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Distress Classification of Korean Firms

This study is an attempt to construct and test a distress classification model for Korean companies. Utilizing a sample of 34 distressed firms from the most recent 1990-1993 period and a matched (by industry and year) sample of non-failed firms, we observe the classification accuracy of two models. Both models utilize measures of firm size, asset turnover, solvency and leverage with one model available for testing only on publicly traded companies and one model is applicable to all public and private entities. We observe excellent classification accuracy based on data from the first two years prior to distress. And, although the accuracy drops off after t-2, the models still provide effective early warnings of distress in many cases. The results of this study are of particular relevance in the current financial market scenario of increased deregulation and greater individual financial institution decision making.

International Bankruptcy Classification Models

Although the largest number of business failure classification models have been performed on U.S. data, there have been at least three dozen studies devoted to other countries. Indeed, two full issues of the **Journal of Banking & Finance**, edited by Altman (1984 and 1988)¹ were devoted solely to these attempts. We do not have the space to review the numerous studies done throughout the world and simply present an updated bibliography, to Altman (1993), of these relevant works in **Appendix A**.

The one prerequisite for any meaningful work on failure classification and prediction is the availability of a data base with information on a sizeable number of failed enterprises in the region. And, although the quality of the financial data is sometimes subject to concern and criticism, a number of countries have "developed" the necessary data-base infrastructure to "host" such studies. And, with the increasing amount of corporate financial distress in many parts of the world, coupled with a global trend toward privatization of heretofore government owned and subsidized firms, the study of corporate distress and the ability to identify it early enough, to conserve assets and jobs, has never been more important.

Far Eastern Models

The current economic malaise in Japan and the recent problems in South Korea are the latest manifestation of both a maturing economy (Japan) and a still growing strong but overheated economy (Korea). We will return to the Korean situation soon. As for Japan,

¹In these issues, over 20 models are presented (vol.8, No.2, 1984 and the **JBF's** "Special Studies in Finance", vol.7, 1988). We apologize to those authors whose study of bankruptcy classification outside the United States is not included in our updated bibliography (see Appendix A).

published and unpublished models to predict corporate bankruptcy were quite prominent in the late 1970's and early 1980's (see Appendix) but then diminished in relevance and appearance throughout the rest of the 1980's. The recent economic situation (1992-1994), however, is somewhat problematic. The Ministry of Finance and large banks are backing-off somewhat from their traditional role of supporting severely distressed firms and artificially keeping them alive. Indeed, in fiscal year 1992, there were 11,767 failed firms with liabilities greater than US\$75,000, the largest in almost a decade and liabilities of these failing firms reached all time record levels. And, the number and liability amount of bankruptcies in 1993 was even greater.

Other attempts in the far east include Ta and Seah-Singapore (1988) and Bidin-Malaysia (1988). (See Appendix A). A revised version of the Malaysian model is still in use by one of the largest mutual funds in the world (PNB) and is part of an early warning-monitoring system established to protect the investments of investors.

The Korean Situation

The South Korean economy has been one of the leading performers amongst the East Asian and Southeast Asian countries. Its growth in the late 1970's and 1980's was the highest in the region and credit risk of its corporate population was not a serious concern. Many analysts were aware that the typical Korean firm was heavily leveraged, perhaps one of the most heavily leveraged in the world, Choi (1983) When the inevitable slow-down occurred in 1991, the economy and its leading corporate players suffered. As long as the Korean government, via the Bank of Korea, supported weak firms, distress was not considered a significant problem.

By most economic standards, the South Korean economy has done exceptionally well in recent years. Indeed, the growth in real GDP was over 12% per year in 1988-1990, but fell to

"just" 6.8% in 1991, increased to 9.3% in 1992 but fell again to 5.6% in 1993. The proportion of firms in distress (unable to get credit due to dishonored checks and liquidations) averaged between 0.05 and 0.10 percent in the last six years, hardly a large number compared to most other nations. Yet, the potential for a serious drop-off in growth and an increase in business failures is always present with such a relatively large recent growth rate and a leverage ratio for firms which averaged around 2.5 to 1.0 (debt/equity ratio) for all non-financial companies. The stock market seemed to recognize this potential by falling by 32% from its high in 1989 to its low point in 1992.

The only Korean study that we are familiar with on business failures and credit evaluation was performed by the Bank of Korea (1982). To the best of our knowledge, this report was not published externally and is now obviously out-of-date. It did, however, utilize a discriminant analysis technique, as we do, to distinguish between healthy and sick enterprise.

