Techniques for assessing corporate financial strength

This article describes the Bank's experience in using a 'Z-score' model—that is, a predictive model based on accounting data which can provide an indication of possible impending financial difficulties for individual companies.

The model has been found to have some value as a screening device, identifying companies for subsequent conventional examination and providing a useful starting point for an assessment of an individual company.

Introduction

During 1978–79 the Bank supported a research project which aimed to develop a model based on accounting data which could provide, for individual companies, an indication of possible impending financial difficulties. The results of this work were published as a Bank Discussion Paper[1] and by the Oxford Centre for Management Studies;[2] and subsequently the Bank has made some tentative use of the model in its general concern with the financial state of the corporate sector.

The Bank has not regarded this technique, known as Z-score analysis, as a substitute for more conventional techniques of assessing the position of the company sector, either in aggregate or at the level of individual firms. In the latter case, where Z-score can be expected to be of most value, careful analysis of accounts over a long period together with scrutiny of other published information is likely to provide the best—indeed the only—basis for any adequate assessment by an outsider of the financial position of a company.

A Z-score model fills a different, though complementary, role: as a composite index of apparent financial weakness, it is based upon those financial ratios in company accounts that have in the past been found to be most closely related to corporate insolvency. In this sense, it is useful in assessing an individual company, in that an analyst needs to explain the trend in the Z-score, as well as its absolute value, and to determine in each case whether the Z-score result is a valid indicator, or whether, for reasons particular to the company, it is not; and second, as an indication of where a company stands relative to others on the basis of a Z-score rating— though again, such an indication will need to be carefully examined for special factors that may have influenced the Z-score. This latter use of Z-score is a potentially important one, in that it may make possible speedy identification of companies meriting a close conventional examination. It was with these limited objectives that the Bank approached the Z-score model.

The model developed for the Bank

Although based on independent research, the principles underlying the model developed for the Bank did not differ greatly from those underlying earlier multivariate studies in this field. The general approach has been to combine a number of accounting ratios covering profitability, liquidity, cash flow, gearing, and, less commonly, the stock price, into a single ratio, usually described as the Z-score.

The model produced for the Bank incorporated flow of funds variables, which had seldom featured in previous work, and compared their usefulness with the more conventional balance sheet and profit and loss ratios. The final model took the form:

$$Z = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4$$

where:
- x_1 = ratio of current assets to gross total assets;
- x_2 = reciprocal of gross total assets;
- x_3 = ratio of cash flow to current liabilities;
- x_4 = ratio of funds generated from operations minus the net increase in working capital to total debt;
- b_j = regression weights.

The model was derived from examination of a large number of accounting ratios of 38 'failed' and 53 'non-failed' listed industrial companies; it was found to be more accurate, using data for three years, at discriminating between the failed and non-failed companies than earlier models. As a test of the validity of the model it was applied to another sample of 10 failed and 19 non-failed firms: successful classification of these firms would to some extent have verified the predictive ability of the model. Although the model misclassified over 50% of the non-failed firms as failures in this relatively small sample, the sample deliberately included a number of firms which were believed to be experiencing financial difficulty: it was encouraging that these firms at risk of failure and in need of further analysis were assigned low Z-scores, which indicated a risk of failure.

(1) *A method of quantifying companies' relative financial strength* by D A J Marais, Bank of England Discussion Paper No 4. (No longer in print but available from University Microfilms International: see the inside back cover for details).

(2) *The prediction of corporate bankruptcy in the UK using discriminant analysis* by M J Earl and D A J Marais, Oxford Centre for Management Studies MRP 79/5.

The use of the model

Although the model performed adequately in tests on sample data, it was recognised from the outset that in practical use the Z-score formula could be regarded as no more than a sifting device that might help to point to companies which should be analysed in detail, and possibly as a rough guide to priorities. In no sense was a low Z-score to be regarded as 'predicting' the inevitable failure of a company.

