

Occupational Health / Safety in the World

Safety and Health in Small-Scale Enterprises and Bankruptcy during Economic Depression in Korea

Ji-Yong KIM¹ and Domyung PAEK²

¹Dongkuk University, School of Medicine, Department of Preventive Medicine and

²Seoul National University, School of Public Health, Department of Environmental Health, Korea

Abstract: Safety and Health in Small-Scale Enterprises and Bankruptcy during Economic Depression in Korea: Ji-Yong Kim, et al. Dongkuk University, School of Medicine, Department of Preventive Medicine—On November 1997, Korea experienced a rather sudden economic depression after a shortage of foreign currency and downfall of foreign investment. This brought a sudden increase in the bankruptcy rate and also an increase in unemployment from the usual 2–3% to over 10%. This study was undertaken to examine the effect of the antecedent health and safety status on the subsequent bankruptcy during economic depression. We were able to obtain the previous occupational health and safety records of 4,811 out of 5,010 companies which had received a financial subsidy from the government for occupational safety and health services during 1997. Based on the data of the Workmen's Insurance Corporation in Korea as of March 1999, we could identify the bankruptcy status of 3,980 companies altogether. When the results of the annual special workers' health examination, workplace environment measurement, and injury rate during 1996 were analyzed according to the survival status of the identified companies as of 1999, the bankrupt companies had significantly worse records in workplace environmental exposures and injury rates than the survived companies. Although the prevalence of noise-induced hearing loss and heavy metal poisoning was higher in the bankrupt companies, the prevalence of pneumoconiosis was lower. The type of industry and the size were also analyzed and accounted for in the final analysis of the impact of safety and health status on the survival of the enterprises, and the results showed the same trends. These results suggest that companies run by better management with better health and safety records will experience less bankruptcy during economic downfall. When considering the long

latency from the first exposure to the final manifestation, the higher prevalence of pneumoconiosis in the survived companies could be explained on the basis of the longer operation time and longer exposure duration.

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In November 1997, the Korean Government had to announce plans to borrow dollars from the International Monetary Fund (IMF) to avoid a foreign currency crisis. With this as a signal, Korea fell into a rather sudden economic depression, which has affected almost all sectors of society. Small-scale enterprises were the hardest hit by this economic crunch. As an example of this impact, the suicide rate has gone up from 14.1 to 19.9 per 100,000 persons¹, and especially suicides of the owners or managers of bankrupt small-scale enterprises were rather frequent news items in Korea during 1998.

Meanwhile, the compensable workmen's injury rate went down in Korea from 0.88 cases per 100 workers in 1997 to 0.68 in 1998². During 1998 the operation time of the workplace was reduced by 13% compared to 1997, and the reduction in the injury rate could be attributed to this reduction in working hours. Nevertheless, during the same time period, many workplaces went bankrupt and the reduction in this injury rate could also have been affected by the selective survival of the company under the pressing economic crisis. This study was undertaken to examine the effect of the antecedent health and safety status of the small-scale enterprises on subsequent survival during the economic depression.

Methods

During 1997 the Korean Government had provided financial subsidies for providing occupational safety and

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Correspondence to: D. Paek, Seoul National University, School of Public Health, 28 Yeunkun-Dong, Chongno-Ku, Seoul 110-799, Korea

Table 1. Bankruptcy and the industry type of the enterprises studied

Industry	Survived (%)	Bankrupt (%)
Auto Manufacturing and Repair	401 (91.6)	37 (8.5)
Chemical Manufacturing	359 (82.3)	77 (17.7)
Metal Fabrication	352 (82.4)	75 (17.6)
Machine Manufacturing	294 (82.6)	62 (17.4)
Electronics Manufacturing	203 (79.3)	53 (20.7)
Electroplating	204 (85.7)	34 (14.3)
Other manufacturing	172 (79.6)	44 (20.4)
Synthetic Textile Manufacturing and Dyeing	144 (84.7)	26 (15.3)
Printing	124 (80.5)	30 (19.5)
Base Metal Manufacturing	104 (80.0)	26 (20.0)
Wood Product Manufacturing	78 (68.4)	36 (31.6)
Textile Fabric Manufacturing	83 (74.8)	28 (25.2)
Others	727 (77.8)	207 (22.2)
Total	3,245 (81.5)	735 (18.5)