Sample Characteristics

Our sample of bankrupt firms consists of 34 publicly traded industrial and trading companies with assets ranging from 9.3 billion won (\$13 million) to 212 billion won (\$296 million) covering a wide range of business activity. See Exhibit 1 for the company names, the date one year prior to distress and the type of bankruptcy. We note two criteria for distress -- technical insolvency (TI) and liquidation (L) -- whichever comes first. The former is where the credit of a company is no longer accepted and the latter is, of course, the final manifestation of a company's life. It is possible that some of the liquidated firms had been technically insolvent prior to the liquidation decision, but we had no official record. Note that the vast majority of

the sample had their official distressed year in 1991 (1990 data) and 1992 (1991 data). Just four firms from the sample are from outside this narrow time frame and all were in distress in the 1990's. So, our sample is quite "up-to-date", although, as noted earlier, the incidence of corporate distress in Korea has diminished in 1993 and early 1994.

Variable Specification

The choice of variables that we identified to provide early warning indication of financial distress are for the most part traditional with the source of data from balance sheets and income statements for up to five years prior to the distress date. Exhibit 2 lists the 20 variables we selected. While we are interested in selecting the "best" model for distress classification, we also wanted to test Altman's 1968 discriminant model (variables 1, 3, 4, 15, and 20). The latter variable (#20), the market value of equity/total liabilities, requires an equity market price and will be included in the Korean public firm model (K2-Score). We will also construct a "private" firm model (K1-Score), or at least one that can be applied to non-publicly traded entities. Since only approximately 600 Korean firms have listed stock prices, a "private" firm model is obviously more practical.

The 20 variables include those measuring profitability (1, 2, 6, 7), activity/turnover (3, 4, 5), size (8), fixed charge coverage (9, 10, 11) liquidity (12, 13, 14, 17), solvency and leverage (15, 16, 19 and 20) and earnings stability (18).² Several variables are expressed as

²The latter is measured by the firms' current earnings before interest and taxes relative to its standard deviation. A high ratio indicates good current performance and relatively low volatility, while a low ratio indicates the opposite. The necessary period to calculate this volatility measure is at least 3-5 years and although significant, we regrettably were not able to use this variable in the final tests due to lack of sufficient data on a significant number of failed firms for back testing the variable and any model that included it.

logarithmic transformations in order to mitigate the effect of outliers, i.e., size of total assets, sales/total assets and interest coverage.

Univariate Results

Exhibit 3 lists the mean and median values for the failed group (34) of firms and a sample of 61 publicly traded non-bankrupt entities for the year prior to distress (failed group) and the same year for the non-failed firms. As will be shown, we also gathered data on a smaller sample of non-bankrupt firms when constructing the actual model. The univariate tests of significance between the average values of the two groups are listed in the last column. We list first the four variables which will comprise our final model.

Note that the average values are what one would expect when comparing distressed firms to healthy ones. Distressed firms are smaller, less profitable, less liquid, more leveraged and with lower interest coverage ratios. For example, the median distressed firm has an equity/liability ratio of 0.39 vs. 0.63 for healthy firms (i.e., debt/equity ratios of about 2:1 vs. 1:2)³. Interestingly, the mean *market* equity to total liabilities was just 0.52 for failed firms vs. 1.18 for non-failed firms and both the book and market equity measures had about the same .01 level univariate significance (t-test = 7.4). Retained earnings were just .02-.03 of total assets for distressed firms compared to .14-.17 for the non-failed firms. Earnings for distressed firms before interest and taxes on assets (EBIT/TA) were .04-.05 and -.01 to -.02 for returns after

³Actually, we were surprised that these debt/equity ratios were as low as they were for both groups, given the general impression that Korean firms are heavily leveraged. This was true prior to 1987, but in recent years the average Korean firm has deleveraged somewhat by issuing equity. As noted earlier, the average non-financial company in Korea had a debt/equity ratio of 2.5 times in 1992.

interest and taxes; for healthy firms the norms were .08 and .05. Sales/TA averaged just 0.78 times for distressed firms compared to 1.1 times for non-failed. Liquidity ratios appeared quite similar, however, between groups.

Interest coverage ratio averages were quite different between groups (0.6 vs. 4.6) but their significance was not high due to very high intragroup variance. When transforming to logs, however, the significance increases dramatically. Finally, distressed firms demonstrate a much lower ratio of current earnings relative to past earnings variance (EBIT/SIGMA-EBIT) = 0.60 vs. 5.77 for healthy firms, but only a relatively modest significance level ($t=3.8$).

