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The Korean Financial Crisis and the Soft Budget Constraint

by

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The Korean Financial Crisis and the Soft Budget Constraint

1. Introduction

Recent research has emphasized the role of poor corporate governance in the East Asian financial crisis of 1997-98. The weakness of corporate governance has been cited as both the cause of the crisis and a crucial factor in its severity. Johnson *et al.* (2000) present cross-country evidence that such measures of corporate governance quality as the effectiveness of protection of the minority shareholders are better at explaining the severity of the crisis than the conventional macroeconomic indicators. Also, Milton (2002) shows that firms with weak corporate governance experienced greater decline in their stock performance during the crisis. Most recently, Joh (2003) showed that weak corporate governance was associated with reduced profitability of Korean firms prior to the crisis, presumably increasing the economy's vulnerability to macroeconomic disturbances. Low profitability of a significant number of firms over a period of time can put these firms in financial distress, which can result in a crisis if macroeconomic conditions deteriorate.[1]

Why did financial distress of a number of firms continue to accumulate in some East Asian economies up to the crisis? That is, why were poorly performing firms not weeded out gradually via default or restructuring prior to the crisis? One possible explanation for this can be the widespread willingness of the banks or other lenders to support poorly performing firms by rolling over their loans, thus prolonging the firms' survival. Essentially, the firms that should have ended their existence might have been bailed out by their lenders.[2]

The firm's expectation of a bailout results in a so-called soft budget constraint (SBC). A large literature exists on the causes and consequences of the SBC.[3] Most of this

[1] Aghion *et al.* (2000) and Krugman (1999) emphasize the role of financial distress of firms as a cause of the crisis.
[2] The banks may have incentives to refinance bad loans both under pressure from the government and due to their own considerations. On the possible reasons for bank passivity see, for example, Corbett and Mitchell (2000), Mitchell (1997, 2000), Perotti (1993), and Schoors and Sonin (2002).
[3] See Maskin and Xu (2001) and Kornai, *et al.* (2003) for detailed surveys and references.

literature is theoretical, although there has been some empirical work aimed primarily at determining the degree of the SBC in the economies in transition.[4] The preceding paragraph suggests that the SBC could have contributed significantly to the financial crises in East Asia. Indeed, Huang and Xu (1999) construct a model that demonstrates how the SBC could have led to a crisis in Korea. However, Huang and Xu's paper represents a purely theoretical exercise. So far, there has been no firm-level empirical analysis of the degree of SBC in any of the East Asian economies or anywhere outside of the economies in transition for that matter. This gap might have been due to the presumption that the SBC is unlikely to exist as a systemic problem outside of the socialist economies or their transitional descendants.

Does the experience of the East Asian crises prove otherwise? The first goal of our paper is to answer this question. Using a novel approach applied to a data set containing annual information on several hundred Korean firms, we examine the presence of the SBC in the Korean economy during the 1991-96 period, particularly with respect to bank lending. Furthermore, we investigate whether budget constraints of Korean firms have been hardened after the crisis.

We focus our analysis on the non-chaebol firms. This is mainly due to the limitations of our data that do not distinguish among firms belonging to different chaebols. Presumably, bank lending to a member of a chaebol is largely determined by the financial state of the entire chaebol as well as by the relationship between the bank and the chaebol. Therefore, not being able to identify all members of a chaebol within our data would make the analysis of bank lending to these firms potentially misleading. Moreover, firms belonging to a chaebol probably have more alternatives to borrowing from the banks than non-chaebols do. For example, a member of a chaebol might be able to receive funds through transfer pricing schemes from other members of the same chaebol. Nonetheless, we will make certain comparisons between non-chaebols and chaebols, keeping in mind the above considerations.

[4] See Schaffer (1998), Lizal and Svejnar (2002), and Hanousek and Filer (2004).

The logic of our analysis is as follows. Our data indicate that there were significantly fewer defaults prior to the 1997-98 crisis than during or after it.[5] One explanation for this disparity may be that fewer firms were in financial distress prior to the crisis. An alternative explanation is that the SBC was much more severe among Korean firms during 1991-96 period than afterwards. To distinguish between these alternatives we use two different approaches. First, we construct a conventional Altman's z-score to determine how the banks might have perceived the likelihood of the firm's default.[6] The z-score is a popular and simple indicator that is supposed to discriminate between the firms that are likely to default in the following year and the financially sound firms. Assuming that the Korean banks were using the z-scores in evaluating the potential borrowers, we examine how the change in the firm's bank debt depends on the z-score. Presumably, in the absence of the SBC, the banks would be reluctant to extend additional loans to firms that have a low z-score, i.e., the firms that would be relatively likely to default in the following year, at least if the budget constraints were hard. Therefore, we can test for the presence of the SBC by estimating the relationship between the z-score and the firm's ability to borrow from the banks. If the firms with low z-scores have exhibited a significantly greater increase in their bank debt than the other firms, the SBC is likely to exist. Our estimates suggest that this was indeed the case during 1991-96. Most importantly, the same approach demonstrates that the problem was greatly alleviated after the crisis. We call this the z-score approach to measuring the SBC.

It is unclear, of course, how well Altman's z-score can discriminate between financially distressed and financially sound Korean firms. The z-score was developed based on a sample of midsized US firms between 1946 and 1965.[7] While it has been subsequently proven to work relatively well on other sets of midsized firms, it is quite possible that the predictive power of Altman's z-score with respect to the default of

[5] On average, the number of defaults in our sample prior to 1997 was about four per year, compared to 30 defaults per year in 1997-98 and over six annual defaults in 2000-2002. Notice that one would expect the number of defaults during 2000-2002 to be relatively low, because so many financially distressed firms were weeded out of the economy in 1997-98.

[6] The z-score was introduced in Altman (1968). It reflects such characteristics of the firm as the ratios of working capital, retained earning, earnings before interest and taxes, market value of equity, and sales to the assets of the firm. We define the precise composition of the score in the next section.

[7] The fact that Altman's z-score has been used mainly for midsized firms provides one reason why we are not including the chaebols in our investigation.

Korean firms, even in the absence of the SBC, would not have been great. Moreover, the z-score is based on a rather limited publicly available information and may be quite different from the analysis performed by the lenders. One may argue that the banks that lend to firms have better information about the likelihood of these firms default. If profit-oriented banks knew with certainty which firms would default soon and which would not, they would naturally tend to lend more to those firms that only appear to be close to default, but in reality are not about to default. This is because these firms would tend to have greater demand for loans to overcome their temporary difficulties. In this case, our results described in the preceding paragraph would have been driven by the increased leverage of the "false positives", i.e., firms that the z-score wrongly predicted to default. To rule out this possibility, we test the effect of actual default in year t+1 on the change in the firm's leverage in year t. We find that default in year t+1 had no statistically significant influence on the firm's borrowings in the years prior to the crisis. After the crisis, however, default in year t+1 had a highly statistically significant negative impact on the rate of change of bank loans in year t. We call this approach a perfect foresight SBC. Note that the absence of a statistically significant positive relationship between the default and borrowing in the pre-crisis years is understandable, because there were very few defaults in that period. Therefore, even if the banks knew perfectly well which firms would have defaulted in the absence of the SBC, the banks might not have expected any firm to default in the SBC environment.

Theoretical arguments suggest that the SBC results in poor projects being submitted and then refinanced. If this is the case, the SBC loans to firms should be followed by relatively poor performance of these firms. We attempt to test this conjecture by regressing the non-defaulted firms' profitability in year t+1 on the change in their leverage in year t and Altman's z-score. Our results indicate that changes in bank debt did not significantly affect next year's profitability of the firms either prior to or after the crisis. One reason for these results is that the effect of the SBC loans on profitability might be spread over a period longer than one year.