health services to 5,010 small-scale manufacturing enterprises. Among these enterprises, we were able to obtain occupational safety and health records for 1996 from 4,811 (96%) enterprises as part of the evaluation study of the subsidy program³⁾. Based on the data of Workmen’s Insurance Cooperation in Korea as of March 1999, we could identify the survival and bankruptcy status of 3,980 enterprises.

To identify those workplace characteristics which may have affected the survival status, univariate analysis was done for type of industry, size, type of subcontract, and labor union organization. In addition to those characteristics, prior health and safety records such as the results of the annual special workers’ health examination, workplace environment measurement, and injury rate were also analyzed according to the survival status of the identified enterprises.

After examining the correlation between risk factors, multivariate analysis was finally done to analyze the impact of safety and health status on the survival of the enterprises. The type of industry and the size were accounted for in the final analyses. Logistic regression based on SAS program was used in the multivariate analysis.

Results

Altogether 735 enterprises out of 3,980 had gone bankrupt as of March 1999 with a bankruptcy rate of 18.5% (Table 1). This bankruptcy rate is much higher than the national average of 7.8% for 1998⁴⁾.

The type of industry was examined against the survival status. The highest bankruptcy rate was 31.6% for wood and furniture manufacturing, and the lowest was 8.5% for automobile manufacturing and repairing, but the

bankruptcy rates for all other industries were not very different from the average, and were between 15 and 20% (Table 1).

When we compared the size of the enterprise with the survival status, the ones with less than 10 employees were the hardest hit, and the bankruptcy rate was 21.7% in terms of both the number of enterprises and the number of employees (Table 2). Those enterprises with more than 41 employees recorded a 13.2% of bankruptcy rate, and the remaining categories had similar bankruptcy rates around the total average.

We also examined the type of operation based on subcontracting, and found little difference between the survived and bankrupt companies ($p>0.05$ by χ^2 -test). About two thirds of the total were operating independently in both survived and bankrupt companies, and the same proportion was observed for other subcontract types (Table 3).

In this study, because of the small scale, only 1% of the enterprises studied had labor unions organized. We could not see any difference between survived and bankrupt companies in organization of labor unions (Table 4, $p>0.05$ by χ^2 -test).

In Korea employers have to provide special health examinations to those workers who are exposed to occupational health hazards, at present mostly noise, dust, organic solvents and heavy metals. Based on the results of these special health examinations, employers have to report to the Ministry of Labor about the results for those workers who show any evidence of an occupational disease or those who do not have this evidence but have some precautionary findings. We have compared four different indices in this study: percentage of those with evidence of occupational disease among those examined,

Table 2. Bankruptcy and the size of the enterprise by the number of employees

Number of employees	Number of enterprise (%)**		Number of workers (%)**	
	Survived	Bankrupt	Survived	Bankrupt
<= 10	633 (78.3)	175 (21.7)	3856 (78.3)	1068 (21.7)
11–20	1048 (81.5)	238 (18.5)	16253 (81.7)	3641 (18.3)
21–30	812 (83.1)	165 (16.9)	20500 (83.0)	4201 (17.0)
31–40	457 (80.3)	112 (19.7)	16123 (80.2)	3978 (19.8)
41 <=	295 (86.8)	45 (13.2)	13756 (86.7)	2093 (13.3)
Total	3245 (81.5)	735 (18.5)	70488 (82.5)	14981 (17.5)

**p<0.01 by χ^2 -test.

Table 3. Bankruptcy and type of operation

Type of operation	Survived (%)	Bankrupt (%)
Intramural subcontract	73 (78.5)	20 (21.5)
Extramural subcontract	454 (79.9)	114 (20.1)
Partial intramural subcontract and independent	31 (81.6)	7 (18.4)
Partial extramural subcontract and independent	422 (85.3)	73 (14.7)
Independent	2,086 (81.6)	471 (18.4)
No response	179 (78.2)	50 (21.8)
Total	3,245 (81.5)	735 (18.5)

p>0.05 by χ^2 -test.

percentage of those with precautionary findings among those examined, percentage of those companies with workers who have evidence of occupational disease among those companies where special health examinations are provided, and the average number of workers with evidence of occupational disease in those workplaces which had reported positive findings.

