An Examination of Micro-economic Fundamentals around the Financial Crisis in Korea: On the Firm Level

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Abstract

We examine micro-economic fundamentals in Korea around the financial crisis in 1997 in terms of default risks of firms. The overall default risk of firms increased during the period of 1992 - 1996 and has decreased sharply since 1998. In addition, while the default risks of chaebol firms were much higher than those of non-chaebol firms before the financial crisis, the default risks of chaebol firms and non-chaebol firms have been similar since 1999. This implies that the microeconomic fundamentals of the Korean economy prior to the crisis were very weak and vulnerable. This implies that the micro-fundamental weakness played an important role as a cause of the financial crisis. The restructuring policy measures during the crisis are evaluated to be successful in the sense that their default risks drastically decreased over 1999-2001.

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I. Introduction

A financial crisis has multiple and complex facets. Therefore there are many causes of financial crisis. The studies on recent financial crashes in Asian countries in the late 1990s provide various arguments about their causes: macro-economic weakness, moral hazard, vulnerable instability of financial markets. Some literatures suggest weak performance and risky financial structure of corporation as the cause of financial crises.[1] With such claims still in debate, many agree with claims that the financial crisis afflicted economies have imperfections in their economic systems, such as inadequate supervision on the banking sector, widespread crony relationships between firms, lenders, the government, etc. Most researches on the causes of financial crisis are likely to put focus on the macro-side of economy on the belief that macro phenomena are the mirror of the micro-situations. However, macro-level analyses might miss or overlook micro-fundamentals in the overall economy. There are several descriptive studies on the firm level analysis in terms of ROA, debt structure and leverage of corporations descriptively[2]. However we hardly find any systematic studies that examine the vulnerability of overall economy based on the micro-fundamentals. The analysis of firm level tends to complement the macro-analysis or show the more detailed and precise information about the overall economy. Therefore we will put focus on the analysis of firm level.

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1. Radelet and Sachs (1998) report that "the Korean economy like many other economies in the Pacific Asia had long been hailed by many analysts as a role model for the rest of the developing world before the crisis, but has been blamed as an example of failed crony capitalism after the financial crisis." and that

We intend to investigate how vulnerable the micro-fundamentals of the Korean economy prior to the crisis were and whether they improved after the crisis in terms of overall default risk of firms. Furthermore, we evaluate whether vulnerable micro-fundamentals contribute to the financial crisis. We also evaluate the restructuring measures of firms. In particular, we will examine if chaebol firms were more vulnerable than non-chaebols. In order to achieve the above-mentioned goals, we first set up models to estimate default risk of firms and then examine how the overall default risk of firms changed before and after the financial crisis, using probit model.

This paper is composed as follows. We discuss the data in section II. In section III, we estimate default risks of firms. In section IV, we compare the default risks prior to the crisis with those after the crisis. Finally we conclude in section V.

II. Informal Analysis

The data used in this study are obtained mainly from the data base constructed by Korea Information Service, Inc.-Financial Analysis System (KIS-FAS) and Maekyung Annual Corporation Reports (MKACR)[3]. The data under study covers from 1990 to 2001. The number of data is 661. Financial services firms are excluded because their accounting system is considerably different from that of other firms in manufacturing, etc. Some observations are also excluded due to lack of information on the variables we use

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"While there were substantial underlying problems and weak fundamentals besieging the Asian economies.... It is the least anticipated financial crises in years."

[2] Refer to Stijn Claessens(2003).

[3] KIS-FAS provides comprehensive corporate and financial information on firms listed on the Korea Stock Exchange since 1980 and MKACR provides the information for over 300,000 firms since 1978.

in this study [4].

In order to find the determinants of corporate defaults and estimate the probability of defaults, we examine various variables reflecting corporate capital structure, profitability, cash flows, ownership structure, etc. We discuss here the definitions of some critical variables in more details. Firms are identified as defaulted if they reported "filed for bankruptcy", "bankrupt", "out-of-operation", "termination of lending", or anything similar in their corporate history. Firms merged with other firms are not considered as defaulted as long as they actually have never defaulted. The dates of default are obtained from the history of firms in MKACR [5].

In this study, chaebols firms defined in this study are basically the same as those formally defined and announced each year by the Korean Free Trade Commission (KFTC), whose list contains different chaebols each year due to changes in their asset sizes and ownership structure. We therefore recognize 35 well known business groups as chaebols in our data set, since their rankings and names change over time [6].

Figure 1 shows the trends of average sales (Sales in 100 billion won), interest rates and profitability, measured by EATR (net income) of firms. From the figure, we can see that the average sales of those firms increased during the period and that the average net income was positive during the period except 1997 and 1998. From 1999, the average

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[4] Firms without accounting data about export ratios are excluded. Two years data are required to calculate most variables used.

