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5

The Ex Ante Quality of Direct Placements, 1951-61

Avery B. Cohan

INTRODUCTION

The ideal measure of the ex ante quality of any debt instrument is, as Macaulay pointed out nearly thirty years ago, the probability that interest and principal will be paid in full and on time.[1] This measure is "ideal" for two primary reasons: *first,* probabilities would take ac-

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I am obliged to the Life Insurance Association of America, which provided most of the necessary financial support for this study—as it did for the study of yields; to the Graduate School of Business Administration of the University of North Carolina (and its Dean, Maurice W. Lee), which provided research assistance and computer time; and to the Workshop in Finance of the Graduate School of Business Administration of the University of North Carolina (and especially to three of its most vocal members: DeWitt C. Dearborn, Henry Latané, and Robert Litzenberger). I am obliged also for the help and counsel of: Lawrence Fisher, Harold Fraine, Milton Friedman, Sidney Homer, Robert Hendrickson, William Hale, Lawrence Jones, Richard McEnally, Robert Parks, Stanley Trustman, and Henry Wallich.

But my greatest obligation is, perhaps, to the Bureau's Review Committee consisting of Jack Guttentag, F. Thomas Juster, Phillip Cagan, and Geoffrey Moore, all of whom, and especially Dr. Moore, devoted much time and energy to the various preliminary versions of the manuscript.

Joan Tron edited the manuscript with great patience, skill, and understanding. H. Irving Forman drew the charts.

[1] Frederick R. Macaulay, *Some Theoretical Problems Suggested by the Movements of Interest Rates, Bond Yields and Stock Prices in the United States since 1856*, New York, NBER, 1938, p. 60.

count of expected economic conditions—as underlying ratios (e.g., times charges earned, debt-equity ratios, and so forth) either separately or combined in some way, cannot; and economic conditions are probably more important than the intrinsic chararteristics of an issue in determining whether that issue will fault during its life and, if so, to what degree. *Second,* probabilities are continuous and cardinal, not discrete and ordinal as are, for example, agency ratings.

There is also a third reason, albeit of a somewhat different order: if lenders, in the process of assessing a new issue, thought of ex ante quality as a probability, and proceeded to articulate the probability, as defined above, appropriate to that issue, they would be led directly to the yield they should require on that issue.[2]

Presumably, when Macaulay used the term "probability" he meant objective (not subjective) probability—as with a fair coin tossed under ideal conditions. But a debt instrument is not a coin, and although objective probabilities for debt instruments must in fact exist, no attempt has been made to unearth them.[3] This study, using a sample of direct placements, attempts to derive the *subjective* probabilities present in the minds of lenders when the direct placements in question were bought.[4] This study is admittedly exploratory, and the results are valid only to the degree that the following proposition is valid: the subjective probability can be derived from the ratio of the return on a government bond to the return on a direct placement of the same maturity—provided that the ratio is adjusted for "extraneous influences" (e.g., differential call deferment) and provided also that various assumptions about the characteristics of the relevant portions of the market for long-term corporate capital are satisfied.

Before discussing the "extraneous influences" and the assumptions, it will be worthwhile to speculate on how the subjective probabilities might be formulated and used by lenders. The subjective probability, which is the object of study here, is the product of two subsidiary proba-

[2] If, for example, the probability that all payments on a proposed new ten-year issue would be made on time were estimated to be .895, and the prevailing yield on ten-year riskless securities were 5.00 per cent, the required return on the new issue would be approximately 1.0617 (see below, p. 285 ff.).

[3] Some progress might be made in this direction by using the data, covering the period 1900–43, amassed by the National Bureau's Bond Project.