In general, the survived companies were better off than the bankrupt companies in those four indices examined for noise induced hearing loss, heavy metal poisoning, and organic solvent poisoning. Significantly more workers with positive evidence for noise induced hearing loss, heavy metal poisoning, and organic solvent poisoning were found in the bankrupt companies than in the survived ones (Table 5), but as for pneumoconiosis, although not significant, more workers with positive evidence were found in the survived companies than in the bankrupt ones.

In Korea, besides the special health examination program, employers have to measure the level of exposures when workers are exposed to certain health hazards such as noise, dust, heavy metals, or organic solvents. As with the health examination results, here we have compared four different indices: the percentage of those workplaces with an excessive level of exposure among those where exposure was measured, the

Table 4. Bankruptcy and labor union organization

Labor union	Survived (%)	Bankrupt (%)
Not organized	3,079 (81.6)	695 (18.4)
Organized	39 (81.2)	9 (18.8)
No response	127 (80.4)	31 (19.6)
Total	3,245 (81.5)	735 (18.5)

p>0.05 by χ^2 -test.

percentage of exposure measurements which exceeded the guidance level among the total number of measurements, the average number of excessive exposures for those workplaces where exposures were measured, and the average number of excessive exposures for those workplaces found to have excessive exposures. While all the four indices for noise, dust, heavy metal, and organic solvents were higher, the percentage of excessive exposures and the average number of excessive exposures per workplace were significantly higher in the bankrupt companies than in the survived companies (p<0.05 by χ^2 -test). The difference was largest for heavy metal exposures. Only 1.5% of the measurements exceeded guidance level for heavy metals in the survived

Table 5. Bankruptcy and result of special workers' health examination in 1996

	Noise induced hearing loss		Pneumoconiosis		Heavy metal poisoning		Organic solvent poisoning	
	Survived	Bankrupt	Survived	Bankrupt	Survived	Bankrupt	Survived	Bankrupt
Number of worker with evident finding (A)	122	39	42	6	11	10	20	9
Number of worker with precautionary finding (B)	1192	252	96	13	100	35	388	98
Number of examined (C)	9959	2132	5916	1123	2308	430	6103	1176
Number of workplace with evident finding (D)	79	22	34	5	9	2	14	1
Number of workplace where workers were examined (E)	1400	307	987	189	489	101	1380	286
A/C (%)	1.23	1.83*	0.71	0.53	0.48	2.33**	0.33	0.77*
B/C (%)	12.00	11.82	1.62	1.16	4.33	8.14**	6.36	8.33*
D/E (%)	5.64	7.17	3.44	2.65	1.84	1.98	1.01	0.35
A/D (number)	1.54	1.77	1.24	1.20	1.22	5.00	1.43	9.00

*p<0.05 by χ^2 -test. **p<0.01 by χ^2 -test.

Table 6. Bankruptcy and results of exposure measurement in 1996

	Noise		Dust		Heavy metals		Organic solvents	
	Survived	Bankrupt	Survived	Bankrupt	Survived	Bankrupt	Survived	Bankrupt
Number of excessive exposure (A)	3305	843	471	163	29	35	190	60
Number of workplace with excessive exposure (B)	810	184	217	54	22	8	110	31
Number of measurements (C)	15046	3105	4010	916	1902	452	5428	1279
Number of workplaces where exposures were measured (D)	2478	529	1383	305	631	135	1553	343
B/D (%)	32.7	34.8	15.7	17.7	3.5	5.9	7.1	9.0
A/C (%)	22.0	27.1**	11.7	17.9**	1.5	7.7**	3.5	4.7
A/D (number)	1.33	1.59**	0.34	0.54**	0.05	0.26**	0.12	0.18*
A/B (number)	4.08	4.58	2.17	3.02	1.32	4.44*	1.73	1.94

*p<0.05 by χ^2 -test. **p<0.01 by χ^2 -test.

companies, while 7.7% exceeded in the bankrupt companies (Table 6).