[5] Appendix Table summarizes the definitions of variables used in the study,

[6] They are Samsung, Hyundai, Daewoo, LG, SK, Kumho, Hyosung, Doosan, Hanjin, Daelim, Jinro, Lotte, Haitai, Hanhwa, Shinho, Nongshim, Ssangyong, Daesang(Miwon), Sammi, Dongbu, Kia, Donga, Kolon, Dongyang, Dongkook, Kohap, Hansol, Youngpoong, Daesung, Daenong, Goryo. Some other chaebols like Halla, Shaehan, Jeiljedang, and Shinsegae are also classified as chaebols, even though they are legally separated from their mother groups.

interest expense of firms declined drastically as the peak in 1998 during the financial crisis. During 1997-1998 firms in Korea can be said to have experienced drastic changes in their business environment.

Figure 1: Trends in Sales, Interest Rates and Profitability (EATR)

Note: 1. All values are the averages of all firms as in Table 1each year.
2. Sales are in 100 billion won, and EATR and InterestR are in percent.

Table 1. Comparison between Defaulted and Non-Defaulted Firms

	Defaulted				Non-Defaulted			
	Overall	Before	Yr1997	After	Overall	Before	Yr 1997	After
Observations	1,756	1,079	125	552	4,570	2,404	346	1,820
EATR	-4.46	-1.37	-8.81	-9.51	1.84	2.30	1.05	1.37
DebtR	98.98	84.48	99.45	127.22	61.47	65.03	67.33	55.64
SRDebtR	49.11	48.77	61.54	46.96	38.99	40.62	42.87	36.10
InterestR	9.38	9.83	10.13	8.32	7.63	8.25	8.22	6.69
SalesG	19.16	28.77	15.46	1.20	16.47	14.79	20.99	17.83
SizeG	13.08	22.85	16.11	-6.69	14.11	17.37	23.83	7.95
ExportR	25.53	26.40	26.11	23.69	29.69	27.96	28.15	32.28
BankLoanR	41.28	36.21	45.66	50.21	23.71	26.01	28.64	19.74
BLChR	3.19	7.18	10.62	-6.29	2.34	4.65	10.06	-2.18
LoanR	57.67	51.92	63.96	65.53	35.93	38.67	41.10	31.33
LoanChR	4.94	11.51	13.51	-9.86	4.10	7.42	12.98	-1.96

Note: All ratios are in percentage, simply averaged, and on a per annum basis.

Table 1 shows the important variables for defaulted firms and non-defaulted firms before and after the crisis. The table confirms that firms in Korea experienced drastic changes starting from 1997 during which the financial crisis occurred. Average profit rates were negative for the defaulted firms (Default) before and after the crisis, while they were positive for the non-defaulted firms for the respective periods.

The short-term debt ratios (SRDebtR) sharply increased during 1997, especially in the case of defaulted firms. While the short term debt ratios of non-defaulted firms

declined drastically after the crisis, total debt ratios of defaulted firms (DebtR) increased. The extremely high ratio of short-term debts during 1997 might have aggravated the overall vulnerability of firms and the whole economy, by seriously deteriorating short-term liquidity of firms, banks and the country.

The ratio of total borrowings to total assets (LoanR) increased to 64.0 percent in 1997 from 51.9 percent in 1996 for defaulted firms, and then further increased to 65.5 percent, mainly due to the substantial decrease in their total assets. On the contrary, it decreased to 31.3 percent after 1998, from its previous peak at 41.1 percent in 1997 in the case of non-defaulted firms. From the table, we can observe that there were substantial differences in the magnitudes of most variables between non-defaulted firms and defaulted firms between the pre-crisis period and the post-crisis period. Statistics were quite different from those before and after the crisis.

From the above review of main variables of firms, we can infer that firms in Korea grew remarkably fast in size measured by total assets until 1998 while their profitability was aggravating, especially starting from 1996, and that their overall debt ratios were also gradually increasing until 1997 and then declined afterwards. It implies that firms in Korea in general might have exposed themselves to gradually more risks of defaults every year before the crisis.

III. Default Estimation Models

The default risk of firms is critical in evaluating the soundness of micro fundamentals because it is a primary indicator of the quality of firms or investment and

reflects the soundness of economy. Firms are sometimes rated in the credit market for corporate bonds, commercial papers, etc. by credit-rating agencies. The probit model is usually exploited for estimation of defaults risk. Here we also use the probit model. The basic specification assumes that the default risk of a firm can be estimated with information available in the prior year. The basic model for estimating default risks of firms is specified in the following multivariate probit model:

$$Default_{i,t+1} = ß'X_{i,t} + \varepsilon_{i,t+1} \quad (1)$$

where the dependent variable, $Default_{i,t}$, indicates whether a firm i defaults in t+1, and all explanatory variables used in the model as listed in Table 3, are denoted by $X_{i,t}$, and where $\varepsilon_{i,t+1}$ denotes error terms. The explanatory variables cover the ownership, debt structure, cost structure, etc.