[4] Direct placements are long-term loans made directly to business by life insurance companies and pension and mutual funds. For a detailed definition, see Avery B. Cohan, *Yields on Corporate Debt Directly Placed,* New York, NBER, 1967, pp. 8–11.

bilities, namely, (1) the probability that a proposed new issue with specific characteristics will be paid off in full and on time provided given economic conditions prevail during its life, and (2) the probability that such economic conditions will in fact prevail. Table 5-1 illustrates (albeit in a highly simplified situation) the process of using the two subsidiary probabilities to reach the probability implicit, as above, in the relationship between the return on a government bond and the return on a direct placement of the same maturity. For the purposes

TABLE 5-1. *Illustration of Calculation on Hypothetical Issue, of Probability of Repayment in Full and on Time*

State of Nature[a]	P_1	P_2	$P_1 \times P_2$
1. Continuous growth, no recessions	.25	.95	.2375
2. Steady upward trend, periodic minor recessions	.65	.80	.5200
3. Steady upward trend, periodic minor recessions, one severe depression	.10	.50	.0500
Total	1.00		.8075

NOTE: P_1 = the probability of each state of nature; P_2 = the probability for repayment in full and on time, for a given state of nature.

[a]See text explanation.

of the illustration three possible economic climates ("states of nature") are postulated to prevail during the life of the debt instrument in question: (1) continuous growth in real GNP at full employment, no recessions; (2) steady upward trend in real GNP, periodic minor recessions with moderate (6–7 per cent) unemployment; and (3) steady upward trend in real GNP, periodic minor recessions, as above, one severe depression lasting 12–18 months with peak unemployment of 12–14 per cent.

These three "states of nature" are, of course, assumed to be mutually exclusive and no other "states of nature" are assumed to be possible. The sum of the probabilities under P_1 in Table 5-1 is thus 1.00. These probabilities simply quantify the hypothetical lender's expectations about the economic atmosphere that will prevail during the life of the debt instrument. The probabilities under P_2 in Table

5-1 are the probabilities, subjectively formulated by the hypothetical lender, that all payments of interest and principal will be made in full and on time, given the corresponding state of nature. These probabilities are thus conditional. They do not add to 1.00.[5]

Where do the probabilities under P_2 (in column 2) come from and what do they really mean? In order to answer these questions we assume a ten-year issue, interest and principal payable annually, and a highly knowledgeable, sophisticated, and systematic lender! The lender, after formulating the probabilities in column 1 (P_1), examines the proposed issue and asks himself what the probability is that such an issue would meet its first payment, at some assumed rate of interest and schedule of amortization, given the first "state of nature." He reflects on the history of issues of this general type and decides that the probability is high, .995. He then asks himself what probability should be attached to the second payment, given that the first has been made in full and on time. He decides that it also is .995. And so forth for each of the succeeding eight years (the successive probabilities need not be the same: they can either rise or decline or take on any movement whatever).[6] Then, in order to ascertain the probability that all payments will be made in full and on time, he multiplies all ten conditional probabilities together. If he has chosen probabilities that are all equal he need only raise .995 to the tenth power. In Table 5-1 the product of the ten probabilities is equal to $(.995)^{10}$ or .950. The latter figure is then the probability that all payments will be made in full and on time given the first state of nature. The lender then repeats the process for each of the other two states of nature, does the necessary arithmetic, and obtains the final probability, .8075, given at the bottom of column 3 of Table 5-1. This is the probability we

[5] The analogy is with a game under the rules of which the player draws first from an urn containing 25 red balls, 65 green balls, and 10 white balls. The probability that the player will draw a red, green, or white ball is 1.00. If he draws a red ball he then draws from an urn containing 95 $10 bills and 5 pieces of paper bearing the legend: go back to start. If he draws a green ball he then draws from an urn containing 80 $10 bills and 20 pieces of paper bearing the above legend. If he draws a white ball he draws from an urn containing 50 $10 bills and 50 pieces of paper. The conditional probabilities that he will draw a $10 bill on his second draw are thus, respectively, .95, .80, and .50. The probability, at the start of the game, that he will draw a $10 bill is therefore .8075.

[6] The subjective probabilities fixed, at any given time on any given issue, separately by a number of lenders would presumably fluctuate normally about their mean.

are here trying to derive, i.e., the subjective probability that all payments will be made in full and on time—whatever the state of nature.