In Korea in all accidents that require more than 3 days of treatment workers may file for workmen's compensation, but some industrial accidents, even though officially recognized by employers, are not reported to the Workmen's Insurance Corporation, and employers pay for the treatment cost out of their own pocket to avoid an increase in insurance premiums or inspection by the Ministry of Labor. We have collected information from employers about the numbers of deaths, compensated

cases, and official but not compensated industrial accidents. Here again, the average numbers of deaths, compensated accidents, and official but not compensated accidents per 1,000 workers were 0.47, 14.15 and 49.20 for bankrupt companies, higher than the corresponding numbers of 0.27, 12.90, and 31.01 for survived companies. Although the differences in the numbers of death and compensated cases were not significant, the number of official but not compensated cases was significantly higher for bankrupt companies (Table 7).

As we wanted to account for the numerous factors

Table 7. Bankruptcy and industrial accidents of 1996

	Survived	Bankrupt
Number of deaths (A)	19	7
Number of compensated (B)	909	212
Number of official but not compensated injuries (C)	2186	737
Number of workers (D)	70488	14981
A/D (/1000)	0.27	0.47
B/D (/1000)	12.90	14.15
C/D (/1000)**	31.01	49.20

**p<0.01 by χ^2 -test.

Table 8. Predictors of bankruptcy based on multiple logistic regression result

Variable	Slope	Odds ratio	Significance	Coefficient of determination
Size of enterprise	- 0.0852	0.9183	0.0163	0.0316
Abnormal health finding	0.0285	1.0289	0.0087	0.0359
Excessive exposures	0.0261	1.0264	0.0510	0.0219
Industrial accidents	0.0556	1.0571	0.5817	0.0000
Constant	- 1.4005		0.0000	

simultaneously in the analysis, we did multiple linear logistic regression after examining individual factors and their distributions. Among factors that we examined, the size of the enterprise was a significant predictor of bankruptcy, whereas industry, subcontract type, and labor union organization were not. We included the size of the enterprise in all the models we examined.

When special workers' health examination results were analyzed together with the size of the enterprise, those workplaces where workers were found to show evidence of noise induced hearing loss had a significantly higher risk of bankruptcy (OR=1.03, p<0.05). Similarly, among workplace exposure measurement results, those workplaces with excessive exposure to noise had a significantly higher risk of bankruptcy (OR=1.03, p<0.05) after accounting for the size of the enterprise. As for industrial accidents, those workplaces with official but not compensated injuries had a significantly higher risk (OR=1.7, p<0.05), whereas those workplaces with reported deaths from industrial accidents had a marginally significant risk of bankruptcy (OR=2.2, p<0.1).

When all the health examination results, exposure measurement results and industrial accident records were analyzed simultaneously together with the size of the enterprise, both abnormal health examination findings and excessive exposure measurements were significant predictors of bankruptcy, but the industrial accident records were not (Table 8).

Discussion

Here we have tried to examine the effect of antecedent health and safety status on the subsequent bankruptcy rate during the sudden economic depression in Korea. This study was done with two main objectives. One was to assess the relationship of health and safety management to the overall management capacity to overcome economic difficulties during depression, and the other was to examine the contribution of selective survival of hazardous workplaces, besides the shortening of work hours, in the reduction in the injury rate during depression.