First of all, we are concerned with which explanatory variables should be considered. First of all, we control for the effect of chaebol firms (Chaebol) with a dummy variable. The following independent variables are considered: age, size (Asset and Employee) , sales, profitability , cash flows, additional loans, a changes in the magnitudes of debt financing working capital ratios, interest expense ratios, debt ratios and short-term debts to total debt ratio, ownership structure, the ratio of exports to total sales etc.

However, it is very difficult to obtain a sufficient number of observations of defaults for these firms in a specific period of time. As we see, insufficient number of defaulted firms might lead to underestimation of default risks of firms. In order to

overcome this problem, we include all defaulted firms during 11 years. We have 179 defaulted firms over the period of 11 years between 1992 and 2002. Using the data set from a large period of time might increase the power of tests for default models, but might be at the cost of stability of models over time.

We use data during the period of years between 1997 and 2002, because we believe that during that period the budget constraint in Korea was stricter than in the prior period and there are less moral hazard. Our belief is supported by the fact that more firms defaulted each year in 1997–2002 than in the previous years. Corresponding to defaulted firms during the period, we need non-defaulted firms. To match the data for defaulted firms, we simply select data for all the non-defaulted firms in 1999[7]. With this sampling method for non-defaulted firms, we can avoid the year effect in estimating default models, but might incur a matching problem between data sets.

Probit model is used to determine the probability of defaults of firms in the following year in each year.[8] We will find out major variables of corporate defaults and study their effects on default risks. The estimated models will allow us to predict default risks of firms during the whole sample period from 1991 to 2001. Then we investigate how the overall corporate default risk has changed over time, by comparing them before and after the crisis in 1997.

The results of different specifications are summarized in Table 2 and Table 3. The number of observations varies across models, mostly due to missing data with

[7] We may use any one-year data set during 1999-2000 without fundamental changes default models and thus other related tests or arbitrarily choose samples of non-defaulted firms from each year to match defaulted firms.

[8] By the same reason, probit models are relatively better justified than corresponding logit models.

respect to some variables used in some models. Model I uses all 661 firms, including 179 firms which defaulted between 1992 and 2002. Model II has the same model specification as Model I, except the facts that 149 defaulted firms are included that failed only between 1997 and 2002. The specifications of Models III, and IV are exactly like those of Model I and II respectively except the fact that the export ratio (ExportR) is included. By dropping 18 observations with missing data, we eventually use data from 613 firms including 133 defaulted firms.

The overall predictability of models (p(Right)) measured by the percentage of correctly predicted observations reaches about 90 percent in the sample.[9] The models predict non-defaulted firms (p(Right|NonD)) better with an accuracy of around 95 percent than defaulted firms (p(Right|D)). They predict defaulted firms (p(Right|D)) with an accuracy of 61.7 percent at the lowest and up to 76.5 percent. The ratio of predicted defaults to actual defaults (predD/Default)) decreases a lot from 92.7 percent in Model I to 75.9 percent in Model IV. The default prediction models are more likely to underestimate default risks of firms in general. Given the insufficient number of observations in non-defaulted firms, models are more likely to underestimate default risks in the sample as the number of defaulted firms in a model decreases.

Table 2: Predictability of Default models

Models	**Model I**		**Model II**		**Model III**		**Model IV**	
Observations	Total	predD	Total	predD	Total	predD	Total	predD
Defaulted	179	137	149	110	133	82	133	82

[9] According to Falkenstein, et. al (2000), Moody's Default Model predicted up to 78.53% right with 28,104 firms including 1604 defaulted firms, whiles Libby (1975) predicted 74% right with 30 defaulted and 60 non-defaulted firms, in 1 year horizon. For more details, see Falkenstein et. al (2000).

Non-Defaulted	482	29	482	22	480	24	480	19
Total Observations	661	166	631	132	613	106	613	101
p(Right)	0.893		0.903		0.878		0.886	
p(Right|D)	0.765		0.738		0.617		0.617	
p(Right|NonD)	0.940		0.954		0.950		0.960	
predD/Default	0.927		0.886		0.797		0.759	

Note: 1. predD: the number of observations predicted to default
2. p(Right|D): the probability of predicting correctly, given that firms are actually defaulted
3. p(Right|NonD): the probability of predicting correctly, given that firms are actually not defaulted

