

Model	Country	Bankruptcy Threshold		Observations
		Lower Bound	Midpoint	
New Altman Model	Korea	-0.637	0.046	86
	US	-0.375	0.164	60

The question then arises of how to resolve the contradiction between the theoretical and empirical findings. As noted earlier, firms in the countries with weak institutions possess higher ownership concentration. In particular, weak institutions induces an entrepreneur to tunneling from the firms at a higher z-score whereas higher ownership concentration keeps an entrepreneur from expropriating. Thus, the inverse relationship of ownerships with institutions plays a role in determining the bankruptcy threshold.

Instead of taking the exogeneity of ownership concentration for granted, it is assumed that ownerships is endogenously determined as a function of the institutional parameter, κ. This makes the expression in Equation 5 change to $Z^b = \frac{\beta(1-\alpha(\kappa)R)}{\kappa}$. Differentiating the new z-score bankruptcy threshold (Z^b) with respect to κ gives the comparative statics in Equation 7.

$$\frac{\partial z^b(\kappa, \alpha(\kappa), \beta, R)}{\partial \kappa} = \frac{\partial z^b}{\partial \kappa} + \frac{\partial z^b}{\partial \alpha(\kappa)} \frac{\partial \alpha(\kappa)}{\partial \kappa} > 0 \tag{7}$$

$$= \underbrace{-\frac{\beta(1-\alpha(\kappa)R)}{\kappa^2}}_{\ominus} \underbrace{-\frac{\beta R}{\kappa} \frac{\partial \alpha(\kappa)}{\partial \kappa}}_{?} \tag{8}$$

Unlike the case of exogenous ownership concentration in Equation 6, the comparative statics in Equation 8 show the two effects of κ on the z-score threshold for bankruptcy: a direct effect of κ in the first term of the right-hand side and an indirect effect via ownership concentration ($\alpha(\kappa)$) in the second term. As in Equation 6, the direct effect is always negative, whereas the indirect effect is ambiguous because the sign of $\frac{\partial \alpha(\kappa)}{\partial \kappa}$ is undetermined yet although $\frac{\partial z^b}{\partial \alpha(\kappa)} < 0$. According to the theoretical finding of Shleifer and Wolfenzon (2002) and the empirical findings of Claessens et al. (2000), and La Porta et al. (1998 and 1999), ownership concentration is higher in countries with weak legal protection of investors. Hence, the initial conjecture is that

US, the univariate discriminant function is re-estimated by dropping the Korean firms that defaulted in 1998 and their counterparts, and new thresholds are computed. Both the lower bound and midpoint thresholds (-0.574 and 0.107) appear to be slightly higher than the previous ones (-0.637 and 0.046, respectively). Nonetheless, they are still lower than the thresholds for the US (-0.375 and 0.164, respectively).

$\frac{\partial \alpha(\kappa)}{\partial \kappa}$ should be negative, in which case it can provide one explanation for the positive relationship between the z-score threshold for bankruptcy and institutional quality, i.e., $\frac{\partial z^b(\kappa,\alpha(\kappa),\beta,R)}{\partial \kappa} > 0$.

A necessary condition for the inverse relationship between ownership concentration and institutions is derived from Equation 8 as shown in Equation 9, ensuring the positive marginal effect of institutions on the z-score bankruptcy threshold.

$$\frac{\partial \alpha(\kappa)}{\partial \kappa} < -\frac{1-\alpha(\kappa)R}{\kappa R} < 0 \tag{9}$$

3-2. Data and Regression Analysis

For the cross-country analysis of the relationship between ownership concentration and institutions (governance), the data for each country are separately collected from the World Bank. The data for governance (rule of law) are obtained from Worldwide Governance Indicators (WGI), and the standardized country data at the firm level for ownership concentration and other variables such as employment and industry are collected from the Enterprise Surveys database.[30] The two data sets are then merged into one underlying basic data set by distributing the value of each country's governance indicator equally to all firms in the country.

The initial survey data set contains 55,105 observations from 79 countries in 2002$\sim$ 2005.[31] After eliminating missing values in ownership concentration and employment variables, and considering industry variables only in the manufacturing sector, 1,482 observations from 54 countries remain in the final sample. For consistency with the empirical analysis for the Korean and US firms with the previous two data sets, the final sample is restricted to the publicly-listed manufacturing firms whose ownership concentration should be greater than 0% and less than 100%.[32] However, some countries possess firms with 100% ownership concentration. Instead of dropping them from

[30] Cross-country data from Worldwide Governance Indicators (WGI) consist of 6 different aggregate indicators, based on surveys from various professionals and enterprise, and underlying data from a variety of organizations (available at http//info.worldbank.org/governance/wgi/index.aspx#home). They are defined by the following: (1) Voice and Accountability, (2) Political Stability and Absence of Violence, (3) Government Effectiveness, (4) Regulatory Quality, (5) Rule of Law, and (6) Control of Corruption. Of these, only rule of law is selected as representative of the governance measure, which is the most closely related to the definition of institutions in this paper.

