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STATISTICAL TECHNIQUES, PROBLEMS OF MEASUREMENT, VARIABLES

As indicated in Chapter 1, the primary purpose of this study has been to construct series on yields on direct placements which would be comparable through time—series, that is, which would represent the behavior through time of yields on reasonably homogeneous instruments. This problem is identical in principle to that of comparing the prices of automobiles between two points in time. If, for such purpose, we simply used average prices, fluctuations would doubtless occur simply because an increase had occurred, from one period to another, in the number of "high-quality" (or "low-quality") cars sold, or because the meaning of high-quality (or low-quality) had itself changed.

In brief, some way had to be found of isolating those characteristics of direct placements which tended during the period to be associated significantly with variations in yield, so that, as a first approximation, those characteristics could be held constant through time. If this were not done, the series would not measure mere changes in the price of a stable commodity; they would measure also intrinsic changes in the commodity itself.

But series which hold characteristics constant will be homogeneous with respect to *quality* through time only if the weight attached to each characteristic does not change through time—or if such changes as do occur are offsetting.

In other words, the term "quality" is usually taken to mean the condition of certain ratios underlying an issue (e.g., times charges earned). It should, rather, be taken to mean the ex ante probability

that the promise made by the borrower will be kept in full. Consider two loans making the identical promise, containing identical auxiliary terms, and resting on identical underlying ratios—but issued at two different moments of time. Clearly, if risk preferences and the general level of rates are held constant, any difference between the yields on the two loans must reflect a difference in ex ante quality, i.e., a difference at the two moments of time in the meaning of the underlying ratios. In short, the underlying ratios on which a loan rests are not themselves identical with quality. They are merely part of the ingredients out of which estimates of quality, half objective, half subjective, are made.

This is not just a pedantic point. In the mid-thirties, no industrial bond which had earned charges less than twenty times was classified as Aaa. Where did this magic figure come from? Obviously, in the judgment of the rating agencies the chances were close to zero that a depression would occur of such severity that the company in question would be unable to meet its charges. It is obvious also that virtually no one today would attach the same probability to the occurrence of a great depression as he would have thirty years ago. It follows that the probability of repayment (i.e., the quality) which would be attached now to a given set of underlying ratios would be higher than the probability which would have been attached to those ratios thirty or twenty or perhaps even ten years ago. It follows further that, if we merely held underlying ratios constant, the resulting series might show "drift" simply because the meaning of the ratios, in terms of quality, had changed.

The foregoing discussion means that procedures were required here which would (1) identify those characteristics of direct placements which were relevant during the period to variations in yield; and (2) assign weights to each such characteristic in a way that would enable us to judge whether those weights changed systematically during the period.

Cross-section multiple regression responded to these requirements better than any other available technique and therefore has been used here.

Ideally, strict cross sections of time should be used, but unfortunately the total number of observations was relatively small; indeed, on many days or even in many months during the period, the number of observations available would not have appreciably exceeded the number of variables to be taken into account. This problem has been dealt with here by the use of a half year (or a quarter, depending on degrees of freedom) as the "regression unit," and by the inclusion of commitment date as a variable—so as to eliminate some of the variation with respect to time within each half year (or quarter).

The Variables

Every effort has been made to include within our original perspective every variable which might conceivably have some bearing on yield.

The dependent variable, yield, is defined as yield at commitment date to maturity. Inasmuch as most placements are bought at par, this is usually simply the coupon. The yield on an issue bought at a premium or a discount is defined as the rate which equates the sum of expected cash inflows (interest plus amortization) to the amount received by the borrowing company.[1]

In addition to the yield it offers, a debt instrument has four primary aspects, each of which has been presumed, at the outset, to be relevant to variations in yield:

1. The promise. This is represented by the stipulated agreement to repay a specified amount of principal plus a specified amount of interest at specified times.

2. The quality of the promise. This is, presumably, some estimate

[1] A portion of all direct placements are what is known in the trade as "roll-overs." A roll-over is a loan which combines an outstanding balance on an old loan (by the same lender) with a new loan at a rate which is an average of that on the old and new loans. In almost every case, the final maturity is extended beyond the maturity of the old loan and amortization is recalculated. Loans of this type have not been included in the study primarily because no satisfactory method could be found to calculate the yield on net new funds.