The paper is organized as follows. The next section describes the data set and the main variables. Section 3 tests for the existence of the z-score and perfect foresight SBC among the non-chaebol firms. We examine the effect of the SBC prior to the crisis on the

likelihood of default during the crisis in Section 4. The results for non-chaebol and chaebol firms are compared in Section 5. Section 6 concludes.

2. The data

Our work is based on the data obtained mainly from the database constructed by Korea Information Service, Inc. (KIS), that provides comprehensive corporate and financial information on firms listed on the Korea Stock Exchange (KSE) since 1980. Some additional corporate profile information not provided by KIS-FAS is procured from another database (MKACR - Maekyung Annual Corporation Reports), constructed by Maeil Business Newspaper that has provided such information on over 300,000 firms in Korea since 1978. These databases are constructed based on financial statements and various auxiliary publicly available documents. All manufacturing firms listed on the KSE, during the 1990-2001 period for at least two consecutive years are included in the primary sample. The number of firms in our sample varies over the years, as the number of firms on the KSE changes. Some observations are also excluded due to the lack of information on some relevant variables, particularly the lack of data on their market value.

For our purposes, we define firms as defaulted in the year when they reported "filed for bankruptcy", "bankrupt", "out-of-operation", "termination of lending", or anything similar in their corporate history, whichever occurred the earliest. Firms that merged with other firms are not considered as defaulted as long as they have never actually defaulted. The dates of default are obtained from the history of firms in MKACR. Note that we do not include observations for the defaulted firms starting in the year of their default.

The summary statistics for our non-chaebol manufacturing firms for different years are shown in Table 1(a-c). The distribution of defaulted and non-defaulted firms between pre- and post-crisis periods is as follows:

	Pre-crisis	Post-crisis
#Firms	380	315
# Observations	1950	894
#Defaults	37	14
Incl. 1997 defaults	23	n/a
#Low z-score observations	150	133
incl. firms defaulted in t+1	10	7
#High z-score observations	177	108
incl. Firms defaulted in t+1	0	1

Notes: 1. While 1997 was the year when the crisis started, we still treat the observations for the firms that defaulted in 1997 as "pre-crisis" observations, because we focus on the banks' behavior towards the firms that default or may be expected to default the following year. That is, our pre-crisis sample includes the firms that defaulted in 1997, because we look at these firms' financial situation in 1996.

2. Low z-scores are those below 0.445. The threshold for high z-scores is 2.548.

The data in Table 1(a) show quite clearly that the firms that defaulted the following year were on average in much worse financial shape than the non-defaulted firms. Cash flow, EBITDA, and market values for the soon-to-default firms were all considerably lower than for their non-defaulted counterparts. Nonetheless, the trends in bank lending to the two groups of firms, both overall and short-term, were on average the same. (The trends in adjusted bank loans were different, but the adjustment strongly biased this indicator downward for the low EBITDA firms.) Also, the ratio of investment to assets was on average the same for both groups of observations. However, when we break down the descriptive statistics for pre-crisis and post-crisis years (Tables 1(b) and 1(c), respectively) the differences in bank lending to the two groups of firms remain negligible prior to the crisis but become quite pronounced after the crisis. The firms that were about to default experienced a much more significant decrease in their ability to borrow after the crisis than the other firms. In the next section, we will demonstrate that this rather superficial evidence of the hardening of the budget constraints post-crisis is confirmed by more sophisticated techniques.

3. Measuring the SBC

While the attempts to estimate the likelihood of borrower's default are probably as old as commercial lending itself, the pioneer in the use of modern analytical techniques for this purpose was Altman (1968) who developed a discriminant function, commonly referred to as his z-score, to distinguish between those firms that are likely to default and those that are not. Altman's z-score was developed based on a sample of 33 U.S. manufacturing firms defaulted between 1946 and 1965 and a paired and appropriately stratified random sample of 33 firms that were still in existence in 1966. The resulting discriminant function for midsized public companies was as follows:

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 0.999X_5 , \qquad (1)$$

where X_1 = working capital/total assets; X_2 = retained earnings/total assets; X_3 = earnings before interest and taxes/total assets; X_4 = market value of equity/book value of total debt; and X_5 = sales/total assets. The probability of default is low for the firms with high values of Z, and this probability is high for the low z-score firms. This discriminant function had surprisingly strong predictive ability both within the initial sample and in a secondary sample used for validating the initial results.

No significant improvements over Altman's z-score have been published until perhaps the recent papers by Moody's Investors Service.[8] It appears, therefore, that over most of the period relevant to our study, Altman's z-score was the best tool available for predicting corporate default. Moreover, the Moody's Investors Service's default functions are not publicly available and we would not have been able to use them in our analysis even if they were estimated much earlier.

Therefore, we use Altman's z-score as a reasonable and commonly known indicator of the likelihood of next year's default. In the absence of the SBC, the firms with a high current z-score would be unlikely to default the following year, while the low z-score firms would be relatively likely to do so. Our data presented in Table 1 are consistent with this general conclusion. The firms that were about to default had

[8] See Sobehart and Stein (2000) and Falkenstein et al. (2000).

significantly lower z-scores than the other firms. Also, almost half of the soon-to-default firms before the crisis and more than half of such firms after the crisis had z-scores in the lowest decile. Only one of the firms with the z-scores in the highest decile defaulted the following year.

Presumably, Altman's z-score is negatively correlated with the firm's current and prospective financial situation and the firm with a low z-score may have a relatively high demand for loans, because without additional borrowing the firm may have to go out of business. However, profit-maximizing banks in a well-functioning market economy typically would not be willing to advance additional loans to a firm that has a low z-score and, therefore, is relatively likely to default. This can be illustrated by the following simple argument. Consider a bank that is deciding whether to lend an additional unit of capital to a firm. Let p denote the bank's estimate of the probability of the firm's default on the loan. Assume that if the firm defaults, the bank's payoff is L, $i > \mathrm{L} \geq -1$, where i is the interest rate charged on the loan. That is, the bank can lose the amount up to the entire principal of the loan.[9] If the firm does not default, the bank's payoff is equal to the interest rate, i. Then, the bank's expected return from lending one unit of capital to the firm is:

$$R = (1-p)i + pL \ .$$

The bank would advance the loan only if $R \geq 0$ or if

$$p \leq i/(i-L) \ .^{10} \qquad (2)$$

That is, the bank would not provide the loan if the probability of default is above the right-hand side of (2). If L is close to -1 and the interest rate in not too high, $i/(i-L)$ would be rather small. Note that banks generally would not increase the interest rate too much even for high-risk firms because after a certain point, a higher interest rate may itself increase the probability of default. More importantly, if the bank does not know the

[9] We disregard the transaction costs associated with administering the loan and other potential complications.

[10] The probability of default may depend on whether the additional loan is made. For the sake of simplicity, we disregard this consideration.

probability of the firm's default with certainly, the interest rate may serve as a screening device, in which case the bank has incentives to keep the interest rate relatively low.[11]

Therefore, if the firm is able to increase its bank debt despite a low z-score, we conclude that the firm operates under the SBC. In essence, the factors reflected in the z-score provide opposite incentives to the firm and the bank with respect to lending to the firm. In an economy with a hard budget constraint, we expect the bank's long-run profit incentive to dominate. Under the SBC, we expect the firm's demand for increased loans to be the main factor in determining the amount of borrowing.[12] According to this logic, we test for the presence of the SBC in Korea by focusing on the relationship between the change of the firm's borrowings from the banks and its z-score. We are interested in whether this relationship reveals the presence of the SBC prior to the financial crisis of 1997-1998 and how this relation has changed after the crisis.

