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Appendix A

SIGNS OF THE COEFFICIENTS

Tables A-1 and A-2 give expected signs and actual signs for each coefficient included in the final reruns. For some coefficients, under the column headed "expected sign," a priori considerations ran in both directions and their net weight was not clear. With respect to b_3 (average term) and b_{13} (maturity), for example, the cross-

TABLE A-1

Industrials: Ten Regression Coefficients, Expected Sign, Actual Sign Cross Sections, and Actual Sign "Over-All" Regression

Coefficient	Expected Sign	Actual Sign[a]	
		Cross Sections	Over-All Regression
b_2	−	−	−
b_3	b	−	−
b_{4r}	+	+	+
b_5	+	−	−
b_6	−	−	−
b_7	−	+	+
b_8	b	−	−
b_{12}	−	−	−
b_{13}	b	−	−
b_{15}	b	−	−

[a]See Tables 25 and 26.
[b]The net weight of a priori considerations was unclear.

TABLE A-2

Public Utilities: Ten Regression Coefficients, Expected Sign, Actual Sign Cross Sections, and Actual Sign "Over-All" Regression

Coefficient	Expected Sign	Actual Sign[a]	
		Cross Sections	Over-All Regression
b_2	-	-	-
b_3	b	-	-
b_{4r}	+	+	+
b_5	+	+	+
b_6	b	-	-
b_7	-	+	+
b_8	b	-	-
b_{12}	-	-	-
b_{13}	b	+	+
b_{15}	b	-	-

[a]See Tables 43 and 44.
[b]The net weight of a priori considerations was unclear.

section analysis did not hold constant expectations as to the future course of interest rates. Clearly, an expectation that rates would decline could be sufficiently strong to outweigh the greater risk implicit in longer duration. The same kind of consideration applies to the ratio of long-term debt to total capital, given the fact that total interest (i.e., total debt) is being held constant. In other words, given total debt, would we expect lenders to prefer a higher long-term debt ratio or a lower one? So far as utilities are concerned, would we expect that, other things being equal, yields on the issues of electric and telephone companies would be higher or lower than yields on the issues of water and gas distribution companies? Clearly, questions such as these can be answered only by reference to the facts.

Type of Security

Table A-1 indicates that, for industrials, b_5 (type of security) takes the wrong sign. The sign indicates that, other things being equal, yields are lower on debentures than on mortgage bonds. This, of course, is the reverse of the finding which had been expected.

It seems altogether possible that X_5 is really measuring those industry effects not held constant by X_6. X_6 is simply a dummy variable (0,1) which merely distinguishes between producers of durable goods and producers of consumer goods. The b_6 coefficient carried the "right" sign, i.e., yields are lower on the issues of companies which produce consumer goods. But producers of both types of goods vary a good deal among themselves with respect, say, to the stability of earnings. Those who have the better records (or prospects) tend, doubtless, to be more likely to be able to obtain funds on their general credit. In brief, X_5 is probably acting as a proxy for those industry effects not held constant by X_6 as defined. This hypothesis finds some support in the fact that b_5 for utilities carries the right sign (Table A-2); X_6 for utilities holds industry effects much more closely constant than does X_6 for industrials.[1]

It would not have been possible to dummy in the thirty-odd two-digit classes for industrials without reducing degrees of freedom well below zero.

Years Nonrefundable

This coefficient was positive for both industrials and utilities. Neither was very large: a change of one standard deviation in X_7 would be capable of affecting yield by something less than 1 per cent. Nevertheless the sign is clearly positive.

[1] Both b_5,s decline in importance after 1955. Over the period, lenders seem to have cared less about differences in the stability of earnings—perhaps because those differences became smaller (Charts D-1 and D-2).

The simple correlation between yield and X_7 was predominantly negative for industrials and predominantly positive for utilities. This was true for industrials primarily because X_7 was correlated positively with the size and duration variables. The larger companies which, in general, pay less for money, get the longer maturities, and the longer the maturity of an issue, the longer will be the period of nonrefundability. So far as utilities are concerned, however, X_7 tends not to be correlated to any significant extent with any other variable (Table 34) and therefore the sign it carries tends to indicate the direction of its separate effect on yield. In other words, for industrials, when the effects of the other variables with which X_7 is correlated, are "partialled out," X_7 shows itself to be positive.

But the question remains: why does yield vary positively with X_7? The numbers which have been used to quantify X_7 must in fact also be measuring something else which, a priori, would vary positively with yield but which is not included in the regressions. Bargaining strength might be one such variable: if two issues are identical in every respect, but the issuer of the first happens to be in a relatively weaker bargaining position than the issuer of the second, that issuer will pay a relatively higher price for money and may find himself also forced to accept a longer period of nonrefundability. In such a case, the longer period of nonrefundability would merely be a measure of his relative bargaining weakness. This hypothesis may or may not be valid, but we should bear in mind that despite the large number of variables which has here been taken into account, some variables had, perforce, to be omitted. Bargaining strength is one and it is not difficult to think of others on which it would have been equally difficult to collect quantifiable data.

Industrial Class

The sign on this coefficient for utilities means that, other things being equal, yields are somewhat lower on the issues of water

and gas distribution companies than on the issues of electric and telephone companies. This finding is not really surprising. The simple correlation between yield and X_6 (Table 34) was positive, but as Table 51 suggests, the issues of water and gas distribution companies are, on the average, of substantially lesser "quality" than the issues of electric and telephone companies. When "quality" is equated as between the two types of issues, yields are found to be somewhat lower on those of water and gas distribution companies.