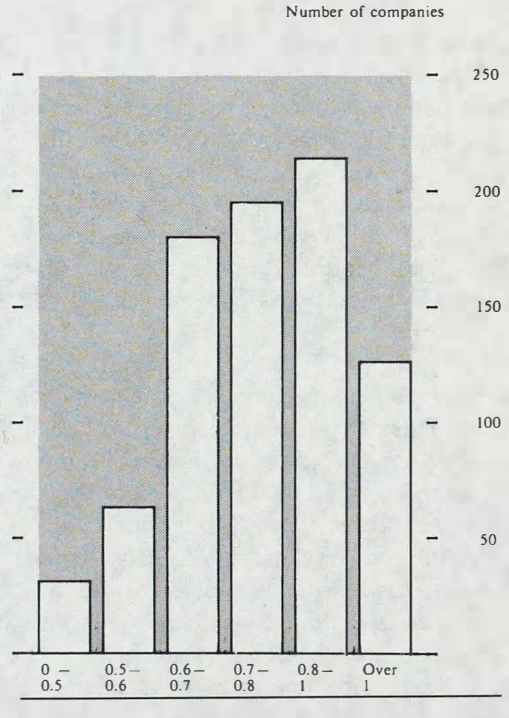
There are a number of reasons for treating Z-score results with caution. First, and most obviously, there are marked variations between the accounting practices of different companies, which make exact comparisons impossible. The profitability of one company may be over-stated or under-stated relative to another by, for example, the classification of certain items as exceptional or extraordinary, or by the adoption of different depreciation policies. There may be other variations in accounting practices, for instance in the revaluation of properties or the treatment of certain types of finance—notably leasing—as off-balance sheet items: these accounting variations can also make comparisons in conventional analysis difficult, particularly in so far as they affect the measurement of capital gearing. For all of these reasons, there are major difficulties in comparing the Z-scores of different companies or in establishing a system of ranking companies according to Z-score.

Second, even if all companies' accounts were prepared on a wholly consistent basis, there are likely to be variations between the profiles of different companies simply as a result of the nature of their businesses. Firms engaged in longer-term contracts, for example, often show substantial advance payments in their balance sheets, and merchanting companies can support much higher capital gearing than would be regarded as normal or acceptable for a manufacturing company. These divergences can cause substantial differences between the financial ratios reported by companies, and consequently in their Z-scores, so the differences do not necessarily imply that one company is more or less at risk of failure than another. In practice, the Bank's formula is not particularly effective for shipping, construction, contracting and merchanting companies; and while it might be possible to derive separate models for companies in these sectors, in most cases the shortage of suitable data on failed companies would make this difficult to achieve. Nor is the formula generally suitable for unlisted companies.

Third, any reference to a Z-score has to be qualified by the fact that it is derived from the latest published annual accounts of the company concerned. No company produces the range of accounting data required for Z-score analysis in its (non-statutory) interim statement; and as annual accounts will typically be published four to six months after the company's year-end, analysts are frequently working on data that are well over a year old. Some smaller or vulnerable companies defer their accounts for even longer than this. Experience of problem cases suggests that difficulties can often multiply rapidly in companies which two years or less earlier might have seemed, even to a careful analyst and certainly to an inspection as cursory as a Z-score, to be quite sound. This in itself seems to point to the need for close and careful scrutiny of all possible sources of information rather than relying heavily on conclusions based solely on published accounts.

Despite these qualifications, a Z-score formula can be a useful initial screening device in identifying companies which appear to merit further examination. But because of the intrinsic problems of Z-score work, and the need not to be led by its results into overlooking potential problems, the cut-off point below which a company is judged to merit examination needs to be set rather higher than the initial research suggested. The results of the tests on the samples of failed and non-failed companies suggested that a cut-off point in the band 0.65–0.70 might be adopted; but experience has indicated that companies falling into a 'grey area' of 0.7–0.8 also merit examination, as do companies whose Z-scores, while above even this level, exhibit a strongly declining trend. This widening of the net will direct attention to a larger proportion of companies than would otherwise be the case: while some 30% of companies have Z-scores below 0.7, the inclusion of the grey area increases the proportion to more than 50%.