Table 3: Comparisons of Results between Default Estimation Models

Models	**Model I**		**Model II**		**Model III**		**Model IV**	
Observations	661		631		613		613	
Probability > χ^2	0		0		0		0	
Pseudo R^2	0.50		0.48		0.43		0.46	
Variables	Coeff.(p-value)		Coeff.(p-value)		Coeff.(p-value)		Coeff. (p-value)	
MfgFirm	-0.306	(0.050)	-0.322	(0.045)	-0.228	(0.117)	-0.244	(0.108)
Chaebol	-0.245	(0.114)	-0.200	(0.165)	-0.207	(0.145)	-0.254	(0.110)
Age	-0.024	(0.001)	-0.019	(0.006)	-0.020	(0.004)	-0.021	(0.004)
Asset	-1.0e-10	(0.161)	-9.1e-11	(0.184)	-4e-11	(0.339)	-3.4e-11	(0.363)
Employee	0.0002	(0.000)	0.0002	(0.000)	0.0001	(0.001)	0.0001	(0.001)
GovSH	-0.387	(0.089)	-0.319	(0.115)	-0.345	(0.148)	-0.222	(0.220)
GovFirmSH	0.061	(0.003)	0.058	(0.004)	0.060	(0.003)	0.056	(0.006)
BankSH	0.008	(0.161)	0.004	(0.309)	_	_	0.004	(0.310)
SecuritySH	0.004	(0.369)	-0.003	(0.395)	_	_	-0.009	(0.212)
InsuranceSH	0.006	(0.422)	0.005	(0.438)	_	_	-0.002	(0.476)
ForeignSH	-0.005	(0.261)	-0.007	(0.178)	-0.009	(0.124)	-0.006	(0.229)
IndividualSH	-0.007	(0.063)	-0.010	(0.019)	-0.013	(0.003)	-0.011	(0.018)
LargestSH	-0.009	(0.019)	-0.012	(0.005)	-0.013	(0.003)	-0.014	(0.002)
FinFirmSH	_	_	_	_	-0.002	(0.362)	_	_
ExportR	_	_	_	_	-0.824	(0.003)	-0.854	(0.003)
CashR	6.529	(0.000)	6.268	(0.000)	6.044	(0.000)	5.714	(0.000)
WorkingKR	-1.631	(0.001)	-1.683	(0.001)	-1.686	(0.001)	-1.523	(0.003)
FgnDebtR	-3.036	(0.006)	-2.762	(0.010)	-0.434	(0.331)	-2.190	(0.032)
TradeDebtR	-2.0e-9	(0.001)	-1.9e-9	(0.002)	-1.7e-9	(0.004)	-1.9e-9	(0.002)
DebtR	1.864	(0.000)	1.735	(0.000)	1.947	(0.000)	1.908	(0.000)
InterestR	6.740	(0.004)	6.566	(0.005)	9.831	(0.000)	8.320	(0.001)
SalesR	-0.332	(0.020)	-0.271	(0.048)	-0.148	(0.141)	-0.124	(0.207)

OCFR	-1.255	(0.053)	-1.320	(0.054)	-1.860	(0.010)	-1.510	(0.033)
EATG	-0.453	(0.118)	-0.398	(0.149)	_	_	-0.447	(0.128)
InvestR	0.904	(0.160)	1.093	(0.125)	2.182	(0.011)	1.821	(0.027)
BLINC	0.554	(0.001)	0.501	(0.001)	_	_	_	_
CLINC	-0.037	(0.445)	-0.200	(0.249)	_	_	-0.149	(0.306)
BondINC	0.189	(0.121)	0.219	(0.099)	_	_	0.766	(0.000)
FLINC	0.664	(0.000)	0.706	(0.000)	_	_	0.120	(0.243)
LRDebtFinR	-0.162	(0.370)	-0.498	(0.188)	-0.442	(0.207)	-0.535	(0.173)
Constant	-1.906	(0.001)	-1.713	(0.002)	-1.502	(0.004)	-1.574	(0.004)

Note: 1. The dependent variable is Default $_{t+1}$. All independent variables are in the *t*-period.
2. P-values are for one-tailed tests.
3. Other types of industry like construction (ConstFirm), sales (SalesFirm) and transportation (TranspFirm) are excluded from models for simplicity.
4. The share of ownership by other firms (FirmSH) is dropped from the models reported here to avoid multicollinearity. With FirmSH in the model, the coefficients are significantly positive.
5. Other variables related to profitability like EATR, EBTR, and EBITDAR are not used, because net cash flows from operation (OCFR) reflect them and work best among them in the model.
6. Short-term debt ratios (SRDebtR) are dropped due to multicollinearity with cash ratios (CashR).

Table 3 provides results of estimation across models. The fitness of probit model is quite good, in terms of the probability greater than χ^2 values. Pseudo R^2 values vary a little across models. They range from 0.43 to 0.50. As we can see, the coefficients of the variables used in the models and their statistical significance are basically same across models. This implies that the models might be robust to some changes in specifications.

First of all, we examine if groupings of manufacturing-nonmanufacturing and chaebol and non-chaebol affect the probability of default risk. From the results, we can conclude that manufacturing firms (MfgFirm) are less likely to default. This might be derived from the facts that manufacturing firms have more fixed assets, other valuable intangible assets or advanced production technology which can be used as collaterals to be required to finance. Also chaebol firms are not likely to default. This is owing to the

general belief that chaebol is recognized not to fail.