[31] All data available in a country are used regardless of year. For example, data for Bulgaria are available for 2002, 2004, and 2005, in which case the governance indicator for a given year is assigned to all firms in the Enterprise Surveys data for that year (available at http//www.enterprisesurveys.org/data).

[32] One firm is identified with 0% ownership concentration and is therefore excluded.

the sample, they are initially included in regression, and then, in order to check the robustness of the regression results, they are excluded from the sample.

Table 9 summarizes the descriptive statistics for survey years, the number of firms and survey sources, and the variables including sample countries. Panel A shows the statistics for all firms including firms with 100% ownership concentration while Panel B shows the statistics for the firms only with less than 100% ownership concentration. Notice that all firms in Albania, Georgia, Latvia and Portugal have 100% ownerships. As noted earlier, the data available over multiple years in some countries are aggregated and averaged. Rule of law is an estimated value for each country in the survey year, ranging from -2.5 to 2.5. Higher value means better governance.

Using this final sample, the negative relationship between ownerships and institutions is verified via OLS regression. Prior to running the regression, in order to observe the ex-ante evidence of the inverse relationship, all countries in the sample are divided into two groups: an OECD (Organisation for Economic Co-operation and Development) group and a non-OECD group. This is because OECD countries are more likely to have better institutions with higher income levels than non-OECD countries.

The first two rows in Table 10 show that, as expected, the OECD group has a higher governance indicator, rule of law on average (0.38), than does the non-OECD group (-0.40), whereas its ownership concentration on average (64.40%) is lower than that of the non-OECD group (67.13%). This supports that ownerships has an inverse relationship with institutions. This feature becomes more apparent after excluding firms with 100% ownership concentration from the sample. The following two rows show that the OECD group still has higher rule of law (0.32) and lower ownership concentration (47.04%) than those of the non-OECD group (-0.35 and 52.55%, respectively).

To confirm this inverse relationship, a simple regression model that describes the relationship between ownerships and institutions is specified as shown in Equation 10. In particular, in order to control for size and unobserved heterogeneity effects on ownership, employment and industry dummy variables in the manufacturing sector are included in the model where employment is in the form of logarithm. The estimated coefficient of institutions (ϕ_1) is expected to be negative as observed in the comparison of OECD and non-OECD groups.

$$Ownership_t = \phi_0 + \phi_1\ Institutions_t\ + \phi_2\ Employment_t + Industry\ Dummies_t + \varepsilon_t \qquad (10)$$

Although the model in Equation 10 may have an endogeneity problem, the quality of institutions is taken into account as an exogenous variable to be consistent with