A few comments on the foregoing "description" of the "lending process" are perhaps in order:

(1) The description sounds artificial: few lenders, if any, would go through the kind of deliberate process described above and few, if any, would so much as think in terms of probabilities. Yet all the probabilities illustrated in Table 5-1 are implicit in every yield every lender sets—given the rate on riskless securities of the same maturity as the proposed issue.[7]

(2) The final probability, .8075 in the illustration, can be used explicitly to fix the return (i.e., 1 + yield) on the proposed issue, given the return prevailing on riskless securities of the same maturity as the proposed new issue. The lender knows, if he is sensible, that on the average he cannot expect to earn more than the return on comparable riskless securities—if he lends in a competitive market.[8] He therefore uses the rate on comparable riskless securities as his discount rate. He then sets up the following present value equation:

$$1 = \frac{rP_1}{1+g} + \frac{r(P_1P_2)}{(1+g)^2} + \cdots + \frac{(1+r)(P_1P_2 \ldots P_{10})}{(1+g)^{10}},$$

where r is the coupon on the proposed new issue; g is the prevailing rate on governments of the same maturity; and $P_1, P_2, \ldots, P_{10}$ are the annual probabilities described above, .979 in the illustration.[9]

The foregoing equation simply means that the present value of the future payments on the proposed new issue cannot exceed the present value of the future payments on a government security of the same maturity.

The lender can now proceed in either of two ways: he can solve for r iteratively or he can solve, in general terms, for P and then solve for r. The latter course is simpler. Solving for P gives:

$$P = \frac{1+g}{1+r}$$

if all the conditional P's ($P_1, P_2, \ldots, P_{10}$) are the same, $P = P_1 = P_2 = \ldots P_{10}$. If the $P_1, P_2, \ldots, P_{10}$ differ among themselves, P is

[7] Regardless of the proposed amortization schedule of the proposed new issue—provided only that the two *maturities* are the same.

[8] This matter is discussed further below.

[9] Actually, in the illustration, $P^{10} = .8075$ and $\sqrt[10]{.8075} = .979$.

simply the nth root of their product or, in the above illustration, .979.[10]

Now that the lender knows that $P = (1 + g)/(1 + r)$, he can obtain r readily. Substituting the simple probability obtained in the illustration above ($\sqrt[10]{.8075} = .979$), and assuming that ten-year governments are selling to return 1.04, r (the required yield on the proposed issue) is 6.23 per cent approximately.[11] Again, few lenders, if any, go through this process explicitly but each and every one of them, with no exceptions, and whether they know it or not, go through it implicitly. Even if a lender does nothing but look at an issue casually and then fix a yield on it, he is making implicit assumptions about the probabilities described above.[12]

The proposed new issue would not be identical to governments in certain "extraneous" ways. The lender might want protection against call and if he did he would have to reduce his required yield accordingly. In addition, he would want to be compensated for that part of the cost of running his investment department that he would not incur if he bought only governments. Also, if he happened to be poorly diversified and therefore risk averse, or if he were risk averse for any other reason, he might seek additional yield on that account. But in any case, working from the underlying probabilities and the return on governments of the same maturity as the proposed new issue, he could determine an appropriate yield on the new issue and adjust, according to his disposition, for call, risk preference, and so forth.[13]

The raw materials of this study are the returns, i.e., the $(1 + r)$'s and the $(1 + g)$'s. In effect we are trying to reverse the process described above: instead of deriving the return (or the yield) from the subjective probabilities, as above, we attempt here to derive the subjective probabilities from the returns. However, the observed returns, as the foregoing illustration makes clear, reflect the effect of various

[10] $(.979)^{10} = .8075$.

[11] $1.04/.979 = 1.0623$.

[12] The process is, of course, a trial-and-error process: in order to assign the initial P's, the lender would have to assume a coupon rate and amortization schedule. He would proceed to obtain a required yield and if this yield and the yield assumed were materially different, he would assume a yield somewhere between the yield initially assumed and the tentative required yield and go through the process again. He would proceed by this process of successive approximation until the two yields were the same.