Specifically, we begin by running the following benchmark fixed effects regression:

$$\Delta BD_{it} = b_0 + b_1 Lo\_Z_{it} + b_2 PC \cdot Lo\_Z_{it} + b_3 Hi\_Z_{it} + b_4 PC \cdot Hi\_Z_{it} + bX_{it} + e_{it}, \qquad (3)$$

where ΔBD_{it} represents the change in the amount of bank debt of firm i in year t divided by the firm's average assets for year t, Lo_Z_{it} (Hi_Z_{it}) is a dummy variable that has a value of 1 if firm i has a low (high) z-score in year t, and a value of 0 otherwise, and X_{it} is a vector of controls. We define low z-score as z-score < 0.445. High z-score are those above 2.548. We choose these values so that 10 % of all observations would have low z-score values and 10% would have high z-scores.[13] Variable PC is a dummy for the post-crisis years (1999-2001). If our hypothesis about the pre-crisis SBC in the Korean

[11] See Stiglitz and Weiss (1981). In their basic model, the bank has no information about the firm's probability of default. When Stiglitz and Weiss introduce observationally distinguishable borrowers, they show that riskier borrowers may be "red-lined" and unable to borrow at all. This result also supports our argument that the firms with low z-score would have difficulties borrowing in a well-functioning market economy.

[12] Notice, however, that a low z-score does not necessarily lead to a higher demand for bank loans by the firm. If the firm's z-score does not change from one year to the next, its demand for loans may not change either. Presumably, the dynamics of the demand for loans would depend more on the change of the z-score rather than on its level. The bank's willingness to lend, however, is presumably determined mainly by the level of the firm's z-score.

[13] The classification of z-scores as "low" does not correspond to Altman's original classification. Altman found that "all firms having Z score of greater than 2.99 clearly fall into the 'non-bankrupt' sector, while those firms having Z score below 1.81 are all bankrupt." (p. 606) The distribution of z-scores for our data, however, suggests a different classification and is not quite as unambiguous as Altman's.

economy is correct, we expect to have $b_1>0$, implying that the firms were able to increase their borrowing from the banks despite the low z-scores. The term that interacts Lo_Z_{it} with the post-crisis dummy variable lets us test the hypothesis that the severity of the SBC did not change in the post-crisis period relative to the pre-crisis years. In particular, a negative value of b_2 would suggest that the budget constraints of the firms in our data set have hardened after the crisis. The high z-score dummy is used as a control variable.

The vector of other controls X_{it} consists of the interest rate the firm paid on its debt during the year,[14] the share of government ownership in the firm, the share of bank ownership of the firm, the age of the firm, and the dummy variable for the post-crisis period.[15] There is a possibility, in fact, likelihood, that the interest rate paid by the firm depends on its ability to obtain additional bank loans. For this reason, we instrumented this variable and used its predicted values in the regressions. We employed the previous year's debt-to-assets ratio and the previous year's average interest rate on total debt as instruments for interest rate paid by the firm.

The results of our benchmark regressions (3) as well as the instrumental regressions are presented in Tables 2(a) (ΔBank debt column) and 3 of the Appendix, respectively. The data support the conjecture that the SBC existed prior to the 1997-98 financial crisis. The coefficient of the low z-score dummy, 0.066, is positive and highly significant. Perhaps even more interestingly, the budget constraint hardens after the crisis. The coefficient of the interactive term with the post-crisis dummy is –0.085. It is also highly statistically significant, and is somewhat greater than the b_1 coefficient by absolute value. This suggests that the hardening of the budget constraints of firms after the crisis was substantial, although perhaps not complete. In the regression using only post-crisis data the coefficient of Lo_Z_{it} is not significantly different from zero. In order to check the robustness of these results we also run regression (3) using more narrow ranges for lower threshold for low z-score dummy (z-scores lower than 0.16, or below the 5-th percentile)

[14] We do not have reliable data on the interest rates charged by the banks. Instead, we use the interest rate on all debt calculated as total interest expense during the year over total stock of debt at the end of the year.
[15] We also ran regressions with dummy variables for each year instead of dummy variables for the period. These regressions produced qualitatively similar results with somewhat greater statistical significance for the relevant coefficients. At the same time, it is much easier to interpret the coefficients of the post-crisis dummy variable. Therefore, we present only the regressions with the period dummy.

and high z-score dummy (z-scores higher than 3.032 or above 95-th percentile). The results presented in Table 2(b) are similar to our benchmark results.

There is at least one potential difficulty with interpreting the above results as evidence of the SBC. The z-score, particularly as calculated by us, may not be a true reflection of the firm's solvency as perceived by the banks. After all, the determination of the likelihood of future default of a corporate borrower is usually a rather subjective process. Moreover, even if the Korean banks used Altman's z-score in their analysis of the probability of firms' default, most likely it was not the only, or even the main, factor.[16] Also, it is difficult to establish whether the z-score would have been a good predictor of corporate bankruptcy in Korea either before or after the financial crisis. This is because if the SBC was indeed severe, there may be no necessary relationship between the firm's financial situation in any given year and its probability of bankruptcy in the following year. That is, the presence of the SBC results in a financially unhealthy firm postponing its bankruptcy long after it should have occurred, implying that even a firm with a very low z-score that should have defaulted in the absence of the SBC might be kept afloat by its debt being refinanced.[17] For these reasons, we run an additional set of regressions that are similar to (3) but where we use the fact of actual default the following year instead of Altman's z-score. We call these the "perfect foresight" SBC regressions as opposed to the "z-score" SBC regressions analyzed above.

If the coefficient on the next year's default in the perfect foresight SBC regression is positive, it means that the additional bank loans were advanced to the firms in genuine financial distress rather than simply to the firms that experienced some temporary deterioration of their financial situation. Even under the SBC, however, a profit-maximizing bank would presumably be reluctant to lend to a firm that is about to default. At the same time, as we argued earlier, in the presence of the severe SBC, the actual default happens very rarely and may not be anticipated by the bank. This consideration

[16] Notice that if the banks did use Altman's z-score or something similar to it and if the other factors involved in such analysis were not systematically related to Altman's z-score, this consideration does not undermine the use of the latter for our purposes in the preceding regressions.

[17] Indeed, in the respective binary logistic regressions, both Altman z-score and the low z-score dummy have the correct sign and are statistically significant in determining the probability of next year's bankruptcy. However, the regressions do not predict any actual bankruptcies correctly at 50% cutoff value. This is presumably due to the fact that the overwhelming number of observations in our data set (about 97%) are for non-defaulted firms, and some of these non-defaulted firms have low z-scores.

would result in a relatively weak relationship between the actual default next year and the increase in bank debt. On the other hand, without the SBC we would expect a negative relationship between the future default and the current ability to obtain bank loans.

Our perfect foresight SBC regression has the following form:

$$\Delta BD_{it} = c_0 + c_1 \cdot D_{it} + c_2 PC \cdot D_{it} + c_3 \cdot PC_{it} + c \cdot X_{it}\, e_{it}\,, \qquad (4)$$

where D_{it} is a dummy variable that has a value of 1 if firm i defaulted in year t+1 and 0 otherwise. We did not include any z-score variables, because the assumption is that the banks are already using all of the available information to predict default. In other words, regression (4) is different from regression (3) only in that we replace the z-score variables with the variables based on the default dummy, D_{it}. The results of the basic perfect foresight regressions are presented in the first column of Table 4. The coefficient of D_{it} is small by absolute value and not statistically significant. This result is consistent with either the inability of the Korean banks to foresee the firm's default or with the presence of the SBC, or both. More important, the coefficient of D_{it} for post-crisis period is negative, large by absolute value, and highly significant, indicating that the situation has changed substantially after the crisis.[18]

One factor that limits our data availability for the z-score regressions is that z-scores require the knowledge of market values of firms. The perfect foresight regressions do not have such limitation. Also, because these regressions do not rely on the value of z-scores, there is no need to limit the sample to manufacturing firms only. Therefore, we can extend our sample from 2844 observations to 3410 observations. The results for what we call the "extended sample" qualitatively the same as the results for the subsample of manufacturing firms, for which market values are available.[19]

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[18] These results depend on the inclusion of 1997 defaults in the sample. When we exclude firms that defaulted in 1997, the post-crisis coefficient for D_{it} is no longer statistically different from the pre-crisis one. However, in the separate regressions for the 1991-1995 and 1999-2001 subsamples, the negative D_{it} coefficient remains negative but insignificant for the former subsample, but is statistically significant at 1% level for the latter subsample.