Time Series Properties of Distressed Firms

Exhibit 4 lists the trend in the level of the 20 financial indicators for our distressed group of firms from the fifth year prior to bankruptcy to the first year prior. While most ratios demonstrate the expected deterioration as failure approaches, there are a few surprises. For example, the average size of the companies actually increase as the firm deteriorates financially. The LOG(TA) variable goes from 9.54 to 10.65 and the LOG(SALES/TA) increases from t-5 to t-3 and then turns negative (less than a SALES/TA of 1.0) in years t-2 and t-1. The BEQ/TL also improves until just prior to bankruptcy at t-1. The same is true for the liquidity variables which also improve until t-1. Solvency (RE/TA) and profitability variables (e.g., EBIT/TA) decline quite regularly over the five year period.

We can conclude, therefore, that early warning financial indicators of distress in Korea are not likely to be as effective as in the U.S.A. (see Altman, 1993, p.200) since Korean distressed firms have continued to grow in size and, in some cases, raise equity capital until the

year or two prior to distress. An important exception, however, is the trend in the MEQ/TL which deteriorates consistently from t-4 to t-1. We will, therefore, proceed with two multivariate-discriminant models -- one with a book equity leverage variable and the other with a market equity variable.

Discriminant-Classification Methodology and Results

We now move to the actual model building for classifying firms into bankrupt or non-bankrupt categories. Over the years, a number of classification statistical methodologies have been used including multiple discriminant analysis, multi-logit and probit analyses, pattern recognition, recursive partitioning and the most recent artificial intelligence technique known as neural networks. Most of these are reviewed or cited in Altman (1993) except the latter method (see Trippi and Turban (1992) and Altman, et. al., 1994). Despite their differences, the results are fairly comparable and we utilize the most popular distress classification method, linear discriminant analysis, in our Korean study.

Two Basic Models

The models were determined as follows. The 34 distressed Korean firms (Exhibit 1) were matched by industry and data year with 61 non-failed entities.⁴ All of the non-failed firms were publicly traded and were in business for many years, i.e., no new entities. We then randomly selected 34 non-failed firms from the 61 firm larger sample, 1000 times, and calculated discriminant functions from each of the 1000 runs. The final models' coefficients are

⁴The 61 firm sample is the same used to calculate average ratio values in Exhibit 3.

based on the average for the 1000 replications. The final two discriminant classification models each contain four variables plus a constant term. The variables are identical except the fourth variable is the book equity/total liabilities (BEQ/TL) in the model for all firms (public and private) -- called the **K1-Score** -- while we use the market equity instead of book equity for the model only available for publicly traded firms -- the **K2-Score** model.

The criteria for selecting the final variable set were as follows:

- (1) High univariate significance (see Exhibit 3).
- (2) The correct sign of all coefficients in the model.
- (3) An acceptable level of accuracy for both the original (training) sample and the holdout (test) sample.
- (4) Reasonable accuracy levels over time.

The two models are as follows:

$$\text{K1-Score} = -17.862 + 1.472 (X_1) + 3.041 (X_2) \\ + 14.839 (X_3) + 1.516 (X_4)$$

$$\text{K2-Score} = -18.696 + 1.501 (X_1) + 2.706 (X_2) \\ + 19.760 (X_3) + 1.146 (X_4')$$

where:

$$\begin{aligned} X_1 &= \text{LOG(TA)} \\ X_2 &= \text{LOG (SALES/TA)} \\ X_3 &= \text{RE/TA} \\ X_4 &= \text{BEQ/TL} \\ X_4' &= \text{MEQ/TL} \end{aligned}$$

Distressed Firm Classification: K1-Model

Exhibit 5 lists the classification accuracy for the K1-Score model based on data from one to five financial statements prior to bankruptcy. Firms with scores below zero are classified as having a financial profile more similar to distressed Korean firms and those with scores above

zero, are classified as non-distressed. The higher the score, the more healthy (less likely to go bankrupt) the firm. The Type I accuracy is quite good in the first year prior to distress with about 97% correctly classified (only one mis-classification out of 34). The accuracy remained excellent for the second year prior to distress (88.2%) and then fell off to about 70% in year t-3. Please note that both the accuracy and the number of observations diminish as the time prior to distress increases, with just 11 observations in t-5. The reduced accuracy is normal and consistent with other studies, e.g., Altman (1968).⁵

One can observe the time series change in K1-Scores for individual failed firms. For example, Figure 1 shows the five year pre-distressed trend in scores for four firms. Note that all indicate high distress potential for several years prior to the event date.