[13] Whether the lender would in fact be able to obtain an extra risk aversion premium is perhaps doubtful. This fact may explain, in part, why small insurance companies during the period in question were, in effect, unable to bid successfully for direct placements.

extraneous influences. And the derivation process itself is obviously based on a number of assumptions. And unless the ratio $(1+g)/(1+r)$ can be adjusted for extraneous influences and/or if the assumptions are not reasonably accurate, it (the ratio) will not be a pure risk ratio—i.e., it will not be the probability we are seeking.

(3) The following illustration may serve to make the meaning of the P's and the P^n's somewhat clearer. In order to keep the necessary computations within reasonable bounds, we assume a sample of 10,000 three-year bonds, all in the same risk class, sold at the same time at par with a coupon of 6 per cent, and that three-year governments are selling to yield 4 per cent. We assume further that we have adjusted the yield on the risky bonds for extraneous influences and, of course, that the various necessary assumptions are satisfied. We invest $1 in each bond.

First, we obtain the average probability by dividing $(1+g)$ by $(1+r)$ and find that it is approximately .9811. Second, we set up the following equation, assuming that $P_1 = P_2 = P_3$:[14]

$$\begin{aligned} 10{,}000 &= \frac{600(.98113)}{1.04} + \frac{600(.98113)^2}{(1.04)^2} = \frac{10{,}600(.98113)^3}{(1.04)^3} \\ &= \frac{588.68}{1.04} + \frac{577.57}{1.0816} + \frac{10{,}011.28}{1.124864} \\ &= 566.04 + 534.00 + 8{,}899.99 \\ &= 10{,}000\ (10{,}000.03) \end{aligned}$$

How should this result be interpreted? On its face, the result means that of the 10,000 bonds 189 will not make either the first payment or any subsequent payment. Of the 9811 remaining alive at the end of the first period, 185 will not make the second or third payments. And of the 9,626 remaining alive at the end of the second period, 181 will not make the final payment. But obviously, we need not interpret the probabilities in this rigid way: we could assume merely that the interest payments on all bonds in the first period would total \$588.68 (.98113 $\times$ \$600) and that, in the second period, they would total \$577.57 [$(.98113)^2 \times 600$] and that interest and principal in the final period would total \$10,011.28 [$(.98113)^3 \times \$10{,}600$]. But this is merely one particular example of the most general case, namely, that the cash inflows on the risky bond, discounted at the rate on riskless securities of the same maturity, must be equal to one times the

[14] To repeat: this assumption is not necessary—provided only that $P_1 \times P_2 \times P_3 = P^3$ or, in this case, .9445.

number of dollars invested—in this case \$10,000. And the ratio $(1+g) / (1+r)$ simply measures the extent to which the promised cash flows are expected to be reduced in order that the above equality will hold. In other words, the actual cash flows can assume any pattern or shape whatsoever: some of the 10,000 bonds may default and be subsequently "worked out," some may be a total loss, some may merely be late in paying interest or principal, and so forth, provided only that $(1+r)\ P = (1+g)$. We could say, as above, that $10{,}000 - P(10{,}000)$ tells us how many bonds will be a total loss, i.e., will make no payments at all, namely, 189. But we could also say that P tells us how much of the original expected cash inflow, \$11,800 appropriately discounted, is not really expected to be received, namely, \$1,800, so that the actual present value of the group of 10,000 bonds would really be expected to be \$10,000—or the present value of \$10,000 invested in riskless securities of the same maturity.

(4) The final compound probabilities (the figure .8075 at the bottom of Table 5-1) are fairly sensitive to the values of the subsidiary probabilities. If, for example, the probability of state of nature number 1 had been fixed at zero and the probability of state of nature number 2 correspondingly raised to .90, the other probabilities remaining the same, the final compound probability would have been reduced to about .77. If the probabilities of state of nature numbers 2 and 3 had been fixed, respectively, at .80 and .20, the final probability would have been about .74.

The next section of the paper summarizes findings. The section thereafter examines, in some detail, the extraneous influences and the assumptions. We then derive and adjust the average and compound probabilities. The final section evaluates the results.