Table 9
Descriptive statistics for employment, ownership, and rule of law

		Panel A Sample including firms with 100% ownership					Panel B Sample excluding firms with 100% ownership				
Countries	Survey Year	No. of Firms	No. of Emp.	Ownership Conc.	Rule of Law	No. of Srcs.	No. of Firms	No. of Emp.	Ownership Conc.	Rule of Law	No. of Srcs.
Albania	2005	5	462	100.00	−0.80	12	.	.	.	.	.
Algeria	2002	29	258	81.17	−0.73	11	11	225	50.36	−0.73	11
Armenia	2005	9	65	95.56	−0.47	15	2	23	80.00	−0.47	15
Azerbaijan	2005	25	541	95.60	−0.80	17	5	321	78.00	−0.80	17
Bangladesh	2002	18	760	45.22	−0.79	13	18	760	45.22	−0.79	13
Belarus	2005	1	500	51.00	−1.06	11	1	500	51.00	−1.06	11
BiH	2002, 2005	20	183	45.15	−0.69	12	20	183	45.15	−0.69	12
Brazil	2003	67	571	57.09	−0.34	16	62	604	53.63	−0.34	16
Bulgaria	2002, 2004, 2005	115	218	62.83	−0.06	14	108	222	60.42	−0.06	14
Chile	2004	67	263	48.99	1.16	16	63	267	45.76	1.16	16
China	2003	43	1907	70.06	−0.45	14	32	2041	59.76	−0.45	14
Croatia	2002, 2005	14	814	82.21	0.05	15	8	683	68.88	0.04	14
Czech	2002, 2005	5	967	90.20	0.74	15	1	70	51.00	0.74	16
Ecuador	2003	220	116	69.03	−0.67	14	157	123	56.60	−0.67	14
Estonia	2002	1	182	50.00	0.71	15	1	182	50.00	0.71	15
Ethiopia	2002	48	91	60.54	−0.78	10	44	95	56.95	−0.78	10
FYROM	2002, 2005	2	585	77.00	−0.47	12	1	920	54.00	−0.59	10
Georgia	2005	2	240	100.00	−0.75	14	.	.	.	.	.
Germany	2005	7	80	66.29	1.73	13	5	91	52.80	1.73	13
Guyana	2004	30	33	77.43	−0.56	8	13	51	47.92	−0.56	8
Hungary	2002, 2005	10	487	88.50	0.75	16	4	583	71.25	0.78	16
India	2002	77	584	38.04	0.01	14	73	600	34.64	0.01	14
Indonesia	2003	76	867	79.51	−0.97	17	42	1015	62.93	−0.97	17
Kazakhstan	2005	12	478	93.75	−0.80	17	2	25	62.50	−0.80	17
Kenya	2003	18	223	72.53	−1.06	16	12	201	58.79	−1.06	16
Kyrgyzstan	2003, 2005	16	453	47.13	−0.89	14	14	411	39.57	−0.88	13
Latvia	2005	1	10	100.00	0.47	14	.	.	.	.	.
Lithuania	2002, 2004, 2005	16	460	73.75	0.48	14	12	583	65.00	0.49	14
Madagascar	2005	3	378	83.00	−0.22	12	2	560	74.50	−0.22	12
Malawi	2005	7	3823	59.57	−0.26	15	5	1814	43.40	−0.26	15
Mali	2003	39	10	95.90	−0.09	11	4	15	60.00	−0.09	11
Mauritius	2005	14	512	42.93	0.87	11	13	538	38.54	0.87	11
Moldova	2003, 2005	10	289	88.20	−0.59	15	3	776	60.67	−0.57	15
Pakistan	2002	29	480	58.55	−0.79	13	18	711	33.22	−0.79	13
Peru	2002	7	11	50.14	−0.56	13	7	11	50.14	−0.56	13
Philippines	2003	134	412	62.34	−0.60	15	106	412	52.39	−0.60	15
Poland	2002, 2003, 2005	27	521	60.26	0.46	16	15	691	28.47	0.55	16
Portugal	2005	1	1045	100.00	1.08	13	.	.	.	.	.
Romania	2005	12	328	80.42	−0.23	17	6	516	60.83	−0.23	17
Russia	2005	11	1120	90.27	−0.88	18	3	243	64.33	−0.88	18
Serbia	2003	1	515	62.00	−0.97	12	1	515	62.00	−0.97	12
Slovakia	2002, 2005	12	1130	81.67	0.36	15	6	510	63.33	0.28	15
Slovenia	2002, 2005	5	372	64.60	0.90	15	4	339	55.75	0.93	15
South Africa	2003	22	1728	65.91	0.03	17	13	2280	42.31	0.03	17
SriLanka	2004	44	247	80.25	0.01	15	18	254	51.72	0.01	15
Syria	2003	6	76	42.50	−0.40	9	6	76	42.50	−0.40	9
Tajikistan	2003, 2005	13	387	80.15	−1.01	13	6	395	57.00	−1.04	12
Tanzania	2003	7	388	91.07	−0.42	14	3	871	79.17	−0.42	14
Turkey	2004, 2005	60	381	55.84	0.08	18	51	294	48.04	0.08	18
Uganda	2003	2	167	80.00	−0.64	15	1	14	60.00	−0.64	15
Ukraine	2002, 2005	14	192	95.36	−0.59	17	1	189	35.00	−0.84	15
Uzbekistan	2003, 2005	19	657	49.42	−1.33	14	16	714	39.94	−1.32	14
Vietnam-b	2005	26	1419	94.08	−0.41	16	4	218	61.50	−0.41	16
Zambia	2002	3	606	83.33	−0.50	13	1	1244	50.00	−0.50	13

Note: In Panel B, all firms in year 2003 for Moldova, and in year 2005 for the Czech Republic, FYROM (Yugoslav Republic of Macedonia), Lithuania, Poland, Slovakia, and the Ukraine are dropped since they have 100% ownership concentration in those years. "No. of Srcs" represents the number of survey sources for estimating the rule of law indicator.