Firms owned by the government (GovSH) are relatively safer from defaults as expected, while the opposite is true for firms owned by government firms (GovFirmSH). Firms owned by government firms might have been relatively inefficient in operation and/or risky in capital structure, but not protected by the government. Firms owned by other non-finance firms (FirmSH) tend to have higher default risks. Overall ownership by financial firms (FinFirmSH) does not have any statistically significant effect on default risks, as in the case of the models with various financial firms separately. On the contrary, ownership by individuals (IndividualSH) reduces the default risks of firms with statistical significance. Firms are less likely to default when their largest shareholders (LargestSH) has a larger share of stocks. Thus, we found that their ownership structure has influences on firms' default risk.

While the size of firms (Asset) measured in total assets has a negative relationship with their default risks, the number of employees (Employee) is positively related with their default risks. That is, a firm with more total assets was safer from defaults. The number of employees might be related with labor-management relationship. As expected, the default risks of a firm decrease as its age (Age) increases. From the results, we can conclude that corporate default risks of firms in Korea also depend a lot on their non-financial factors such as size, affiliation with other firms, and age.

Higher cash holdings (CashR) reported in financial statements are an indicator of higher default risks of firms. Cash holdings at the end of the accounting year are found to be very strongly correlated with the ratio of short-term debts to total assets (SRDebtR).

The results are quite against common beliefs that firms with more highly liquid assets on the book are safer. On the contrary, the high short-term liquidity ratio of firms to working capital (WorkingKR) decreases their default risks substantially. The results imply that safe firms are more liquid in paying short-term debts.

As expected, the results support our expectation that the riskier capital structure with a higher short-term (SRDebtR) and overall debt ratio (DebtR), and higher interest burden(InterestR), the more the corporate default risk tends to be high.[10] Likewise, better performance in sales (SalesR) and net cash flow from operation (OCFR) results in lower default risks. In the models reported here, we do not use income-related variables like EBTR, EATR, and EBITDAR as they are found to be highly correlated with the net cash flow from operation(OCFR). The variable OCFR reflects not only profitability of firms but also net cash flows from ordinary business activities, better than other profitability variables, because it includes extraordinary losses or gains. Increases in net income (EATG) are negatively related with default risks without much statistical significance.

Higher investment ratio (InvestR) tends to increase the overall risks of firms. This might imply that overall investments of Korean firms were not efficient during the period. Long-term financing (LRDebtFinR) has a positive relationship with risks, but without statistical significance. Debts resulting from trade (TradeDebtR) and foreign debts (FgnDebtR) are positively and significantly related with default risks. A firm has positive net financing from lenders (BLINC, and FLINC), or corporate bond markets

(BondINC) is positively related with default risks while the effect of crony loans (CLINC) is not clear. The strongly positive relationship between debt financing and investments might indicate that investment through debt financing during the period were quite inefficient. We found that chaebol category, age, size, ownership, export ratio, cash ratio, working capital, debt ratio, interest expense ratio play important roles as determinants for defaults.

IV. Analyses of Default Risks

In this section, we analyze how corporate default risks had changed in the Korean economy for an extended period between 1991 and 2001, using the above estimated defaulted models. Predicted default risks, denoted by $p(Default)_{i,t+1,}$ based on the samples from the relatively hard budgeting era around the financial crisis in 1997 provide dynamic information about the overall risks of firms in Korea. We further test the differences in overall default risks over time, between chaebol firms and non-chaebol firms to check if chaebol firms are in riskier situation than non-chaebol firms.

Considering similarities in default models, we use Models III and IV. Considering the importance of studying the relationship between default risks of overall firms and the sovereign risk of the whole economy, we test here whether there were substantial changes in overall corporate default risks before and after the Korean financial crisis. Table 4 shows the average corporate default risks predicted by Model III and

[10] The short-term debt ratio (SRDebtR) shows a very strong positive relationship with corporate default risks in all the models. The variable is dropped from those models listed above due to severe

Model IV, each year during the whole sample period. The table confirms that there are no fundamental differences in predicted default risks between the two models.

Table 4: Predicted Default Risks

Year	Model III $p(Default)_{t+1}$ (A)	Model IV $p(Default)_{t+1}$ (B)
1991	0.356	0.359
1992	0.388	0.387
1993	0.364	0.359
1994	0.386	0.372
1995	0.416	0.412
1996	0.403	0.405
1997	0.396	0.397
1998	0.308	0.304
1999	0.182	0.176
2000	0.192	0.189
2001	0.142	0.144
Overall	0.320	0.317

Note: The differences of means are between $p(Default)_{t+1}$ in Model III and that in Model IV in year t.