We also observe that firms with K1-Scores above 0.75 were essentially distress-free while scores below -2.00 indicated severe distress potential. For K2-Scores, the grey zone is slightly under from +0.75 to -2.30. These zones might be called the "Grey-Zones", since we observe errors in classification in this interval.

Non-Distressed Firm Accuracy: K1-Score Model

The classification accuracy for the 61 firm non-distressed sample is reported in terms of when the data was available. For example, Exhibit 6 indicates that the largest number of observations in any one year with data available is 1990 (59) and the Type II accuracy in that year was 83%. The classification accuracies ranged from a high of 93% in 1992 to 77% in

⁵The results using Altman's (1968) variables #1, 3, 14, 15 and 20 and coefficients were less accurate, i.e., 63.2% for the distressed firms and 69.8% for the non-failed entities. When this model's coefficients were re-estimated, using Korean data, the classification accuracies increased considerably to 87.4% and 81.4%.

1988. And, one can observe that the accuracies tend to increase over the period 1988-1992. This is, no doubt, due to the relatively poor economic situation in the late 1980's in Korea. Overall, there were 250 observation-years with an average Type II accuracy of 83.6%.

Exhibit 7 shows the breakdown of accuracies by industry category from a much larger sample of over 400 seemingly non-distressed firms over the years 1988-1992.⁶ This sample comprises all firms listed on the various sections of the Korean Stock Exchange and includes relatively new companies as well as larger, established ones.

The results show a lower overall accuracy of about 70%, with a number of industries displaying relatively poor results, e.g., leather tanning and dressing, fabricated metal products and wood, pulp and paper. On the other hand, industries such as construction, motor vehicles, petroleum and plastics and basic metals all have accuracies greater than 80%. It should be noted that the original 34 distressed firms were not represented by construction companies.

The relatively low 70% accuracy of non-failed firms is perhaps due to the fact that a non-trivial number of these firms in our test sample are indeed in some distress and will soon enter the ranks of sick or distressed companies. Indeed, about 20 (5% of the sample) are listed in the second tier of the Exchange and are on the "Watch List" for possible delisting. In addition, many smaller, newly issued stocks are in this sample and the probability of distress of younger entities is considerably greater than for older, more established firms.

⁶The source of this data are the Annual Reports of each company. We only include those industries with at least ten companies comprising its total in any one year. A small number of these firms may have experienced financial distress prior to 1988.

Classification Accuracy: K2-Score Model

As noted earlier, we find that the market value of equity indicator is extremely significant and shows a desirable trend as bankruptcy approaches. Since we have always expressed our confidence in market value indicators of financial distress, we decided to specify a model just for publicly traded firms. Indeed, this model (K2-Score) is identical to the "private firm" one except we substitute the market value of equity for the book value. The resulting model's parameters were indicated earlier.

Exhibit 8 indicates that the sample size of distressed firms in the construction of K2-Score is now lower (28) and the accuracy essentially the same as for the "private-firm" model. For example, at t-1 and t-2 the Type I accuracies are 96.6% and 85.2% vs. 97.0% and 88.2% for the K1-Model. At t-3, however, the use of market values actually increased the accuracy (71.4% vs. 69.7%); although the sample size is smaller.

For non-distressed firms, one can observed in **Exhibit 9**, the accuracy is somewhat higher for K2 than for the K1-Model, e.g., 85.7% overall compared to 83.6%, for the entire sample period. The sample size is slightly smaller in Exhibit 9 vs. Exhibit 6.

Conclusion

We have, for the first time, constructed a distress classification model for South Korean companies. Utilizing a sample of 34 distressed firms in 1990-1993 and a matched (by industry and year) sample of non-failed firms, we observed the accuracy of two models -- one for non-public entities and the other for both public and private companies. The resulting models combined measures of firm size, sales to assets, solvency and leverage (the latter measured in

market or book values). Both demonstrated excellent classification accuracies in the first two years prior to distress. And, although the accuracies drop off considerably after t-2, the models still are acceptable for long-range, early-warnings in many cases.

The study and its results, have two major limitations. First, due to the relatively up-to-date sample from 1990-1993, and the need to use all or most of these 34 distressed firms in the construction of the models, it is not possible to test the model on a new meaningful "holdout" group. Second, the Type II accuracy is just over 70% in some cases when tested on the total population of firms listed on all sections of the Korean Stock Exchange. As noted earlier, however, several of these entities were not in very good shape in 1993 and if they become clearly distressed in 1994/95, actually belonged in the sick group. Therefore, the analysis of our models on future distressed and healthy entities will be the true test of its predictability.