The health and safety data collected in this study were mainly provided by employers under the mandatory health and safety programs stipulated in the Industrial Safety and Health Law. Most of these mandatory programs have limitations in assessing and preventing wide-range health hazards, such as ergonomic problems or newly introduced chemicals. Nevertheless, well known classical occupational health hazards, such as noise and silica exposure, can be dealt with by these programs, and health and the safety data used in this study indicated obvious, even though limited, problems in the health and safety status of small scale enterprises in Korea. Because information about bankruptcy status was collected independently without knowing the health and safety status, we could test whether the antecedent health and safety status could affect subsequent bankruptcy of the small-scale enterprises.

The proportion of bankrupt enterprises in this study was 18.5% and this figure was higher than the national average, which indicates that only those workplaces with fewer than 50 employees were included in this study. When we divided the size of the workplace further, those with fewer than 10 employees had a higher bankruptcy rate of 21.3% whereas those with more than 41 employees had only a 13.3% bankruptcy rate. But when we examined the type of industry, we found almost all the industries included in this study had similar bankruptcy rates. Neither the type of operation based on subcontract nor the organization of a labor union could explain the survival of the enterprise. This might reflect the fact that economic depression started rather suddenly and almost all the economic sectors have been affected by this impact. This rather sudden and severe nature of the blow to the economy might explain the effect of marginal issues, such as health and safety, not the mainstream area of management, on the survival of the enterprises.

The results of this study suggest that the antecedent health and safety status is related to the subsequent survival of the small-scale enterprise during economic depression, but whether management of health and safety can directly affect the survival of the enterprise during depression can be debated as to its mechanism and scope. Most likely successful management should have seriously addressed health and safety issues, as well as the productivity or profit of the enterprise, and this add-on phenomenon could have manifested itself as a health and safety effect on subsequent bankruptcy. In other explanations, because of previous investment in health and safety areas, those enterprises with a better record in health and safety could save health and safety expenses during economic hardships and survived while those with a worse record could not.

One of the interesting findings in this study was the higher prevalence of pneumoconiosis in the survived companies, whereas the indices for all other health hazards were worse for bankrupt companies. Even though the prevalence of pneumoconiosis was higher, the excessive exposure to dust was less frequent for the survived companies. Considering the fact that development of disease depends on the period as well as the level of hazardous exposure, the development of pneumoconiosis at certain enterprises can be affected by the turnover in the workforce as well as the level of exposure to dust. As those survived companies had more pneumoconiosis cases even with a lower level of exposure to dust, they should have had less turnover in the workforce and a sufficient number of workers with longer exposure duration than the bankrupt companies. Management quality including health and safety issues might also have affected this speculated rate of turnover in the workforce in this study.

The injury rate for 1998 in Korea had decreased to 0.68%, which is 16% less than the 1997 level of 0.81%. The average operation hours for the manufacturing sector had decreased by 12.7% in 1998 compared to the level in 1997. The cause of the excess decrease in the injury rate, even after accounting for the decrease in operation hours, was debated. Whereas the Ministry of Labor of Korea had attributed the decrease to its effective health and safety programs⁵⁾, we speculated that because of the selective survival of less hazardous enterprises during the economic depression the overall injury rate could have decreased. During economic depression, opening of new enterprises will be minimal and the injury rate in these newly opened enterprises, even though we could not have accounted for it, should have affected the overall rate minimally. Because we have used health and safety data for small-scale enterprises with fewer than 50 employees, speculation about the cause of the decrease in injury rate might have been far fetched when compared with actual observations. Nevertheless, our speculation appears to be supported by the fact that almost all the economic sectors comprising big and small scale enterprises were affected by the economic depression, and the fact that the samples included in this study were drawn from all parts of the country. The fact that most industrial accidents occur in small-scale enterprises also supports our speculations.

In this study, not all the determinants of the survival of enterprises could be accounted for, and assessment of the health and safety status depended on limited data provided by employers. These shortcomings should be eliminated in future studies, but the results of this study suggest a need to account for the change in industry structures and enterprise profiles, especially during economic downturns, when crude health and safety data are used in the evaluation of the effect of health and safety programs on the nation over the period or in comparing the health and safety status of different countries, such as developed and under-developed nations with different survival pressures.

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