(usually implicit) of the probability that the promise will be kept in full.

3. The security. This is the "cushion" likely to be available to the lender in the event that earnings fall temporarily or default occurs.

4. The auxiliary terms. These are represented by those terms which are not part of the promise and without bearing on the quality thereof or on the "cushion," e.g., call provisions and restrictive covenants other than those designed to improve the quality of the promise.

THE PROMISE

The following variables (represented by "X" designations) are aspects of the promise itself.

Average term (X_3) is simply the weighted average length of the loan. Any loan requiring amortization prior to maturity may be considered to be a series of loans. Thus, a $10,000 loan for ten years, required to be amortized at the rate of $1,000 a year, is really ten separate loans of $1,000 each for periods of one to ten years, i.e., $1,000 is being loaned for one year, $1,000 for two years, and so forth. The average term of the loan is then simply

$$\frac{\Sigma a_i t_i}{\Sigma a_i}$$

where $a_1 \ldots a_n$ = the amount amortized annually and $t_1 \ldots t_n$, the number of years for which each such amount, a_i, has been outstanding. The sum of $a_1 \ldots a_n$ is, of course, the original amount of the loan. The average term of a loan thus represents the average length of time each dollar of the original loan was expected, at issue, to be outstanding.

Maturity (X_{13}) is the expected number of years to final maturity, i.e., the year in which the last payment on principal is expected to be made minus the year in which the loan was negotiated. This variable simply distinguishes between issues of the same average term but different final maturities.

Size of issue (X_8) is the total number of gross dollars received by the borrower. Cost of flotation, if any, has not been deducted.

Average size of issue (X_{16}) is the average amount expected to be outstanding per year during the life of the loan, calculated in a manner analogous to that of average term.[2]

QUALITY OF PROMISE

The "quality" of an issue is here assumed to be related to two broad classes of variables: (1) those which measure the ratio of the expected value of earnings before interest and taxes (EBIT) to pro-forma interest and (2) those which measure growth in and the variability of that ratio.

Times charges earned (X_4) is the ratio of earnings before interest and taxes (EBIT) to pro-forma interest. In general, lenders "look at" a five-year weighted average figure, EBIT, averaged over the immediately preceding five-year period, divided by pro-forma interest.

Earnings are stated in the accounting sense. They are sometimes adjusted (and sometimes not, depending on what the lending institution may have done) for items of income or expense, or both, which were expected to be nonrecurring. By and large, lenders tend to adjust earnings only for large nonrecurring items, i.e., those which are likely to have a noticeable effect on the size of the times-charges-earned ratio.

Interest is pro-forma total interest. Practice in this regard varies widely among lenders. Some include pro-forma interest expected to be payable on account of short-term bank borrowing and other short-term liabilities. Some use actual rather than pro-forma interest on the grounds that the latter will be "unfair" to growing companies. Happily, however, the basic data were always available and we were able to use a uniform standard of our own choosing.

[2] The numerator is the same in both cases but the denominators are different. In the calculation of average term, the denominator is the amount of the issue; in the calculation of average size, the denominator is the maturity of the issue.

Total pro-forma interest seemed a more reasonable choice than either pro-forma long-term interest or actual interest paid (whether total or merely long-term), especially given the fact that growth was to be taken into account in other ways.[3]

The ratio of EBIT to pro-forma interest, of course, tells the lender how many dollars of EBIT will be available to pay each dollar of expected charges, on the assumption that earnings in the future will be no worse than they have been in the immediate past. On the same assumption, the ratio is also a rough, indirect measure of the ability of the company to repay principal out of earnings. For example, on a 5 per cent, twenty-year loan, to be amortized in equal annual instalments, two times pro-forma interest (before taxes) would be equal to one instalment on the loan.[4] Thus, a times-charges-earned ratio of three would mean that the borrower's average earnings over the past five years would just be sufficient to pay interest plus amortization due in the first year. In a few cases, data on earnings were not available five years back. No issues were included however, unless three years were available.