SUMMARY

This study does, essentially, four things: (1) It attempts to assess the effect of the extraneous influences on the yield differential between corporates and governments; (2) It suggests a new measure of the quality of new corporate debt issues, namely, the *probability* that all payments of interest and principal will be made in full and on time; (3) It computes this measure quarterly for a large sample of the direct placements bought by life insurance companies during the period 1951–61, separately for industrials, utilities, and finance company issues; (4) It adjusts the results for what appear, in fact, to be the two most important extraneous influences, namely, the effect on yields on direct placement of (a) risk-aversion on the part of the life insurance companies and (b) differential call deferment as between direct placements and governments.

The findings will be of primary interest to policy makers, students of the business cycle, and regulatory agencies. They will perhaps also be of interest to investors and to those scholars and practitioners who are interested in developing better measures of the quality of both new and outstanding credit instruments.

The conclusions are: (1) Of the various extraneous influences, only two are likely to affect the probabilities in a significant way for the present purpose, namely, differences in call provisions when yields are generally high and expected to fall, and risk aversion on the part of lenders.

(2) Because the life insurance companies are risk averse, yield differentials (and hence the probabilities) are sensitive to fluctuations in the volume of lower-grade financing. In 1955–57, for example, when the volume of lower-grade financing was very heavy, the life insurance companies required yields on direct placements that were substantially higher than necessary to compensate for the risk of default alone. When the effect on the probabilities of the volume of lower-grade financing was removed (by use of regression techniques), they (the probabilities) rose by as much as 14 percentage points (see Charts 5-4, 5-5, and 5-6).

(3) Long-term governments have, generally, much longer call deferment than direct placements. For this reason yields on direct placements are higher, relative to yields on governments, than they would be on the basis of risk alone. These differences range roughly from 5 to 40 basis points and affect the compound probabilities by as much as 10–12 percentage points (see Charts 5-12, 5-13, and 5-14).

(4) The quality of direct placements may have deteriorated slightly during the period under study. The average probability, as defined above, for the direct placements bought in 1951–53 was .807 for industrials, .809 for utilities, and .816 for finance company issues. In 1959–61, these probabilities had declined, respectively, to .763, .781, and .778 (see Table 5-13).

(5) For the period as a whole, average compound probabilities were .783 for industrials, .795 for utilities, and .811 for finance

company issues (see Table 5-13). For the period 1900–43, the "realized compound probabilities" implicit in the Hickman-Fraine results (for issues comparable, in composition, to the direct placement sample) were .754 for industrials and .721 for utilities.

ASSUMPTIONS AND EXTRANEOUS INFLUENCES

As indicated above, the term "quality ex ante" is here taken to mean the estimate, explicit or implicit, made by the lender at time of issue, of the probability that the promise made by the borrower will be kept in full. This estimate, although usually based on "objective" data (i.e., on the historical record), must be subjective because, in its nature, it cannot be anything else: it is a subjective evaluation of the historical record in the context of the circumstances surrounding the purchase of the new debt instrument. And it is perfectly possible for two identical issues, bought at different times, to have different probabilities attached to them by lenders.

Ideally then, we are seeking, for each new issue (and for new issues on the average), period by period, an estimate of the subjective probability of repayment in full and on time, i.e., the probability that the realized yield on any bond (or group of bonds) will be equal to the promised yield on that bond (or group of bonds). And, of course, if we could obtain a time series of such probabilities, we would be able to observe whether the probabilities were increasing (higher quality) or decreasing (lower quality).[15]

Unhappily, probabilities in the above sense, even if explicitly formulated, are not part of the public record: they appear only via their

[15] We should, of course, be very careful about the inferences we draw from the behavior of the probabilities—after all, from the lenders viewpoint, the expected yield on the worst bonds, taken as a group, should be equal to the rate on riskless bonds. We could say only that as quality, in the above sense, declined, defaults per dollar of bonds bought would probably increase. But the fact that quality, in this sense, had declined would not necessarily mean that the insurance companies were or would be "worse off." In fact, it doubtless means the reverse, provided yields had been properly determined on lower quality issues: if yields had been appropriately determined on lower quality issues the insurance companies would be able, in effect, to invest their enormous flows of cash to yield the current rate on riskless securities. If they tried to invest these cash flows directly in riskless securities, they would, doubtless, drive yields on those securities down to a point below, probably well below, the prevailing yield on such securities.