[19] For the sake of comparability to the z-score regressions, we focus on the "market values subsample." We also ran the z-score regressions on the extended sample of firms where we used book values of the firms instead of their market values. The results were somewhat stronger but not radically different from the results that employed market values to calculate z-scores.

A serious objection to one of the basic features of our approach to determine the presence of the SBC relates to Schaffer's (1998) argument that the accounting value of the change in the firm's bank debt may be a biased measure of the true financial flows between the firm and the banks and, therefore, a biased measure of the SBC. This is because interest payments are calculated on accrual basis. A firm in financial distress often stops paying interest, but it continues to accrue, causing an increase in the amount of bank debt, while the banks are not committing any fresh capital to the firm. The distressed firm appears to be able to increase borrowing from the banks even though it is actually operating under a hard budget constraint. We address this concern in three different ways. First, we look at the changes in short-term bank debt, i.e., debt with maturity of up to one year. Second, we employ a procedure to adjust bank debt for the possible bias and use the adjusted debt amount in our regressions. Third, we perform the tests similar to the ones suggested by Schaffer (1998) to overcome this problem.

The short-term debt approach is probably the most natural one, but it has a serious disadvantage of disregarding a large portion of bank loans. Given the short maturity of the debt, it is unlikely to be increasing simply by the accrual of interest. Presumably, the distressed firm would either have to default on the debt or have it refinanced. Even if this were not always the case, the short-term bank debt would be less subject to the bias described above. The regressions with respect to short-term debt are presented in the middle parts of Tables 2 and 4. The results are quite similar to those for all bank debt in pointing to the existence of the SBC prior to the financial crisis and a hardening of the budget constraint after the crisis.

Another way to account for the potential bias in measuring the softness of the budget constraint would be to adjust for the possible non-payment of accrued interest directly. To do this, we assume that the firms actually pay accrued interest as long as they have sufficient earnings to do so. Accordingly, we compare the firms' earnings before interest, taxes, depreciation, and amortization (EBITDA) to the accrued interest. If the firm's EBITDA are negative, we assume that the firm paid none of the accrued interest.[20] If EBITDA are positive and greater than all interest accrued during the year, including

[20] This is not always the case in reality, of course. Even a firm with negative EBITDA may have cash reserves to make interest payments. Therefore, this assumption biases our results against finding SBC for firms with negative EBITDA.

the interest on non-bank debt, we assume that the firm actually paid all interest due. Finally, if EBITDA are positive but smaller than total interest, we allocate the EBITDA amount between payment of interest on bank debt and payment of interest on other debt in proportion to the different types of debt on the firm's books. We then subtract the unpaid bank debt interest from the change in bank debt during the year and use the resulting value, divided by the firm's average assets during the year, as our dependent variable. The regression results for this adjusted change of bank debt are shown in the last columns of Tables 2 and 4. The results are only slightly weaker than the results for unadjusted data,[21] supporting the existence of the SBC prior to the crisis and a significant hardening of the budgets in 1999-2001.

We also use a technique proposed by Schaffer (1998). He plotted the change in bank debt net of accrued interest against EBITDA for the firms with negative EBITDA. The idea was to see whether the negative EBITDA firms on average experience an increase in their bank debt net of accrued interest. Instead of presenting a plot, we simply note that in our extended sample, 96 out of 256 observations with negative EBITDA during some year, i.e., 40%, exhibit an increase of bank debt during the same year. For the pre-crisis period, 53 of 106 observations with negative EBITDA show an increase in bank debt, while during the post-crisis period only 23 of 88 observations exhibit the same property. In other words, the percentage of increases of bank debt adjusted for non-payment of interest among negative EBITDA firms declined from 50% before the crisis to about 26% after the crisis. Note, however, that unlike the firms in the economies in transition studied by Schaffer (1998), at least some Korean firms most likely could and did, make interest payments even in the years when their EBITDA was negative. Therefore, the assumption of complete non-payment of interest by negative EBITDA firms probably leads to an underestimation of the softness of these firms' budget constraints.

Our method, while in part resembling Schaffer's, is quite different from another approach recently used by Lizal and Svejnar (2002) to determine whether the SBC existed in a sample of Czech firms. Their technique was based on a supposition that in an

[21] The only qualitative difference is that the positive coefficient of low z-score dummy in Table 1a is not statistically significant for the adjusted data.

economy where firms almost exclusively rely on bank financing for investment, the fact that less profitable or even unprofitable firms are able to invest suggests that banks are willing to provide loans to poorly performing firms, implying the existence of the SBC. Therefore, Lizal and Svejnar included firms' profitability as one of the explanatory variables in the investment regression. A zero or negative coefficient on profitability would suggest that the SBC exists. However, the same type of argument may not work with our data, because Korean firms presumably have had access to different types of financing, including accumulated retained earnings and loans from sources other than the banks.[22] Still, for the sake of comparison, we run similar regressions based on our annual data.[23] The results are presented in Table 5. We find that Korean firms' profitability measured by EBITDA ratio to assets is an important factor in determining the rate of investments. While the coefficient on EBITDA ratio is positive for the pre-crisis period, it is not statistically significant even at 10% level.

4. The effect of SBC on default during the 1997-98 crisis

Having established the presence of the SBC with respect to bank financing of Korean firms prior to the financial crisis, we now ask whether the soft loans helped the accumulation of the firms in the economy that eventually defaulted during the crisis. We define the firm as having SBC if it managed to increase its bank debt despite a low z-score. The following table summarizes the relevant numbers:

	Number of firms	Firms defaulted in 1997-98	Share of firms defaulted in 1997-98
All firms surviving through 1996	364	45	12.4%
incl. non-SBC firms	284	24	8.5%
SBC firms	80	21	26.3%

As the table demonstrates, more than a quarter of all our SBC firms defaulted during the crisis compared to less than 10% of the non-SBC firms. These ratios suggest that a

[22] Hanousek and Filer (2003) have recently questioned the validity of Lizal and Svejnar's approach even in the transition context.
[23] Because of using annual data instead of quarterly observations, we do not use lags in our regressions.

tougher lending policy by the banks prior to the financial crisis would have significantly reduced the number of defaults during the crisis, alleviating or perhaps even preventing it from taking place.

In order to control for certain factors other than SBC that might affect the probability of default during crisis, we run Probit regressions that included, in addition to the SBC dummy, the number of employees, employees per unit of assets, share of exports in its sales, share of bank ownership of the firm, short-term debt-to-asset ratio, age of the firm, and debt-to-asset ratio.[24] Only the last two variables in additin to the SBC variable came out statistically significant. The resulting Probit regression that includes only the statistically significant variables is shown in Table 6.

While the coefficient of the SBC is positive and highly significant, we need to acknowledge that having SBC prior to the crisis remains a relatively poor predictor of default during the crisis. Because there were few defaults even during the crisis, most SBC firms did not default. Therefore, although the having had SBC prior to the crisis significantly increases the risk of default, the chance of defaulting remains relatively low. The above results do suggest, however, that the existence of the SBC prior to 1997 most likely was an important factor in the extent of corporate defaults and, therefore, in the depth of the crisis.