Table 10
Descriptive statistics for OECD and non-OECD countries

100%		OECD countries					Non-OECD countries				
Ownership	Variable	Obs.	Mean	S.D.	Min.	Max.	Obs.	Mean	S.D.	Min.	Max.
Including	Rule of Law	122	0.38	0.42	0.08	1.73	1,360	−0.40	0.52	-1.41	1.16
	Ownership	122	64.40	34.21	0.43	100	1,360	67.13	29.77	1	100
Excluding	Rule of Law	82	0.32	0.43	0.08	1.73	942	−0.35	0.56	-1.41	1.16
	Ownership	82	47.04	28.60	0.43	99	942	52.55	24.23	1	99.95

Note: The Czech Republic, Germany, Hungary, Poland, Portugal, Slovakia, and Turkey belong to the OECD group. The unit of ownership is percent.

the theoretical model.[33] Moreover, there could be other econometric issues such as measurement errors or omitted variables. Although this simple regression model cannot accommodate all these potential econometric problems, it correctly estimates the negative coefficient of institutions with its statistical significance, which is consistent with the empirical findings in the literature.

Table 11 reports regression results from the model. The first two columns in Panel A present the results from the sample that includes firms with 100% ownership concentration. A regression is initially performed without industry dummy variables. As shown in the first column of Panel A, rule of law exerts a negative effect on ownership concentration, and also it is statistically significant at the level of 1%. Moreover, the size variable i.e., employment has a negative effect on ownership concentration with statistical significance at the level of 1%. In general, ownerships is more likely to be diversified in large firms, which presumably have better institutions. Hence, like the governance indicator, firm size exerts a negative effect on ownership. Regression results with industry dummy variables in the second column show that even after controlling for unobserved heterogeneity on industries, the sign and significance level of the estimated coefficient of rule of law do not change.

In order to check the robustness of these regression results, the firms with 100% ownership concentration are dropped from the sample. Regression both without and with industry dummy variables in Panel B still yields an inverse relationship between rule of law and ownership concentration at the significance level of 1%. However, size variable's statistical significance unfavorably disappears.

As the robustness check of the results in Table 11, the same regressions are run by clustering the firms within a country because it is likely that firms are correlated

[33] Klapper and Love (2004) consider corporate governance as an endogenous variable and find the determinants of governance. Drakos and Bekiris (2009) show that in a simultaneous framework, managerial ownership taken as an endogenous variable has a positive correlation with firm performance. However, they take ownership of the largest shareholders into consideration as an exogenous variable. In a theoretical framework, Shleifer and Wolfenzon (2002) take into account cash-flow ownership by an entrepreneur as an endogenous variable.

Table 11
Ordinary least square (OLS) regression with countries data at the firm level

Variables	Ownership Concentration			
	Panel A including firms with 100% ownership		Panel B excluding firms with 100% ownership	
Rule of law	−7.286***	−8.790***	−4.026***	−5.321***
	(1.365)	(1.327)	(1.226)	(1.239)
Employment	−1.256***	−0.890*	−0.110	0.066
	(0.455)	(0.474)	(0.463)	(0.486)
Industry dummy	No	Yes	No	Yes
Constant	70.495***	59.031***	51.463***	56.430***
	(2.368)	(3.262)	(2.427)	(3.264)
Number of countries	54	54	50	50
Number of observations	1,482	1,482	1,024	1,024
R^2	0.023	0.071	0.009	0.049

Note: Employment is in the form of logarithm. The coefficients of industry dummy variables are not reported.

within a country and independent across countries. This generates the adjusted robust standard error, leaving the estimated coefficients unchanged. Table 12 shows that rule of law still exerts a negative effect on ownerships with statistical significance in both Panels. Accordingly, the outcomes found in Panel A are robust.

More importantly, this empirical finding supports the theoretical finding that the difference in the z-score threshold for bankruptcy counts on the difference in ownership concentration, endogenous to institutions. This implies that the difference in the z-score threshold for bankruptcy between Korea and the US may be due in part to the difference in ownership concentration.

In addition to the difference in institutions between the countries, they have different bankruptcy laws and procedures that govern the rights of debtors and creditors filing for bankruptcy. Thus, laws governing bankruptcies in each country might affect differences in z-score thresholds. If bankruptcy law of a country allows firms (debtors) to declare bankruptcy more easily than that of another country, i.e., without high financial distress, then, the overall financial state of the firms filing for bankruptcy in the former country is likely to be better than that in the latter. This can help explain why the average z-score for the default firms and the z-score bankruptcy threshold in the US are higher than that in Korea.