We do expect that our results will have several beneficial applications, particularly in the banking and other credit sectors of the economy. Early warning models are potentially useful, even if not totally accurate, for external and even internal objective evaluation of the health of corporations. These models are of particular relevance in today's Korean financial market as it becomes increasingly deregulated with greater individual financial institution decision making.

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Appendix A
Distress Classification Models for Non-U.S. Countries
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Exhibit 1
List of Distressed Korean Firms

No.	Company Name	Year ¹	Type ²	Asset Size ³	No.	Company Name	Year ¹	Type ²	Asset Size ³
1	DAE DO SANG SA	'89	TI	12.7	18	ANAM PRECISION	'91	L	101.7
2	HEUNG YANG	'90	L	54.1	19	BORNEO FURNITURE	'91	L	180.1
3	IN SUNG IND.	'90	TI	18.2	20	CHUNG HWA ENTERPRISE	'91	TI	30.1
4	JOONG WON ELECTRONICS	'90	L	26.6	21	DAIMI IND.	'91	TI	27.6
5	KENNY TRADING	'90	TI	9.3	22	DONG SUNG SEMICONDUCTOR	'91	L	39.2
6	KION TRADING	'90	TI	22.5	23	GAHSUNG IND.	'91	L	115.4
7	KYONG IL LEATHER	'90	TI	59.6	24	HAN KOOK BELT	'91	L	31.7
8	MEEWOO	'90	L	33.4	25	HYUP JIN ENTERPRISE	'91	L	109.6
9	NON NO	'90	L	212.0	26	JEIL REFRIGERATING	'91	L	25.8
10	ORIENTAL PRECISION	'90	L	205.1	27	KUHN PUNG PHARM.	'91	L	61.2
11	SAM HO MOOLSAN	'90	L	132.4	28	SAM SUNG DRUGS	'91	TI	11.6
12	SEO JIN FOODS	'90	TI	36.2	29	SAMYANG OPTICAL	'91	L	36.4
13	SHIHAN INT'L	'90	TI	62.0	30	SINJUNG PAPER	'91	TI	57.6
14	WOO SAENG	'90	TI	17.5	31	SUNG HWA	'91	TI	126.4
15	YANG WOO OXIDE CHEM.	'90	TI	27.4	32	WOODAN	'91	TI	31.2
16	YOUNGONE COMMUNICATIONS	'90	L	19.0	33	HANIL CORP.	'92	TI	36.5
17	YUNG TAI ELECTRONICS	'90	TI	42.1	34	JINYOUNG	'92	TI	16.6

¹⁾ Year is based on the last fiscal year of financial statements which are available prior to distress.

²⁾ Type of distress consists of technical insolvency(TI) and liquidation(L).

³⁾ in billion WON (WON/\$ is 716.40 in 1990 and 760.80 in 1991.)

Exhibit 2
List of Variables

Number	VARIABLE NAME
1	EBIT/TA
2	NI/TC
3	SALES/TA
4	LOG (SALES/TA)
5	SALES/TC
6	EBIT/SALES
7	NI/SALES
8	LOG (TA)
9	EBIT/INT
10	LOG (EBIT/INT)
11	CF/TL
12	WC/LTD
13	CURRENT RATIO
14	WC/TA
15	RETAINED EARNINGS/TA
16	BOOK EQUITY/TC
17	NORMALIZED QUICK RATIO
18	EBIT/SIGMA
19	BOOK EQUITY/TL
20	MARKET EQUITY/TL

*Notation

EBIT = earnings before interest and taxes
 TA = total assets
 TL = total liabilities
 LTD = long-term debt
 TC = total capital = LTD + Equity
 NI = net income
 CF = operating cash flow
 WC = working capital = CA - CL
 NORMALIZED QUICK RATIO = (CA - CL - Inventory)/TA
 SIGMA = standard deviation of three years EBIT

Exhibit 3
 AVERAGE AND MEDIAN OF RATIOS BETWEEN GROUPS
 (Test of Mean Differences Between Groups Included)