5. Comparisons between non-chaebol and chaebol firms

So far we have concentrated on the non-chaebol firms, mainly because our data do not distinguish among the firms belonging to different chaebol groups. This data deficiency is a serious limitation because bank lending to chaebol members is likely to depend not only on the financial situation of a given firm, but on the bank's view of the chaebol as a whole. Also, chaebol members probably have greater opportunities for obtaining financing from non-bank sources, including assistance from other members of the same chaebol via, for example, transfer pricing mechanisms. For these reasons, it is difficult to infer the presence of the SBC for chaebol firms by using our technique. However, given the great importance of the chaebols in the Korean economy in general,

[24] All variables, except for the SBC dummy are for 1996. We also tried using the ratio of total debt to assets, but that variable is highly correlated with the SBC dummy.

and in the development of the 1997-98 crisis in particular, we cannot leave them completely out of the picture. Therefore, keeping in mind the above caveats, we examine the implications of our data for the SBC among the chaebol firms.

The descriptive statistics on the chaebol firms are presented in Table 7. A comparison of this table with the data for non-chaebols reveals that chaebols were significantly larger on average, had greater debt-to-asset ratios and lower z-scores. The high debt-to-asset ratios are instructive, because they suggest that one way or another, the chaebol firms managed to accumulate large amounts of debt. As we will argue later, this fact alone suggests that the budget constraints of these firms were not particularly hard. Notice also that there were no chaebol defaults prior to 1997.

Tables 8 and 9 present our regressions for the combined dataset with a dummy variable CH set to one for chaebol firms and zero otherwise. In the z-score regressions (Table 8), the cutoff values for low z-scores and high z-scores are set to the same values as for the non-chaebol firms. The results show that both prior to and after the crisis, the chaebols exhibited weaker relationship between their z-scores and their borrowings from the banks. As we argued above, this may be due either to the better ability of the chaebols to borrow from other sources or to the fact that the banks base their lending decisions with respect to the chaebol members on the financial situation of and the bank's relationship with the entire chaebol, rather than the given firm. In addition, there were significant fluctuations in the policy of government-sponsored banks with respect to lending to chaebols. In the perfect foresight regressions (Table 9) the introduction of the chaebols does not change substantially the relationship between the ability to borrow and the default the following year compared to the non-chaebols only. Prior to the crisis, the soon-to-default chaebols appeared to be able to borrow more than their non-chaebol counterparts. Note, however, that the only chaebols in the pre-crisis period that defaulted in year t+1 defaulted in 1997. One can argue that the banks could not foresee the 1997 defaults and, therefore, the inclusion of their lending behavior in 1996 may not be justified. We can evaluate this argument only for the non-chaebol firms. As we noted in footnote 18 above, the results for the non-chaebol firms change somewhat if we exclude 1996 from the perfect foresight regressions, but the change is not dramatic.[25]

[25] The exclusion of 1996 does not significantly affect the z-score regressions.

The weakness of the statistical relationship between the chaebol firms' z-scores and their bank debt may also be caused by the differences in the distribution of z-scores for the chaebols and non-chaebols. To adjust for these differences, we also run regressions with the threshold values for low and high z-scores set, respectively, at the 10% (z-score of 0.349) and 90% (z-score of 2.375) percentiles of the combined dataset. The results for these different threshold values are shown in Table 10. In these regressions, the coefficients of the low and high z-scores for chaebols, with a couple of exceptions, are not significantly different from the respective non-chaebol coefficients.

Tables 11 and 12 show the results of similar regressions for the chaebol members only. In the z-score regressions (Table 11), the threshold values for low and high z-scores are set at the same levels as for the combined dataset, i.e., at 0.349 and 2.375, respectively. The coefficients of the relevant variables in the fixed effects regressions have the same signs as for the non-chaebol subset, but with the exception of the short-term loans, they are mostly not statistically significant. The random effects regressions perform closer to the non-chaebols, but the results are still not as stark.[26] It remains the case, however, that we cannot reject the null hypothesis of the coefficients of the low z-score dummies for the chaebol firms being zero. This suggests that the chaebol members have been able to borrow from the banks irrespective of their financial situation. We interpret it as evidence of SBC for the chaebols both prior to the crisis and afterwards although this evidence is weaker than it is for other firms. In addition, the results of the perfect foresight regressions are even stronger for the chaebols than for the other firms.

While the application of our technique to the chaebol firms produces somewhat weaker evidence of the SBC among the chaebols members than for non-chaebols, the fact is that chaebol firms in our sample on average have much higher debt levels than the non-chaebol firms and also have much lower z-scores. All this suggests that the cheabols have been able to borrow despite their relatively weak financial situation. The difference seems to be that the non-chaebols were increasing their borrowing when their financial situation deteriorated wile the chaebols have been borrowing all the time. As was shown earlier, the debt-to-asset ratio, apart from the presence of SBC, appears to exert

[26] The Hausman test for the choice between random and fixed effects models is inconclusive for these regressions.

significant influence on the probability of default. This remains the case when we include chaebol firms in a regression shown in Table 6.

The inclusion of a dummy for a chaebol firm in the above regression, either by itself or interacted with the SBC and DEBT variables, does not affect the relevant coefficients in a meaningful way. Moreover, the coefficients of the variables containing the chaebol dummy are not statistically significant. However, in a regression that includes chaebol members only, the relevant coefficients have the same signs as in the case of all firms, but none of them are statistically significant (see Table 6). This may again be a consequence of the cross-ownership relationships among different firms in a chaebol, implying that default occurs for the entire chaebol and depends only weakly on the characteristics of specific members of the group. Notice also that we have relatively few (111 to be precise) chaebol firms in the sample.

To summarize, the chaebols in our sample tended to have much lower z-scores than their non-chaebol counterparts but they exhibited a weaker relationship between the low z-scores and their borrowings from the banks that do the non-chaebol firms. At the same time, the chaebols were considerably more leveraged prior to the crisis than the other firms. The high debt load appears to have contributed to their propensity to default during the crisis. This suggests that SBC existed among the chaebols prior to the crisis and that it played an important role in exacerbating it.

6. Conclusions

We have shown that a serious SBC problem existed among the Korean non-chaebol firms prior to the 1997-98 crisis and probably among the chaebols as well. Also, we demonstrated that significant hardening of the budget constraints took place after the crisis. The latter result is probably even more important than the former, because the existence of the SBC prior to the crisis was widely perceived to be the case. Our first result confirms this widespread perception. The post-crisis hardening of the budget constraint, however, is less expected. In addition, the relatively large in absolute value and highly statistically significant differences between our main results for the pre- and post-crisis periods serve as an indirect validation of our approach.

While soft lending might have been quite rational from the point of view of individual banks, particularly in the short run, it had likely caused serious problems in longer term by creating dysfunctional incentives for the firms, increasing their debt load, and failing to weed out weak firms gradually prior to the crisis. Due to these factors, many firms found themselves in a difficult financial situation that became unsustainable when a macroeconomic shock occurred, resulting in too many firms failing at once.

The fact that there has been significant hardening of the firms' budget constraints after the crisis suggests that the crisis is unlikely to be repeated on nearly the same scale in today's Korean economy even if similar macroeconomic shocks occur.