To see if there are any differences in the bankruptcy codes of Korea and the US, they are examined. The main differences in their laws regard the following.[34]

[34] The list below focuses on the differences in a filing mainly under Chapter 11.

Table 12
Ordinary Least Square (OLS) regression with clustering firms within a country

Variables	Ownership Concentration			
	Panel A including firms with 100% ownership		Panel B excluding firms with 100% ownership	
Rule of Law	−7.286**	−8.790***	−4.026*	−5.321**
	(3.365)	(3.980)	(2.151)	(2.203)
Employment	−1.256	−0.890	−0.110	0.066
	(1.098)	(0.980)	(0.817)	(0.486)
Industry Dummy	No	Yes	No	Yes
Constant	70.495***	59.031***	51.463***	56.430***
	(6.136)	(7.291)	(2.427)	(4.838)
No. of Countries	54	54	50	50
Observations	1,482	1,482	1,024	1,024
R^2	0.023	0.071	0.009	0.049

Note: Employment is in the form of logarithm. The coefficients of industry dummy variables are not reported.

(1) Qualification of Filing a Petition for Relief: *In the US, irrespective of insolvency, the debtor (financially troubled corporation) may generally file a petition for reorganization, whereas in Korea, the debtor may do so only under an excess of total debts to total assets or insolvency.*

(2) Appointment of Trustee: *In the US, at the start of the reorganization process, the debtor continues operating the business with the rights and powers of a Chapter 11 trustee, which is referred to as debtor in possession (DIP), whereas in Korea, the bankruptcy administrator is appointed by the court and given the rights of the management and supervision of the business.*

(3) Automatic Stay: *In the US, filing a petition automatically stops most collection actions against the debtor or the debtor's property, whereas after a petition is filed in Korea, if initiated or continuing lawsuits by creditors impede achieving the relief sought, the court may "comprehensively" stop all claims against the debtor.*

(4) Debtor-in-Possession (DIP) Financing: *Under DIP financing in the US, a corporation in the process of reorganization can more easily borrow additional funds from financial institutions than can a corporation in Korea.*

(5) Collective Labor Agreement: *In the US, at the start of the reorganization process, the existing collective labor agreement may be revoked, whereas in Korea, it may not.*

These differences imply that US firms can file for bankruptcy more easily and that

the rights of the debtor are better protected in the US than in Korea. In other words, US firms presumably have less financial distress at the time of filing a petition under Chapter 7 liquidation and Chapter 11 reorganization of the bankruptcy code than do Korean firms. Moreover, under this legal protection, a debtor filing a petition in the US has more freedom from the financial pressure of creditors than does one in Korea. This suggests that the lower z-score threshold in Korea relative to the US may be due in part to bankruptcy rules.

4. Conclusion

This paper sheds some light on how the institutional quality affects bankruptcy threshold. To this end, a new Altman z-score model for Korean and US firms is re-estimated and the z-score threshold for bankruptcy is generated. The bankruptcy threshold in Korea is found to be lower than that in the US, implying that a country with weak institutions is likely to have a lower bankruptcy threshold than a country with strong institutions.

In order to explore the theoretical relationship between the z-score threshold for bankruptcy and the quality of institutions, the two popular corporate governance models (Johnson et al., 2000; La Porta et al., 2002) are extended to a simple bankruptcy model. The model implies that the z-score threshold for bankruptcy should be higher in countries with weaker minority investor protections and, more generally, weaker institutions. This implication contradicts to the empirical finding. The contradiction is reconciled by endogenizing the degree of ownership concentration to institutional quality, requiring that ownerships should have an inverse relationship with institutions.

Using Worldwide Governance Indicators (WGI) and Enterprise Surveys data from the World Bank, the comparison of OECD and non-OECD countries and especially, OLS regression confirm that ownerships is inversely related to institutions. This supports that the difference in the z-score threshold for bankruptcy between Korea and the US may be in part attributed to the difference in ownership concentration. Most importantly, this helps explain the apparent positive association between the z-score bankruptcy threshold and the quality of institutions,

Furthermore, the bankruptcy codes of Korea and the US are examined to determine whether the legal rules governing bankruptcy exert a significant effect on the difference of bankruptcy threshold. It is found that to file a petition for bankruptcy is easier and debtors' rights are better protected in the US than in Korea. This suggests that laws governing bankruptcies in each country may be also partly responsible for differences in the z-score threshold for bankruptcy between the countries.

The outcomes in this study are quite meaningful and robust. Nevertheless, since some of them are limited only to Korea and the US, it is admittedly necessary to further explore more countries.

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