Dispersion of EBIT (X_{17}). Two companies with the same average times-charges-earned ratio may present different degrees of risk because of differences in dispersion about those averages. In order to take variation of this sort into account, the standard deviation of EBIT was calculated (around trend) for each issue, and divided by the mean thereof.

Growth of EBIT (X_9). Three companies may have the same average times-charges-earned ratios, with the same dispersion, but represent, nevertheless, different degrees of risk: earnings in one case may be stable; in the second, growing; and in the third, declining. In order to take account of variation in this respect, least-squares trends were fitted to EBIT. The absolute amount of the trend was divided by the five-year mean of EBIT in order to put all trends on a comparable basis.

[3] In general, depreciation is left out of account in calculating the ratio.
[4] Assuming an approximate 50 per cent tax rate.

SECURITY

Lenders do not ask merely what, in any given case, the relative probability of repayment is—assuming the continuation of the conditions prevailing during the preceding five years. They ask also: (1) what would happen to any given loan if a recession occurred and (2) what recourse would be available if such a loan did, in fact, default?

In an attempt to answer these questions, lenders look primarily at the ratio of working capital to long-term debt, the ratio of long-term debt to total capital, and the lien position of the particular security.

The ratio of working capital to long-term debt (X_{14}). What does this ratio mean? Presumably, in a period of business recession, if sales declined, working capital would "run off" into cash and become available for repayment of long-term debt; i.e., inventory and receivables (on the asset side) would undergo a net decline, the addition to receivables would be less than collections (unless the decline in business activity affected the ability of customers to repay), and inventory would be used up faster than it was replaced.

Thus, a company which has a sizeable cushion of working capital relative to long-term debt would probably be able to service that debt for some time, even if sales declined, or perhaps pay it off entirely. Working capital, then, is a rough measure of recession-liquidity, and the ratio of working capital to long-term debt is a measure of recession-liquidity per dollar of long-term debt.

For the present purpose, the relevant ratio has been taken to be that of pro-forma working capital to pro-forma long-term debt. For finance companies, the following variables were used: the ratio of cash plus net receivables to total debt (X_{22}), the ratio of net receivables to EBIT (X_{20}), trend in the latter ratio (X_{21}) and the standard deviation around that trend (X_{25}). The ratio of net receivables to EBIT was a proxy for the ratio of net receivables to volume of business on which data were not available over a suffi-

ciently large number of issues. The ratio of net receivables to volume of business is a measure of the average term of net receivables. A low ratio tends to indicate that receivables are turning rapidly.

The ratio of long-term debt to total capital (X_{15}). Lenders are also interested in what their position is likely to be if the company defaults and its creditors should be obliged to foreclose. A rough measure of this is provided by the ratio of total debt to net tangible assets.[5] This ratio measures the "cushion" which would be available to the company's creditors in the event of liquidation. For example, if the ratio is .50, total assets could be sold at 50 per cent of their respective book values and still leave sufficient funds to pay off all debt in full. As an index of this "cushion," the ratio of pro-forma long-term debt to total pro-forma capitalization has been used.[6] For finance companies, the ratio of net worth to senior and equal long-term debt was used (X_{24}).

Type of lien (X_5). Lenders are also interested in the position they will occupy should foreclosure become necessary. All loans have therefore been classified in terms of lien position. The assumption has been made that any loan secured by specific property (real or other) or specific income (i.e., rents) will carry a lower yield (all else being equal) than an unsecured loan. All loans have been put into one or another of the following classes: (1) first lien on specific property; (2) other lien on specific property, secured by securities or by a lease; (3) senior debenture or note; and (4) subordinated debenture or note.

AUXILIARY TERMS

Years nonrefundable (X_7) is the only variable in this category which has been taken into account. Call premia were left out primarily because, in most cases, they are fixed after yield has been

[5] Alternative measures would be total debt divided by total tangible assets and long-term debt divided by tangible net worth.

[6] The sum of net worth and pro-forma long-term debt. Data on total debt were not available on a sufficiently large number of issues.

determined and are the same as or not materially different from the coupon on the issue.

MISCELLANEOUS VARIABLES

Certain other variables which, on the surface, seem to add little if anything to those discussed above, have also been taken into account. These variables bear more on the issuer than on the issue itself, its quality or underlying security. They have been taken into account because lenders indicated that their "attitude" toward an issue could be substantially affected by them.