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APPENDIX

Table 1(a). Descriptive statistics for manufacturing non-chaebol firms (1991-2001)

VARIABLE	FIRMS DEFAULTED IN t+1				NON-DEFAULTED FIRMS			
	MEAN	STD	MIN	MAX	MEAN	STD	MIN	MAX
Age	27.07	9.35	10.00	51.00	28.73	12.16	1.00	104
Gov. share (%)	0.04	0.22	0.00	1.80	0.12	1.17	0.00	20.00
Bank share (%)	3.98	5.58	0.00	29.20	6.84	8.97	0.00	88.50
Z-score	0.50	0.96	-2.24	4.22	1.38	1.15	-8.01	25.01
ΔBank debt/assets	0.02	0.24	-1.02	0.67	0.02	0.12	-2.08	1.00
ΔShort-term bank debt/assets	0.03	0.20	-0.88	0.57	0.02	0.09	-0.58	1.02
ΔAdj. bank debt/assets	-0.01	0.25	-1.08	0.67	0.01	0.12	-2.08	0.97
EBITDA/assets	0.04	0.08	-0.29	0.19	0.10	0.07	-0.33	0.56
Cash flow/assets	-0.03	0.10	-0.37	0.27	0.05	0.09	-0.41	0.64
Invest./assets	0.07	0.09	0.00	0.53	0.07	0.07	0.00	0.65
Assets	169	197	13	1,405.5	220.7	898	4.7	17,695
EBITDA	7.6	18.5	-76.7	92.5	26.8	155.7	-26.7	3,249.6
Market value	34.9	46.7	1.5	367	73.5	379.8	1.7	9,720

Note: all monetary values are in billion won in current prices (exchange rate as of 3/27/04: 1,158 :$1)

Table 1(b). Descriptive statistics for manufacturing non-chaebol firms (1991-1996)

VARIABLE	FIRMS DEFAULTED IN t+1				NON-DEFAULTED FIRMS			
	MEAN	STD	MIN	MAX	MEAN	STD	MIN	MAX
Age	26.53	9.72	10.00	51.00	27.06	11.65	5.00	99.00
Gov. share (%)	0.00	0.00	0.00	0.00	0.11	1.22	0.00	20.00
Bank share (%)	5.31	5.59	0.00	24.20	9.26	8.68	0.00	46.20
Z-score	0.53	0.79	-2.24	1.98	1.43	0.86	-1.29	10.37
ΔBank debt/assets	0.03	0.18	-0.79	0.38	0.04	0.10	-2.08	0.77
ΔShort-term bank debt/assets	0.03	0.17	-0.79	0.39	0.03	0.08	-0.53	0.71
ΔAdj. bank debt/assets	0.01	0.19	-0.84	0.38	0.03	0.10	-2.08	0.77
EBITDA/assets	0.06	0.08	-0.20	0.19	0.11	0.06	-0.20	0.46
Cash flow/assets	-0.03	0.08	-0.27	0.08	0.06	0.08	-0.28	0.64
Invest./assets	0.06	0.06	0.00	0.26	0.06	0.07	0.00	0.62
Assets	133	101.8	19.6	428	168	698	4.7	13,830
EBITDA	9	8.9	-8	33	20.8	127	-17.6	2,512
Market value	30.8	25.7	2.7	120.8	59.6	234	1.7	5,424.7

Note: all monetary values are in billion won in current prices (exchange rate as of 3/27/04: 1,158 :$1)

Table 1(c). Descriptive statistics for manufacturing non-chaebol firms (1999-2001)

VARIABLE	FIRMS DEFAULTED IN t+1				NON-DEFAULTED FIRMS			
	MEAN	STD	MIN	MAX	MEAN	STD	MIN	MAX
Age	27.93	7.54	17.00	42.00	31.83	12.48	1.00	104.00
Gov. share (%)	0.19	0.51	0.00	1.80	0.20	1.19	0.00	14.60
Bank share (%)	0.74	1.96	0.00	7.40	3.29	9.27	0.00	88.50
Z-score	0.73	1.34	-1.06	4.22	1.37	1.43	-4.58	25.01
ΔBank debt/assets	-0.12	0.35	-1.02	0.26	-0.02	0.12	-0.95	1.00
ΔShort-term bank debt/assets	-0.06	0.26	0.88	0.18	-0.02	0.11	-0.58	1.02
ΔAdj. bank debt/assets	-0.16	0.38	-1.08	0.24	-0.03	0.12	-1.02	0.97
EBITDA/assets	0.06	0.08	-0.06	0.19	0.09	0.08	-0.33	0.56
Cash flow/assets	0.00	0.08	-0.21	0.08	0.05	0.09	-0.41	0.38
Invest./assets	0.07	0.08	0.00	0.27	0.07	0.07	0.00	0.65
Assets	162	161	38	637.7	305.5	1,120.6	16.8	17,695
EBITDA	919	-17.6	59	35	35	183.7	-26.7	3,249.6
Market value	54.9	95.6	3.5	367	110.7	612.8	1.7	9,720

Note: all monetary values are in billion won in current prices (exchange rate as of 3/27/04: 1,158 :$1)

Table 2(a). Benchmark regressions with low z-score dummies (fixed effects)

Variable	ΔBank debt		ΔShort-term bank debt		ΔBank debt (adjusted)	
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Low Z-score	0.066**	4.97	0.043**	4.03	0.041**	3.14
Low Z-score·Post	-0.084**	-4.79	-0.074**	-5.15	-0.085**	-4.77
High Z-score	-0.010	-0.93	-0.012	-1.28	-0.011	-0.96
High Z-score·Post	-0.026	-1.42	-0.005	0.36	-0.025	-1.40
Post	-0.039**	-3.58	-0.024**	-2.65	-0.039**	-3.56
Age	-0.002	-1.55	-0.002*	-2.03	-0.002#	-1.74
Gov. share	0.0003	1.55	0.001	0.66	0.0004	1.64
Bank share	-0.0005	-1.48	-0.0003	-1.30	-0.0005	-1.55
Predicted int. rate	-0.863**	-5.76	-0.347**	-2.83	-0.973**	-6.44
Adj. R^2	0.049		0.024		0.058	
Number of obs.	2844		2844		2844	
Number of firms	410		410		410	

Note: ** - significant at 1% level; * - significant at 5% level; # - significant at 10% level

Table 2(b). Regressions with low z-score dummies defined via a lower threshold (fixed effects)

Variable	ΔBank debt		ΔShort-term bank debt		ΔBank debt (adjusted)	
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Low Z-score	0.052**	2.72	0.058**	3.73	0.025	1.34
Low Z-score·Post	-0.079**	-3.27	-0.087**	-4.40	-0.085**	-3.52
High Z-score	-0.043**	-2.67	-0.036**	-2.73	-0.044**	-2.69
High Z-score·Post	0.001	0.07	0.028	1.44	0.0006	0.02
Post	-0.045**	-4.20	-0.027**	-3.13	-0.045**	-4.13
Predicted int. rate	-0.861**	-5.72	-0.356**	-2.89	-0.951**	-6.28
Adj. R^2	0.045		0.023		-0.058	
Number of obs.	2844		2844		2844	
Number of firms	410		410		410	

Note: ** - significant at 1% level; * - significant at 5% level; # - significant at 10% level

Table 3. Instrumental regression for predicted interest rate

Variable	Interest rate (t)	
	Coefficient	t-stat
Constant	0.0073**	5.56
Debt/assets (t–1)	0.0381**	21.45
Interest rate (t–1)	0.5767**	48.62
Adj. R^2	0.4303	
Number of obs.	4483	

Table 4. Perfect foresight regressions (fixed effects)

Variable	ΔBank debt		ΔShort-term bank debt		ΔBank debt (adjusted)	
	Coefficient	t-stats	Coefficient	t-stats	Coefficient	t-stats
Default	-0.0168	-0.739	0.0009	0.052	-0.0268	-1.175
Default·Post	-0.1090**	-2.692	-0.0659*	-1.983	-0.1238**	-3.040
Post	-0.0488**	-4.520	-0.0293**	-3.313	-0.0509**	-4.687
Age	-0.0018	-1.211	-0.0025*	-1.982	-0.0022	-1.445
Gov. share	0.0006	0.251	0.0018	0.907	0.0006	0.261
Bank share	-0.0006#	-1.840	-0.0004	-1.520	-0.0006#	-1.879
Predicted int. rate	-0.8804**	-5.919	-0.4090**	-3.349	-1.0069**	-6.727
Adj. R^2	0.0432		0.0157		0.0568	
Number of obs.	2844		2844		2844	
Number of firms	410		410		410	