effect on yields. Now, assuming that bonds can be grouped into homogeneous risk classes, the expected value of $1 worth of bonds in any risk class should be equal to the expected value of $1 worth of bonds in every other risk class and to the value of $1 of riskless bonds. This, in turn, means that the yield differential between a direct placement and a government bond of the same maturity should be a measure or an index, in some sense, of the probability we seek, provided (1) that governments are considered by investors to be riskless; (2) that the direct placement market is a fully competitive market from the point of view of the issuer, i.e., that no issuer need pay more for money than the yield on governments of the same maturity (and relevant nonquality characteristics) plus an appropriate risk premium; (3) that the buyers of direct placements are able to move funds freely from one type of security to another—mortgages, direct placements, other corporates, governments—in order to take advantage of whatever yield differentials may appear; (4) that the direct placement and government bonds being compared have the same nonquality characteristics; (5) that the yields being compared are net yields, i.e., that the yield on the direct placement is net of any cost of origination; and (6) that the buyers of direct placements are risk neutral.

Of these six provisos, the last is perhaps the most important. If lenders are in fact risk averse, they will tend to require, on lower-grade securities, yields higher than necessary to compensate for the pure risk of default alone. And if they do, the yield differentials on which this study is based will be distorted.

But under study here are only those corporate issues (direct placements) bought directly by large financial institutions rather than by "the public." Large financial institutions ought not to have risk preferences. What, after all, is risk preference? If an investor holds a large, diversified bond portfolio, there ought to be no real difference to him between a riskless bond and a very risky one, provided the degree of risk of the risky bond has been properly assessed and the yield on it is such that its expected value is the same as that on the riskless bond.[16] In other words, the large investor who has sufficient cash coming in, in each period, to meet his obligations (as the life companies do) and who is able to hold, relative to total assets, small

[16] Except to the extent that substantial defaults may be misinterpreted by management to mean that a portfolio manager has not been doing his job properly.

amounts of a large number of issues is really taking no risk whatever—provided he has properly assessed the probabilities. For such an investor, the investment problem consists essentially in assessing probabilities, calculating appropriate yields on new issues, forecasting the future course of interest rates and "arbitraging" the market. But, to repeat, if such investors are in fact risk averse, i.e., if they prefer bonds with a lower expected variance of return to bonds with a higher expected variance of return, they will require yields higher than necessary to compensate for pure risk alone. And hence, the yield differential between direct placements and governments will be higher than would otherwise be the case.

So far as the other assumptions, above, are concerned, we assume:

(1) *That governments are free of the risk of fault.* This assumption seems reasonable enough.

(2) *That the direct placement market is a competitive market.* It follows that no borrower has to pay more for money than the rate on a comparable government security plus an appropriate risk premium. This assumption does not seem unreasonable, given the fact that the direct placement market is made up of over sixty life insurance companies, plus a number of pension and mutual funds.

(3) *That the large financial institutions are able to switch the various assets in their portfolios so as to equate yields on all types of assets at the margin.* In other words, if expected yields on direct placements were to rise above the yield on governments (or vice versa), the insurance companies should be free to sell mortgages or governments or anything else in order to buy direct placements (or in the converse case, to sell direct placements in order to buy governments). This assumption is dubious because no satisfactory secondary markets exist in either direct placements or mortgages.

On the other hand, during the period under study here, the insurance companies held a large volume of governments: $13,459 million at the beginning of 1951 and $6,134 million at the end of 1961.[17] If, during the period, expected yields on direct placements had been above yields on governments for very long, the life insurance companies could have sold more governments than they actually did sell, in order to buy direct placements. Further, if expected yields on direct placements had been below the yield on governments for very long, holdings of direct placements would not have increased continuously

[17] The great bulk of these securities were held by the sixty largest life companies, i.e., by the principal purchasers of direct placements.

during the period, as in fact they did. In other words, if expected yields on direct placements had long been below the yield on governments, cash flow would not have been reinvested in direct placements. And, in such case, the volume of direct placements held by the insurance companies would have declined in at least some periods. In fact, however, the reverse occurred.