Figure 2 shows the trend of default risk of firms. We can see that corporate default risks in Korea were high at the beginning of the sample period and had increased by 1997 at the time of financial crisis. The overall default risks just before the financial crisis increased, comparing with those of 1991. Thus, the Korean economy might have collapsed long before the crisis in 1997, due to its weak micro-economic fundamentals. From 1998 until 2001, the overall corporate default risk decreased sharply each year, except in 2000. With economic recovery and comprehensive restructuring measures by firms, the default risks of firms declined sharply after the crisis and stayed low for some years in a row. We further investigate whether the changes in overall corporate default

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multicollinearity with cash holdings (CashR).

risks measured by the difference in means between two consecutive years are statistically significant, with following the null hypothesis and the alternative hypothesis.[11]

$$\text{H0: } \mu_t - \mu_{t-1} = 0 \qquad (2)$$
$$\text{H1: } \mu_t - \mu_{t-1} \neq 0$$

Figure 2: Trend of Overall Predicted Default Risks

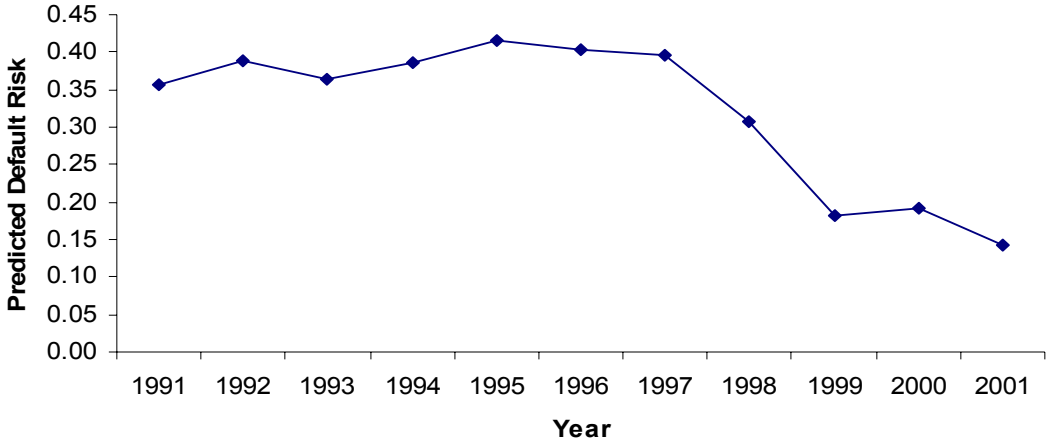

Table 5: Group Mean Tests of Corporate Default Risks over Time

Year	p(Default)	Difference ($\mu_t - \mu_{t-1}$)	P-Values*
1991	0.356		
1992	0.388	0.032	0.022
1993	0.364	-0.024	0.132
1994	0.386	0.022	0.172
1995	0.416	0.030	0.064
1996	0.403	-0.013	0.436
1997	0.396	-0.007	0.668
1998	0.308	-0.088	0.000
1999	0.182	-0.126	0.000
2000	0.192	0.010	0.548
2001	0.142	-0.050	0.002

Note: P-values are for two-tailed tests.

[11] We assume in the two-sample t test that groups are with equal variances, for simplicity. Tests with unequal variances show very similar results. This applies to all group mean tests in this paper

From Table 5, we conclude that the overall corporate risks in Korea declined in 1993, 1998, 1999, and 2001, and increased in 1992, 1994, and 1995 from the previous year, respectively. The default risks were steadily high during 1995-1997 without statistically significant changes. The result might suggest that Korean economy was very vulnerable in the micro fundamental prior to financial crisis. It is reasoned that the financial crisis in 1997 might be mainly due to the persistence of weak economic fundamentals, which started from 1995 or earlier. The sharp declines in default risks since 1998 might reflect comprehensive restructuring policies in corporate capital structure as a result of contractions in lending by financial institutions and fundamental changes in corporate finance.

Now, we formally test whether substantial differences in overall corporate default risks between pre and post of financial crisis took place as follows:

$$\text{H0: } \mu_t - \mu_{t-1} = 0 \qquad \text{(2a)}$$
$$\text{H1: } \mu_t - \mu_{t-1} \neq 0$$

where t is a period (before, during, and after crisis) and t-1 is the earlier period than t.

Table 6. Corporate Default Risks Before and After the Crisis

Periods	p(Default)	Difference ($\mu_t - \mu_{t-1}$)	P-Values*
Before Crisis	0.386	_	_
During Crisis	0.346	-0.040	0.000
After Crisis	0.172	-0.174	0.000
Overall	0.320	_	_

Note: P-values are for two-tailed tests.

From Table 6, we can see that the group mean, 0.386, for the pre-crisis period was much larger than the overall default risk, 0.346, during the crisis. The average default risk, 0.172, after the crisis, was much lower than the default risks before the crisis. Thus, firms in Korea which had exposed themselves to severe default risks before the crisis, have adapted themselves to the new business environment during the crisis, such as restructuring measures after the advent of the crisis, and achieved much lower default risks of firms after the crisis than before.