	DISTRESSED (N=34)		NONBANKRUPT (N=61) ¹		T-VALUE
	MEAN	MEDIAN	MEAN	MEDIAN	
LOG (TA)	10.6350	10.4710	11.3760	11.1980	4.26**
LOG (SALES/TA)	-0.3163	-0.2593	0.0278	0.0601	4.91**
RET/TA	0.0227	0.0302	0.1692	0.1428	11.16**
BEQ/TL	0.4487	0.3887	0.9214	0.6347	7.40**
EBIT/TA	0.0370	0.0586	0.0818	0.0738	3.90**
NI/TC	-0.0256	0.0134	0.0613	0.0461	4.91**
SALES/TA	0.7780	0.7716	1.1036	1.0619	6.10**
SALES/TC	1.6200	1.4370	1.8883	1.7141	1.75
EBIT/SALES	0.0508	0.0689	0.0801	0.0671	1.27
NI/SALES	-0.0175	0.0125	0.0361	0.0297	4.29**
EBIT/INT	0.5960	0.9460	4.5500	1.7100	1.94
LOG (EBIT/INT)	0.0001	0.0568	0.5694	0.4153	7.10**
CF/TL	0.0251	0.0533	0.2209	0.1574	8.61**
WC/LTD	0.8980	0.8130	1.2420	0.6110	1.74
CA/CL	1.4141	1.3308	1.5992	1.3209	2.07*
WC/TA	0.1728	0.1746	0.1514	0.1326	0.81
BEQ/TC	0.5602	0.5415	0.6488	0.6395	3.38**
QUICK	-0.0746	-0.1657	-0.0611	-0.0829	0.22
EBIT/SIGMA	0.6010	0.6520	5.7700	2.5600	3.80**
MEQ/TL	0.5231	0.4970	1.1761	0.7735	7.38**

¹) Statistics for nonbankrupt group are based on 250 observations of 61 firms.

*) denotes 5% significance level.

***) denotes 1% significance level.

Exhibit 4
 AVERAGE RATIOS OF DISTRESSED GROUP
 (Five Years Prior to Distress)

	T-1 (N=34)	T-2 (N=34)	T-3 (N=33)	T-4 (N=32)	T-5 (N=16)
LOG (TA)	10.6350	10.3390	9.9320	9.5680	9.5460
LOG (SALES/TA)	-0.3163	-0.1727	0.0716	0.3380	0.2530
RET/TA	0.0227	0.0398	0.0599	0.0751	0.0809
BEQ/TL	0.4487	0.5742	0.5666	0.4306	0.4230
EBIT/TA	0.0370	0.0586	0.0622	0.0883	0.1057
NI/TC	-0.0256	0.0220	0.0357	0.0755	0.0971
SALES/TA	0.7780	0.9191	1.2540	1.7010	1.5200
SALES/TC	1.6200	1.9280	3.0320	4.8190	3.7530
EBIT/SALES	0.0508	0.0692	0.0575	0.0685	0.0963
NI/SALES	-0.0175	-0.0005	0.0006	0.0183	0.0584
EBIT/INT	0.5960	0.9550	0.9360	1.4300	1.7680
LOG (EBIT/INT)	0.0001	0.0923	0.0710	0.1482	0.1929
CF/TL	0.0251	0.0619	0.0703	0.0953	0.0936
WC/LTD	0.8980	1.8560	1.2520	0.8080	0.8250
CA/CL	1.4141	1.6095	1.5320	1.3239	1.4430
WC/TA	0.1728	0.2230	0.1884	0.1155	0.1338
BEQ/TC	0.5602	0.6202	0.6396	0.5606	0.4801
QUICK	-0.0746	-0.0269	-0.0599	-0.1325	-0.040
EBIT/SIGMA*	0.6010	1.8610	1.4880	N/A	N/A
MEQ/TL*	0.5231	0.8510	1.1420	1.4350	1.3700

* Sample size less than other ratios

Exhibit 5
FIVE-YEAR PREDICTIVE ACCURACY FOR DISTRESSED GROUP

Year prior to Bankruptcy	Hits	Misses	Percent
1st (N=34)	33	1	97.06%
2nd (N=34)	30	4	88.24%
3rd (N=33)	23	10	69.70%
4th (N=32)	16	16	50.00%
5th (N=16)	11	5	68.75%

Classifications are based on the following model;

$$K\text{-score} = -17.8619 + 1.4722 \text{ LOG(TA)} + 3.0411 \text{ LOG(SALES/TA)} + 14.8387 \text{ (RE/TA)} + 1.5159 \text{ (BEQ/TL)}$$

Exhibit 6
 CLASSIFICATION ACCURACY OF NONBANKRUPT FIRMS
 (1988-1992)

Year	Cases	Hits	Misses	Percent
1988	57	44	13	77.19%
1989	58	47	11	81.03%
1990	59	49	10	83.05%
1991	47	42	5	89.36%
1992	29	27	2	93.10%
Total	250	209	41	83.60%