Z-score distribution of 809 listed companies



The use of the Z-score, and the concentration of analytical effort which such screening facilitates, makes it possible to identify with reasonable confidence those companies whose financial position is, or may shortly become, precarious. By this main criterion, the assessment procedures for which Z-score is a starting point or datum have so far performed fairly well. But both parts of the assessment are important. In 19 of the 25 or so cases in which medium-sized to large companies experienced serious financial difficulty in 1980 and 1981, the accounts prior to the difficulties coming to

light—typically more than a year out of date by the time—revealed Z-scores within or below the 0.65–0.7 cut-off area; and in a further 3 cases the Z-score fell into the grey area of 0.7–0.8. In regard to accounts for previous years, however, the discriminant power of the Z-score was much less good: taking the accounts for two years earlier, only 6 of this particular group of 25 companies fell below the lower cut-off point, although with a 0.8 cut-off, Z-score proved considerably more useful.

Medium-sized to large companies experiencing serious financial difficulty in 1980–81

	Z-score calculated on basis of accounts:		
	Immediately prior to failure or rescue	1 year earlier	2 years earlier
Number of companies with Z-score:			
Above 0.8	3	7	8
0.7–0.8	3	6	11
Below 0.7	19	12	6

Even though in all three years most Z-scores were below 0.8, this is not in itself a conclusive indication of impending difficulties; as noted above, over 50% of the listed companies in the database used by the Bank for these purposes currently have Z-scores below this point. But almost all of the companies which ran into difficulty did show a strongly declining Z-score trend—as is evident, in general terms, from the table. For some companies the decline was pronounced. Ten showed falls of 20% or more in the two preceding years, sometimes starting from a point well above the 'grey zone'. A sharply declining Z-score has indeed been such a common warning of impending financial problems that considerable attention needs to be paid to it. Nevertheless, sound companies, too, can for various reasons exhibit a falling Z-score, so whether emphasis is placed on the level or on the trend of a company's Z-score, many healthy companies need to be eliminated from the lists produced by the Z-score model. Such companies can usually be identified by a relatively brief financial analysis. The majority of the remaining companies which exhibit some symptoms of decline will not fail. In some cases the incipient financial weakness will be corrected by timely action from inside or outside the company or by an improvement in the company's trading environment. The use of scanning techniques such as Z-score, complemented by analysis of accounts and other readily available data, can often play a role in stimulating necessary corrective action by companies.

Summary

It should be clear from this brief account that experience with the model developed for the Bank has been mixed. But it would have been wrong to expect too much. A model of this nature is unlikely to have identified all those companies which have faced financial difficulties over the past few years, not least because of the varied sources of those difficulties. The model was developed to identify companies that exhibit a series of accounting relationships which have in the past been associated with failure; and, as the chart shows, there are many such companies. The main value of Z-score has been as a screening device which identifies a fairly large group of companies, each of which may merit further close examination; but the group identified by the model is very large indeed—more than half of all the companies examined—mainly because of the need to emphasise *trends* in Z-score and to look at companies in a broad band above the cut-off point identified in research work.

It may be possible to rework the Z-score model to produce a formula which better reflects current economic circumstances and current accounting conventions. Indeed there might be some merit in repeating the original research on the basis of more up-to-date samples of failed and non-failed companies, and in attempting to derive models for those sectors where the present formula does not perform adequately. But experience with the present model suggests that the gains would be limited.

This article has looked only at experience with the Bank's own Z-score. Z-score techniques and other more sophisticated techniques of risk assessment are being increasingly used in the financial community. Several commercial Z-score services are now available, and although it is sometimes difficult for users to evaluate these (the formulae used are not published) this interest in developing new techniques of analysis is to be welcomed. Used carefully, and with appropriate flexibility, such techniques can help to focus on established methods of corporate analysis.