Now let's compare the default risks of chaebol with those of non-chaebols. We test whether there were substantial differences (Difference) in the overall corporate default risk between two groups, chaebols and non-chaebols as follows:

$$\text{H0: } \mu_i - \mu_{\_i} = 0 \qquad (3)$$

$$\text{H1: } \mu_i - \mu_{\_i} \neq 0$$

where i is for a chaebol firm and $\_i$ is for a non-chaebol firm

Default risks over the sample period for two different groups are shown in Figure 3. It seems that the trends in the overall default risks for both chaebol and non-chaebol firms are in tandem with each other. Until 1997, chaebol firms were persistently riskier than non-chaebol firms. However, from 1998, default risks between two groups became indistinguishable. Moreover, in 1999 and 2001, non-chaebol firms experienced higher default risks than chaebol firms, though without statistical significance.

Figure 3: Trends in Default Risks of Chaebol and Non-Chaebol Firms

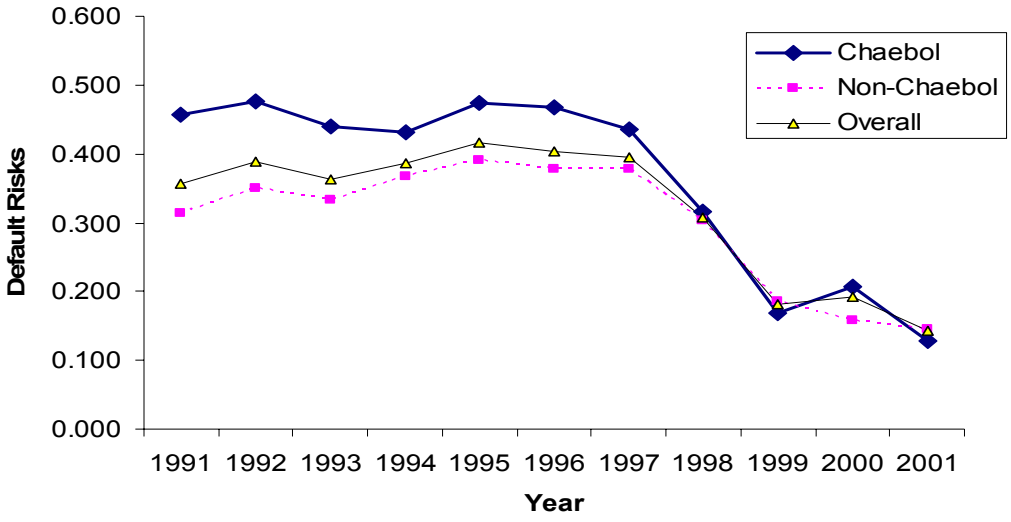

Table 7: Default Risks of Chaebol Firms and Non-Chaebol Firms

Year	Number of Chaebol Firms	Predicted default prob. Of chaebol	Predicted default prob. Of non-chaebol	P-Values for difference
1991	163	0.457	0.313	0.000
1992	176	0.477	0.350	0.000
1993	167	0.439	0.333	0.000
1994	171	0.432	0.367	0.008
1995	176	0.475	0.391	0.000
1996	173	0.468	0.378	0.000
1997	141	0.435	0.379	0.052
1998	173	0.316	0.304	0.664
1999	161	0.169	0.186	0.466
2000	161	0.207	0.158	0.389
2001	141	0.129	0.146	0.455
Overall	1,802	0.369	0.300	0.000

Note: P-values are for two-tailed tests.

The above results suggest the existence of chronic inefficient working for chaebol firms before the financial crisis, and that there were drastic changes in lending towards firms after the crisis starting from 1997 or 1998, especially to chaebol firms. Drastic plunges in

corporate default risks after the crisis might reflect the economy-wide restructuring policies during the period to reduce risks, especially in loans for chaebol firms.

The high default risk of firms in particular, for the chaebol firms, seems to contribute to the financial crisis. The restructuring policies during the financial crisis can be evaluated to reduce the default risk of both non chaebol and chaebol firms.

V. Conclusion

We have developed the benchmark default models using probit models with firm level data in Korea for the period of 1997-2001, including the defaulted firms before the financial crisis. With the estimated default models, we predicted default risks of all firms listed on the Korean Stock Exchange (KSE) between 1991 and 2001, and studied default risks for chaebol and non-chaebol firms. Overall default risks of firms increased until the financial crisis in 1997. They declined sharply after 1999. The fundamental risks of the Korean economy measured by default risks of firms had steadily reached their peak in 1995 and had stayed very high until the advent of the financial crisis. We have found that chaebol firms had much higher default risks, while non-chaebol firms had lower overall default risks. This implies that micro fundnamentals of chaebol firms were much weaker than those of non-chaebol firms. The Korean economy was in a perilous situation for a long period of time without proper measures being taken by the government, lenders, firms, or investors until the day of its debacle by external shocks. Also we can make a tentative conclusion that the restructuring measures of firms were successful in the sense

that the overall default risk decreased after the financial crisis.