Note: ** - significant at 1% level; * - significant at 5% level; # - significant at 10% level

Table 5. The relationship between investment and EBITDA
Dependent variable: Ratio of investment to assets

	Fixed effects	t-stat	Random effects	t-stat
EBITDA	0.0550	1.642	0.0467#	1.715
EBITDA·Post	-0.0448	-1.061	-0.0593	-1.549
Post	0.0110	1.600	0.0108*	2.267
Age	-0.0006	-0.735	-0.0003*	-2.022
Gov. share	-0.0006	-0.485	-0.0001	-0.105
Bank share	-0.0002	1.181	0.0003*	2.099
Constant			0.0651**	11.52
Adj. R^2	0.1678			
Number of obs.	2844		2844	
Number of firms	410		410	

Note: ** - significant at 1% level; * - significant at 5% level; # - significant at 10% level; Hausman test of fixed effects vs. random effects is inconclusive

Table 6. The determinants of default during the crisis
Dependent variable: 1 if the firm defaulted during 1997-98; zero otherwise

Variable	Non-chaebol firms	t-stat	All firms	t-stats	Chaebol firms	t-stat
SBC during 91-97	0.5194*	2.484	0.4793**	2.762	0.3890	1.247
Age	-0.0241*	-2.569	-0.0195*	-2.537	-0.0126	-0.909
Total debt/assets	2.5140**	3.867	2.0283**	3.766	1.0665	0.957
Constant	-2.3591**	-5.097	-2.1216**	-5.306	-1.5531#	-1.718
Number of firms	364		459			111

Table 7(a). Descriptive statistics for manufacturing chaebol firms (1991-2001)

VARIABLE	FIRMS DEFAULTED IN t+1				NON-DEFAULTED FIRMS			
	MEAN	STD	MIN	MAX	MEAN	STD	MIN	MAX
Age	30.75	8.36	18.00	54.00	30.37	11.24	1.00	82.00
Gov. share (%)	0.02	0.11	0.00	0.60	0.05	0.58	0.00	11.80
Bank share (%)	18.12	22.99	0.00	89.70	10.65	10.28	0.00	75.20
Z-score	-0.08	1.39	-3.60	3.79	0.86	0.78	-6.15	4.67
ΔBank debt/assets	0.01	0.19	-0.78	0.35	0.03	0.12	-0.52	0.81
ΔShort-term bank debt/assets	0.02	0.18	-0.76	0.28	0.02	0.11	-0.55	0.68
ΔAdj. bank debt/assets	-0.03	0.20	-0.78	0.35	0.02	0.12	-0.52	0.81
EBITDA/assets	0.02	0.13	-0.42	0.18	0.11	0.07	-0.24	0.61
Cash flow/assets	-0.01	0.09	-0.21	0.14	0.05	0.09	-0.43	0.49
Invest./assets	0.08	0.07	0.00	0.30	0.08	0.08	0.00	0.68
Assets	1,480	2,533	42	13,020	1,374.9	2,681.8	13	27,410
EBITDA	86.6	206.8	-226	882.6	186.9	637.9	-467.8	10,101
Market value	183.7	443	5.5	2,215.6	357	1,712	3	33,058

Note: all monetary values are in billion won in current prices (exchange rate as of 3/27/04: 1,158 :$1)

Table 7(b). Descriptive statistics for manufacturing chaebol firms (1991-1996)

VARIABLE	FIRMS DEFAULTED IN t+1				NON-DEFAULTED FIRMS			
	MEAN	STD	MIN	MAX	MEAN	STD	MIN	MAX
Age	30.25	9.93	18.00	52.00	28.31	10.64	7.00	77.00
Gov. share (%)	0.00	0.00	0.00	0.00	0.01	0.22	0.00	4.80
Bank share (%)	14.83	7.92	3.40	31.50	13.90	9.56	0.00	40.90
Z-score	0.30	0.87	-1.97	1.22	0.96	0.61	-1.85	4.35
ΔBank debt/assets	0.11	0.12	-0.06	0.35	0.05	0.10	-0.26	0.63
ΔShort-term bank debt/assets	0.10	0.12	-0.06	0.28	0.04	0.08	-0.23	0.55
ΔAdj. bank debt/assets	0.10	0.13	-0.06	0.35	0.05	0.10	-0.26	0.63
EBITDA/assets	0.06	0.13	-0.35	0.18	0.11	0.06	-0.23	0.59
Cash flow/assets	0.02	0.09	-0.21	0.14	0.05	0.08	-0.43	0.42
Invest./assets	0.09	0.06	0.00	0.18	0.08	0.08	0.00	0.68
Assets	1,114.5	1,790.8	168.9	6,623	865	1,459.7	14.8	14,700
EBITDA	91	225	-226	732	122.6	408.8	-12	6,662
Market value	181	361.6	8	1,313	228.8	479.8	3	6,542.6

Note: all monetary values are in billion won in current prices (exchange rate as of 3/27/04: 1,158 :$1)

Table 7(c). Descriptive statistics for manufacturing chaebol firms (1999-2001)

VARIABLE	FIRMS DEFAULTED IN t+1				NON-DEFAULTED FIRMS			
	MEAN	STD	MIN	MAX	MEAN	STD	MIN	MAX
Age	33.58	7.32	26.00	54.00	34.39	11.68	1.00	82.00
Gov. share (%)	0.05	0.17	0.00	0.60	0.16	1.12	0.00	11.80
Bank share (%)	31.47	32.36	0.00	89.70	5.31	10.62	0.00	75.20
Z-score	-0.46	1.81	-3.60	3.79	0.83	0.97	-2.25	4.67
ΔBank debt/assets	-0.08	0.24	-0.78	0.09	-0.03	0.11	-0.38	0.51
ΔShort-term bank debt/assets	-0.07	0.22	-0.76	0.08	-0.03	0.10	-0.48	0.20
ΔAdj. bank debt/assets	-0.14	0.23	-0.78	0.06	-0.04	0.11	-0.43	0.38
EBITDA/assets	0.01	0.14	-0.42	0.14	0.10	0.08	-0.24	0.61
Cash flow/assets	-0.01	0.10	-0.21	0.11	0.06	0.09	-0.34	0.49
Invest./assets	0.06	0.06	0.00	0.21	0.08	0.09	0.00	0.59
Assets	1,652.9	1,219	52	3,426	2,282	4,065	13	27,410
EBITDA	65	83	-57.7	259.6	285	925	-215.8	10,101
Market value	101	158	5.5	575.7	739.9	3,316.8	3.6	33,058

Note: all monetary values are in billion won in current prices (exchange rate as of 3/27/04: 1,158 :$1)

Table 8. Z-score regressions (chaebols and non-chaebols; fixed effects)

Variable	ΔBank debt		ΔShort-term bank debt		ΔBank debt (adjusted)	
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Low Z-score	0.0657**	5.098	0.0436**	4.052	0.0419**	3.224
Low Z-score·Post	-0.0849**	-4.919	-0.0742**	-5.157	-0.0848**	-4.881
High Z-score	-0.0105	-0.925	-0.0120	-1.267	-0.0108	-0.948
High Z-score·Post	-0.0253	-1.417	0.0059	0.397	-0.0254	-1.410
Low Z-score (chaebols)	-0.0604**	-2.957	-0.0342*	-2.011	-0.0479*	-2.329
Low Z-score·Post (chaebols)	0.0951**	3.355	0.0318	1.344	0.0828**	2.900
High Z-score (chaebols)	-0.0031	-0.076	-0.0042	-0.123	-0.0030	-0.074
High Z-score·Post (chaebols)	-0.1225*	-2.009	0.0440	0.866	-0.1186#	-1.932
Post	-0.0403**	-4.119	-0.0282**	-3.457	-0.0407**	-4.126
Chaebol	0.0179	0.614	0.0072	0.298	0.0229	0.782
Chaebol·Post	-0.0211#	-1.661	-0.0243*	-2.295	-0.0213#	-1.663
Age	-0.0026*	-2.018	-0.0020#	-1.934	-0.0029*	-2.242
Gov. share	0.0002	0.116	0.0011	0.598	-0.0004	0.213
Bank share	-0.0009**	-3.248	-0.0005*	-2.574	-0.0009**	-3.495
Predicted int. rate	-0.8186**	-6.355	-0.3743**	-3.483	-0.9410**	-7.253
Adj. R^2	0.0706		0.0467		0.0789	
Number of obs.	3742		3742		3742	
Number of firms	530		530		530	