Size of company. In general, lenders feel more comfortable about a loan made to a large company than about one made to a small company. Therefore, other things being equal, yields on loans to large companies will tend to be less than yields on loans to small companies. Three measures of size have been used: a *five-year average of EBIT* (X_{12}), a five-year average of *sales* (X_{19}), and *total-pro-forma capitalization* (X_2).

Ratio of EBIT to sales (X_{10}, X_{11}, X_{18}). This ratio has been included as a test of efficiency. If two companies, identical in every other respect, differ in this respect, the presumption is that the company with the higher average ratio of EBIT to sales would be able to borrow at lower cost. If the two companies were identical also in terms of their *average* ratios, the presumption is that the company whose ratio showed the larger trend and/or the smaller standard deviation would be able to borrow at lower cost. Hence the ratio itself (averaged over the five-year period immediately preceding commitment date), the coefficient of variation of that average, and trend have all been taken into account. For finance companies, the ratio of EBIT to net worth (X_{23}) was used.

Industrial Classification (X_6). All issues have been classified by type of business of the borrower. Two classifications have been used for industrials—durable and nondurable; three for finance companies—sales finance, personal loan, and both; and five for utilities—electric and telephone, gas pipelines, water and gas distribution, urban transport, and other.

TABLE 12

Identification Number and Description of All Variables Tested

X_1	A time variable[a]
X_2	Total pro-forma capitalization
X_3	Average term
X_4	Times pro-forma interest earned
X_{4r}	Total pro-forma interest
X_5	Type of security
X_6	Industrial class
X_7	Years nonrefundable
X_8	Size of issue
X_9	Relative trend in EBIT (earnings before interest and taxes)
X_{10}	Relative trend in ratio of EBIT to sales
X_{11}	Coefficient of variation in ratio of EBIT to sales
X_{12}	EBIT
X_{13}	Maturity
X_{14}	Ratio of working capital to pro-forma long-term debt
X_{15}	Ratio of pro-forma long-term debt to pro-forma total capitalization
X_{16}	Average size of issue
X_{17}	Coefficient of variation of EBIT
X_{18}	Ratio of EBIT to sales
X_{19}	Sales
X_{20}	Ratio of net receivables to EBIT
X_{21}	Ratio of net receivables to EBIT, trend
X_{22}	Ratio of cash plus net receivables to total debt
X_{23}	Ratio of EBIT to net worth
X_{24}	Ratio of net worth to senior and equal pro-forma long-term debt
X_{25}	Ratio of net receivables to EBIT, σ around trend

[a]Month of quarter for industrials, quarter or half-year for utilities, and the yield on Aaa corporates for finance companies.

TABLE 13

Variables Tested for Each Class of Issue

	Industrials	Utilities	Finance Companies
X_1	x	x	x
X_2	x	x	x
X_3	x	x	x
X_4	x	x	x
X_{4r}	x	x	–
X_5	x	x	x
X_6	x	x	x
X_7	x	x	–
X_8	x	x	x
X_9	x	x	x
X_{10}	x	x	–
X_{11}	x	x	–
X_{12}	x	x	x
X_{13}	x	x	x
X_{14}	x	–	–
X_{15}	x	x	–
X_{16}	x	x	–
X_{17}	x	x	x
X_{18}	x	x	–
X_{19}	x	x	–
X_{20}	–	–	x
X_{21}	–	–	x
X_{22}	–	–	x
X_{23}	–	–	x
X_{24}	–	–	x
X_{25}	–	–	x

Table 12 lists, by identification number, all the variables tested. Table 13 indicates which of the variables discussed above were tested for each of the three classes of issues.[7]

[7] It goes without saying that some variables which just might have some bearing on yield have not been included in the analysis. Depreciation charges, for example, have nowhere been taken into account nor have so-called restrictive covenants, i.e., restrictions on dividend payments, on the sale of assets or on the issuance of equal or prior debt, and so forth. Depreciation charges have not been taken into account largely because data were not uniformly available. Restrictive covenants have not been taken into account largely because they could not be satisfactorily quantified.