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Appendix Table 1: Variables and Descriptions

MfgFirm, ConstFirm, SalesFirm, TranspFirm: 1 if a firm is in the industry of manufacturing, construction, sales, and transportation respectively, 0 otherwise [1 2]

Age: The age of the firm (calculated from the date of establishment)

Asset: Total assets (in 1,000 won)

AssetG: The growth rate of total assets; [total asset(t)-total asset(t-1)]/total asset(t-1)

Employee: The number of employees of a firm

Default: 1 if the firm is defaulted during the whole sample period, 0 otherwise

D-4, D-3, D-2, D-1, D0, D+1, D+2, D+3, D+4: 1 if the year is __ years before or after the year of default (D0), 0 otherwise. [1 3]

[1 2] Firms are classified following the Korean Standard Industry Classification (Korean SIC), as reported in the primary data base KIS-FAS. In our tests, we use a simplified classification with four major categories: manufacturing, construction, sales, and transportation.

GovSH: The share of the firm owned by the government in percentage
GovFirmSH: The share of the firm owned by government firms in percentage
BankSH: The share of the firm owned by banks in percentage
SecuritySH: The share of the firm owned by security firms in percentage
InsuranceSH: The share of the firm owned by insurance firms in percentage
FinFirmSH: The share of the firm owned by financial firms in percentage

FinFirmSH=BankSH+SecuritySH+ InsuranceSH

ForeignSH: The share of the firm owned by foreign investors in percentage
FirmSH: The share of the firm owned by firms other than those mentioned above in percentage
IndividualSH: The share of the firm owned by individual investors in percentage
LargestSH: The share of the firm owned by the largest shareholder in percentage
ExportR: The ratio of exports to the sales of the firm (=Export/Revenues)
SalesR: Sales(t)/ Total Asset(t-1)
CashR: Cash/ Total Asset. Cash includes cash and its equivalents.
WorkingKR: (Current Asset – Current Debt) / Total Asset
InterestR: Interest Expenses(t)/ Total Debt(t-1)
DebtR: Total Debt/Total Asset
EBITDAR: EBITDA(t)/Total Asset(t-1)[14]
EBITDA: The ratio of earnings before interests, taxes, and depreciation and amortization
EBTR: The ratio of earnings before income taxes (EBT), EBT(t)/ Total Asset(t-1)
EATR: The ratio of earnings after income taxes (EAT), EAT(t)/ Total Asset(t-1)
EATG: The growth rate of EAT, (EAT(t)-EAT(t-1))/ Total Asset (t-1)
BLR: Bank Loan(t)/Total Asset(t-1)
Bank Loans: loans including bank overdrafts, and foreign currency loans
BLChR: [Bank Loan(t) – Bank Loan(t-1)]/Total Asset(t-1)
SRBLChR: [Short-term Bank Loan(t) – Short-term Bank Loan(t-1)]/Total Asset(t-1)
LRBLChR: [Long-term Bank Loan(t) – Long-term Bank Loan(t-1)]/Total Asset(t-1)

* Other short-term and long-term loans are defined in the same way.

BLINC: 1 if bank loans are increased in the year from the previous year, 0 otherwise.
CLR: Crony Loan(t)/Total Asset(t-1)
Crony Loans: Loans by related parties, like owners, directors, employees, and affiliate firms of the firm
CLChR: [Crony Loan(t) – Crony Loan(t-1)]/Total Asset(t-1)
CLINC: 1 if crony loans are increased in the year from the previous year, 0 otherwise.
BondR: Corporate Bonds(t)/Total Asset(t-1)
BondChR: [Corporate Bonds(t) – Corporate Bonds(t-1)]/Total Asset(t-1)
BondINC: 1 if the amount of bonds is increased in the year from the previous year, 0 otherwise.
ForeignLR: Foreign Loans/Total Asset
Foreign Loans: Loans in foreign currencies and overseas loans
FLChR: [Foreign Loan(t) – Foreign Loan(t-1)]/Total Asset(t-1)
FLINC: 1 if foreign loans are increased in the year from the previous year, 0 otherwise.
TradeDebtR: (Accounts payables + Trade payables)/Total Asset
TDChR: [Trade Debt(t) – Trade Debt(t-1)]/Total Asset(t-1)
TDINC: 1 if trade debts are increased in the year from the previous year, 0 otherwise.
OCFR: Net Cash Flow from Operation(t)/Total Asset(t-1)
LoanR: Aggregate Loans(t)/Total Asset(t-1)
Aggregate Loans: Sum of all borrowings: bank loans, crony loans, and corporate bonds
LoanChR: [Loans(t) – Loans(t-1)]/Total Asset(t-1)
InvestR: Total Investments(t)/Total Asset(t-1)

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[14] D-4 and D+4 include four and more years before and after default, respectively.

LRDebtFIN: Long-term Debt Financing, LRDebtFIN(t)/Total Asset(t-1)

Note: Dates are same for the nominator(s) and the denominator(s), unless specified.