Classifications are based on the following model;

$$K\text{-score} = -17.8619 + 1.4722 \text{ LOG}(TA) + 3.0411 \text{ LOG}(\text{SALES}/TA) + 14.8387 (\text{RE}/TA) + 1.5159 (\text{BEQ}/\text{TL})$$

Exhibit 7
CLASSIFICATION RESULTS, HOLDOUT SAMPLE OF NONBANKRUPT FIRMS (BY INDUSTRY)

INDUSTRY NAME	'88		'89		'90		'91		'92	
	N	PERCENT	N	PERCENT	N	PERCENT	N	PERCENT	N	PERCENT
FOOD & BEVERAGES	30	66.67	40	67.50	40	72.50	40	72.50	40	70.00
TEXTILES	26	76.92	37	75.68	37	75.68	37	72.97	37	70.27
TANNING & DRESSING OF LEATHER	11	54.55	11	54.55	11	36.36	11	27.27	11	27.27
WOOD, PULP & PAPER PRODUCTS	18	50.00	25	52.00	25	60.00	25	48.00	25	60.00
CHEMICALS & CHEMICAL PRODUCTS	56	78.51	72	73.61	72	76.39	71	74.65	72	73.61
PETROLEUM & PLASTICS PRODUCTS	16	68.75	17	70.59	17	64.71	17	70.59	17	82.35
NON-METALLIC MINERAL PRODUCTS	20	80.00	23	82.61	23	78.26	23	73.91	23	69.57
BASIC METALS	26	88.46	33	93.94	32	90.63	33	87.88	33	81.82
FABRICATED METAL PRODUCTS	29	55.17	35	57.14	35	51.43	35	51.43	36	47.22
RADIO, TV & COMM. EQUIPMENT	32	71.88	37	75.68	37	62.16	37	64.87	37	62.16
ELECTRICAL MACHINERY ¹	20	55.00	23	73.91	23	65.22	23	69.57	23	78.26
MOTOR VEHICLES	16	75.00	18	77.78	18	83.33	17	82.35	18	83.33
CONSTRUCTION	38	71.05	39	66.67	39	66.67	39	79.49	39	92.31
OTHERS ²	21	76.19	24	70.83	24	62.50	25	56.00	24	58.33
TOTAL	359	70.75	434	71.66	433	69.51	433	69.05	435	70.12

¹ Electrical machinery contains 5 manufacturers of office & computing machinery.

² Others include Fishing & Mining, the manufacture of Wearing Apparel and Furniture, and precision instrument manufacturers.

Exhibit 8
 FIVE-YEAR PREDICTIVE ACCURACY FOR DISTRESSED GROUP
 (Market value Model: K'-Score)

Year prior to Bankruptcy	Hits	Misses	Percent
1st (N=29)	28	1	96.55%
2nd (N=27)	23	4	85.19%
3rd (N=21)	15	6	71.43%
4th (N=10)	4	6	40.00%
5th (N=4)	3	1	75.00%

Classifications are based on the following model;

$$K' \text{-score} = -18.6957 + 1.50113 \text{ LOG(TA)} + 2.7059 \text{ LOG(SALES/TA)} + 19.7604 \text{ (RE/TA)} + 1.1461 \text{ (MEQ/TL)}$$

Exhibit 9
 CLASSIFICATION ACCURACY OF NONBANKRUPT FIRMS
 (Market Value Model: K'-Score, 1988-1992)

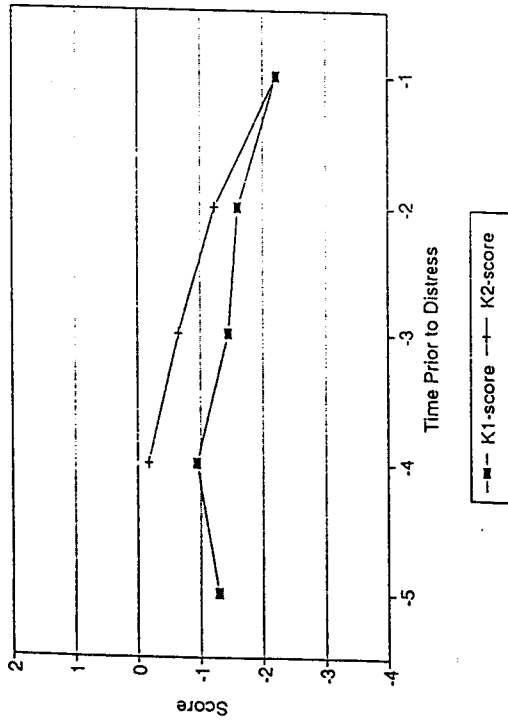
Year	Cases	Hits	Misses	Percent
1988	40	30	10	75.00%
1989	51	44	7	86.27%
1990	57	49	8	85.96%
1991	47	42	5	89.36%
1992	29	27	2	93.10%
Total	224	192	32	85.71%