Average Term and Maturity

When maturity (X_{13}) and size of issue (X_8) are held constant, average term (X_3) measures weighted average amortization, i.e., given two issues of the same size and maturity, average term will be longer on the issue which is amortized later in its life, and vice versa. Table A-3 illustrates this point for two issues of $1 million and five-years maturity. Issue A, which is amortized in equal amounts in each year, has an average term of three years. Issue B, which is not amortized at all in the first three years and is amortized in equal amounts in years four and five, has an average term of four and a half years.[2] With size and maturity held constant, average term is thus an unambiguous measure of duration.

However, with average term and size held constant, maturity has a rather special meaning. If two issues of the same size and average term differ in maturity, their amortization schedules must also differ, and the issue with the longer maturity will tend to be more heavily amortized in the early years of its life. Table A-4 illustrates this point by comparing the amortization schedules of two issues of the same size and average term but of different maturity. Issue A has a maturity of five years and is identical to Issue A in Table A-3. Issue B, however, has a maturity of ten years. In order to equate average term on the two issues, amortiza-

[2] When an issue is not amortized at all during its life but simply paid off in full at maturity, average term and maturity are the same.

TABLE A-3

Comparison of Average Term of $1 Million Issue of Five-Years Maturity with Different Amortization Schedules

Years	Amortization (000 dollars)	Weighted Amortization
	ISSUE "A"	
1	200	200
2	200	400
3	200	600
4	200	800
5	200	1000
Total	1000	3000
	Average Term = $\frac{3000}{1000}$ = 3 Years	
	ISSUE "B"	
1	--	--
2	--	--
3	--	--
4	500	2000
5	500	2500
Total	1000	4500
	Average Term = $\frac{4500}{1000}$ = 4.5 Years	

tion on the longer issue must be heavier in the earlier, less-heavily weighted years. In the illustration, 96.5 per cent of Issue B, but only 80 per cent of Issue A, is amortized in the first four years. Thus, with average term and size held constant, the coefficient on maturity is assessing the *net* effect of two opposite influences on yield—longer final maturity as such and, given that longer life, heavier amortization in the earlier years of the loan.

The behavior of the coefficients on average term may be summarized as follows:

1. For industrials (Chart D-1), from mid-1953 to the end of 1958 lenders were offering a premium for longer duration—presumably because they expected interest rates to decline. After 1958, this premium disappeared.

2. For utilities (Chart D-2), lenders appeared to prefer longer

TABLE A-4

Comparison of Amortization Schedules of $1 Million Issue of Three-Years Average Term, with Different Maturities

Years	Amortization (000 dollars)	Weighted Amortization
	ISSUE "A"	
1	200	200
2	200	400
3	200	600
4	200	800
5	200	1000
Total	1000	3000
	Average Term = $\frac{3000}{1000}$ = 3 Years	
	ISSUE "B"	
1	200	200
2	200	400
3	200	600
4	365	1460
5	--	--
6	--	--
7	--	--
8	--	--
9	--	--
10	35	350
Total	1000	3010
	Average Term = $\frac{3010}{1000}$ = 3 Years	

duration through the whole period although this preference weakened noticeably after mid-1958. After mid-1958 none of the coefficients on average term is significant.

The coefficients on maturity are telling us essentially the same tale, namely, that until 1957–58, a borrower who wanted a longer maturity had to take a longer average term also in order to avoid being required to pay a higher yield.

Chart D-1 indicates that until the second quarter of 1958, the coefficient on maturity for industrials was predominantly positive. During this period, it showed eighteen plus and eleven minus signs. But between the second quarter of 1958 and the fourth quarter of 1961, it showed thirteen minus signs and just two plus signs. This sharp change in the behavior of the coefficient between 1958 and 1961 was sufficient to cause the sign to be negative over-all and, on balance, in the cross sections.

The coefficient for utilities showed sixteen plus signs and six minus signs in the cross sections and was positive in the over-all regression. The coefficient was trending strongly downward, however, and was predominantly positive only until the first half of 1957. During this period, eleven of thirteen signs were positive. Thereafter, the coefficient showed five plus and four minus signs—and a weighted average of the last nine coefficients would carry a negative sign.

In short, it appears that "something happened" in 1957–58 which caused b_3 and b_{13} for industrials and b_{13} for utilities to change sign; it also caused b_3 for utilties to weaken substantially.[3]

What happened in 1957–58 which might explain the change in the behavior of these coefficients? The answer is, perhaps, not far to seek. After a trough in mid-1958, interest rates began to rise sharply (e.g. Chart 8) and at the same time, presumably, expectations as to their future course changed drastically.

The results here suggest fairly strongly that we should not

[3] Interestingly enough, the coefficient on maturity for finance company placements showed similar behavior. It was positive for the first two cross sections (1951–54 and 1955–57) but negative in the third (1958–61).

expect the signs on duration variables to be uniformly positive. The signs will tend to be determined in large part by current expectations as to the future course of interest rates.

Long-Term Debt Ratio

The sign on b_{15} simply indicates that, given total debt, lenders prefer companies with less short-term and more long-term debt. This finding can be rationalized readily enough: if a company has relatively less short-term debt, debt service (interest plus amortization) will be less per dollar of total debt, simply because short-term debt must, in general, be fully amortized within the current year.[4] This means that, given total debt, the company with relatively more long-term debt will have more cash available to service its total debt.

When the regressions were run with X_4 omitted, b_{15} carried a plus sign for both industrials and utilities—although, of course, X_4 doubtless acts as a proxy for X_{15} when the latter is omitted.

[4] Either by net cash outlay or by new borrowing.