Note: ** - significant at 1% level; * - significant at 5% level; # - significant at 10% level

Table 9. Perfect foresight regressions (chaebols and non-chaebols; fixed effects)

Variable	ΔBank debt		ΔShort-term bank debt		ΔBank debt (adjusted)	
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Default	-0.0177	-0.799	-0.0008	-0.044	-0.0278	-1.252
Default·Post	-0.1088**	-2.747	-0.0643#	-1.945	-0.1236**	-3.107
Default (chaebol)	0.0768#	1.839	0.0588#	1.686	0.0851*	2.029
Default·Post (chaebol)	0.0087	0.136	0.0109	0.204	-0.0055	-0.086
Post	-0.0482**	-5.070	-0.0321**	-4.056	-0.0504**	-5.284
Chaebol	0.0032	0.110	0.0086	0.355	0.0076	0.262
Chaebol·Post	-0.0129	-1.219	-0.0310**	-3.484	-0.0156	-1.466
Age	-0.0022#	-1.738	-0.0022*	-2.097	-0.0026*	-2.000
Gov. share	0.0005	0.228	0.0016	0.836	0.0007	0.307
Bank share	-0.0009**	-3.412	-0.0006**	-2.967	-0.0010**	-3.528
Number of obs.	3742		3742		3742	
Number of firms	530		530		530	

Note: ** - significant at 1% level; * - significant at 5% level; # - significant at 10% leve

Table 10. Z-score regressions with 10% thresholds for the combined dataset (chaebols and non-chaebols; fixed effects)

Variable	ΔBank debt		ΔShort-term bank debt		ΔBank debt (adjusted)	
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Low Z-score	0.0606**	4.162	0.0481**	3.967	0.0372*	2.537
Low Z-score·Post	-0.0835**	-4.347	-0.0739**	-4.617	-0.0874**	-4.522
High Z-score	-0.0189#	-1.785	-0.0183*	-2.081	-0.0186#	-1.746
High Z-score·Post	-0.0176	-1.049	0.0107	0.770	-0.0178	-1.053
Low Z-score (chaebols)	-0.0335	-1.474	-0.0197	-1.041	-0.0235	-1.027
Low Z-score·Post (chaebols)	0.0649*	2.067	-0.0017	-0.065	0.0541#	1.713
High Z-score (chaebols)	0.0140	0.387	0.0188	0.623	0.0136	0.373
High Z-score·Post (chaebols)	-0.0744	-1.443	0.0171	0.400	-0.0723	-1.395
Post	-0.0421**	-4.281	-0.0303**	-3.705	-0.0424**	-4.287
Chaebol	0.0101	0.348	0.0043	0.179	0.0156	0.532
Chaebol·Post	-0.0143	-1.156	-0.0175#	-1.695	-0.0146	-1.175
Age	-0.0026*	-2.065	-0.0022*	-2.062	-0.0029*	-2.263
Gov. share	0.0004	0.189	0.0012	0.627	0.0006	0.287
Bank share	-0.0009**	-3.268	-0.0005*	-2.468	-0.0009**	-3.455
Predicted int. rate	-0.8295**	-6.431	-0.3816**	-3.554	-0.9441**	-7.275
Adj. R^2	0.0678		0.0484		0.0779	
Number of obs.	3742		3742		3742	
Number of firms	530		530		530	

Note: ** - significant at 1% level; * - significant at 5% level; # - significant at 10% level

Table 11 (a). Z-score regressions (chaebols only; fixed effects)

Variable	ΔBank debt		ΔShort-term bank debt		ΔBank debt (adjusted)	
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Low Z-score	0.0260	1.577	0.0273#	1.874	0.0122	0.738
Low Z-score Post	-0.0147	0.627	-0.0723**	-3.481	-0.0285	-1.213
High Z-score	-0.0019	-0.058	0.0019	0.069	-0.0016	-0.052
High Z-score Post	-0.0742	-1.577	0.0346	0.833	-0.0728	-1.546
Post	-0.0571**	-3.112	-0.0579**	-3.576	-0.0591**	-3.219
Age	-0.0036	-1.492	-0.0008	-0.400	-0.0037	-1.550
Gov. share	-0.0008	-0.135	-0.0008	-0.163	0.0007	0.128
Bank share	-0.0016**	-3.707	-0.0009*	-2.414	-0.0017**	-3.999
Predicted int. rate	-0.7135**	-2.804	-0.4807*	-2.141	-0.8773**	-3.447
Adj. R^2	0.1302		0.1165		0.1413	
Number of obs.	898		898		898	
Number of firms						

Note: ** - significant at 1% level; * - significant at 5% level; # - significant at 10% level

Table 11(b). Z-score regressions (chaebols only; random effects)

Variable	ΔBank debt		ΔShort-term bank debt		ΔBank debt (adjusted)	
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Low Z-score	0.0371*	2.541	0.0372**	3.048	0.0212	1.449
Low Z-score Post	-0.0262	-1.201	-0.0814**	-4.383	-0.0387#	-1.771
High Z-score	-0.0056	-0.196	-0.0083	-0.342	-0.0059	-0.206
High Z-score Post	-0.0692	-1.640	0.0252	0.705	-0.0674	-1.596
Post	-0.0764**	-6.978	-0.0629**	-6.773	-0.0784**	-7.153
Age	-0.0004	-0.892	0.00005	0.130	-0.0004	-0.771
Gov. share	-0.0010	-0.188	-0.0018	-0.372	0.0004	0.081
Bank share	-0.0011**	-2.895	-0.0005#	-1.770	-0.0012**	-3.109
Predicted int. rate	-0.6368**	-2.876	-0.4097*	-2.221	-0.8120**	-3.660
Intercept	0.1294**	5.342	0.0757**	3.981	0.1403**	5.766
Number of obs.	898		898		898	
Number of firms						

Note: ** - significant at 1% level; * - significant at 5% level; # - significant at 10% level
Hausman test of fixed effects vs. random effects is inconclusive

Table 12. Perfect foresight regressions (chaebols only; fixed effects)

Variable	ΔBank debt		ΔShort-term bank debt		ΔBank debt (adjusted)	
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Default	0.0647#	1.911	0.0565#	1.880	0.0627#	1.858
Default·Post	-0.0965*	-1.995	-0.0364	-0.850	-0.1234*	-2.557
Post	-0.0550**	-3.113	-0.0696**	-4.439	-0.0608**	-3.453
Age	-0.0041#	-1.684	-0.0015	-0.712	-0.0044#	-1.795
Gov. share	-0.0008	-0.143	-0.0008	-0.156	0.0003	0.051
Bank share	-0.0015**	-3.528	-0.0012**	-3.056	-0.0016**	-3.699
Predicted int. rate	-0.6000*	-2.348	-0.6070**	-4.439	-0.7755**	-3.043
Adj. R^2	0.1297		0.1060	-2.677	0.1455	
Number of obs.	898		898		898	
Number of firms	130		130		130	

Note: ** - significant at 1% level; * - significant at 5% level; # - significant at 10% level