Classifications are based on the following model;

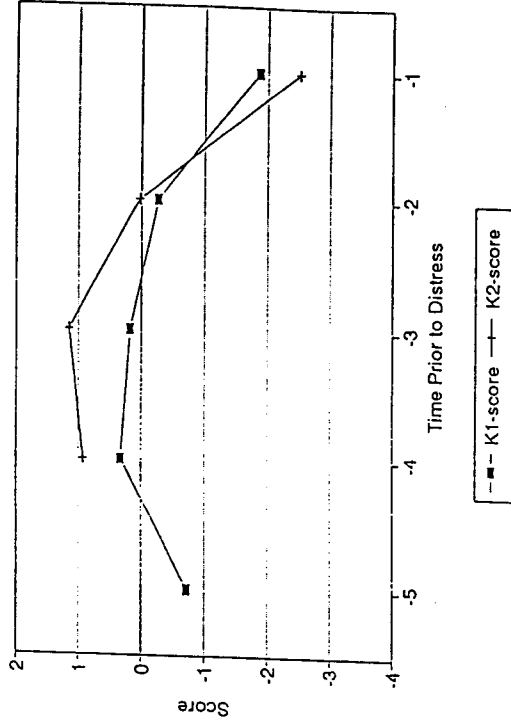
$$K' \text{-score} = -18.6957 + 1.50113 \text{ LOG(TA)} + 2.7059 \text{ LOG(SALES/TA)} + 19.7604 \text{ (RE/TA)} + 1.1461 \text{ (MEQ/TL)}$$

(Figure 1) K1 and K2 Scores
Korean Distressed Companies

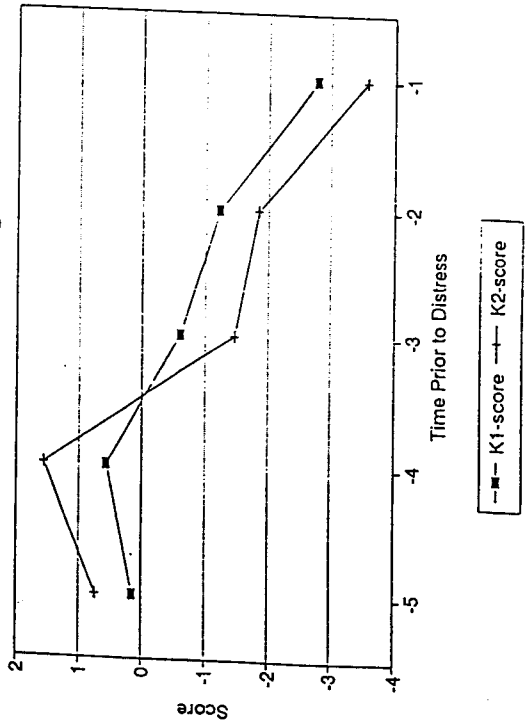
Han Kook Belt



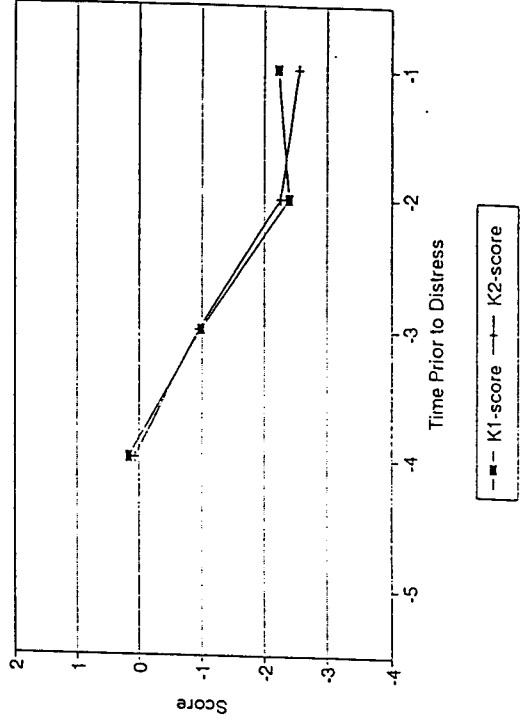
Borneo Furniture



Sam Sung Drugs



Oriental Precision



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