(4) *That the direct placement and government bonds being compared have the same nonquality characteristics.* The two most important nonquality characteristics, apart from maturity, are marketability and call protection. In general, direct placements are not marketable but usually can be called by the borrower after some specified period of time. Government securities, on the other hand, are highly marketable and generally cannot be called at all—they are generally protected against call through their lives (there are occasional exceptions: some long-term governments can be called five to ten years prior to maturity but not before then).

The difference in call protection means that, other things being equal, yields on governments should be lower than yields on direct placements. But the amount by which they will be lower will vary depending on expectations as to the future course of interest rates. When rates are expected to rise, the difference on this score will be zero or negligible. When rates are expected to go down, the difference may be as much as 40 basis points.

In addition, other things being equal, yields on governments should be lower because of their greater marketability—although it seems likely that the insurance companies attach little if any importance to marketability and, in order to obtain it, would be willing to sacrifice little if any yield on the direct placements they buy. But, perhaps, some part of the yield differential between direct placements and governments is due to differences in marketability between the two types of securities.

No adjustment has been made here for differences in marketability between governments and direct placements. An adjustment has, however, been made for differential call deferment on the basis of data which has recently become available. This adjustment is admittedly rough.[18]

(5) *That the yields being compared are net yields.* In general,

[18] Gordon Pye, "The Value of Call Deferment on a Bond: Some Empirical Results," *Journal of Finance,* December 1967, p. 632. Pye's results became available after all the basic calculations here had been done.

when an insurance company buys government securities, it has no transactions cost and, hence, the yield offered on the government is the net yield the insurance company actually receives. But the yields used here on direct placements, are not net yields in the above sense: every insurance company that is active in the direct placement market maintains a securities department at an annual cost which is not negligible in absolute terms, but which probably does not exceed one-tenth of one per cent of funds invested each year. Thus, if net yield were calculated taking these "transaction costs" into account, it would be lower than the nominal yield by perhaps 8 to 10 basis points.[19] In other words, the yields on direct placements used in this study are somewhat higher than they would have been if they could have been put on a "net" basis.

For this reason also, then, yields on governments are somewhat understated relative to yields on direct placements, and the measures derived below are biased somewhat downward. No attempt has been made to adjust for this bias.

In sum, then, the first three assumptions seem reasonable and ought not to bias the results one way or the other. The biases introduced by the fact that direct placements are not readily marketable and by the differential "transactions cost" of direct placements are probably slight and no attempt has been made to adjust for them. Adjustments have been made, however, for "risk aversion" and for differential call deferment.

Obtaining Probabilities

As indicated above, $P = (1 + g)/(1 + r)$, where r is the coupon on a risky security with specified maturity,[20] g is the yield on a government bond of the same maturity, and P is the subjective average probability we seek.

[19] The estimate comes from trade sources. The yield on a new acquisition of $1 with maturity of 15 years and a nominal yield of 4 per cent, would be reduced to about 3.92 per cent if the cost of acquisition were one-tenth of one per cent, thus:

$$1.001 = \frac{.04}{(1 + g)} + \cdots + \frac{1.04}{(1 + g)} 15; g \div .0392.$$

[20] Virtually all the direct placements in the present sample were sold at par. For those few that were not, yield rather than coupon was used.

Ideally, in order to obtain the *P*'s we should take the following steps: (1) Monthly series should be constructed for yields on governments for every maturity from five to forty years. These yields should be free of extraneous (e.g., coupon) influences. (2) The yield on each direct placement should be adjusted to make it comparable with the yield on a riskless security of the same maturity, in terms of call provisions and the other extraneous influences.[21] (3) Each of the riskless yields, so obtained, should be divided by the yield on each direct placement bought in the same month and of the same maturity, e.g., the yield in January 1951 on riskless securities of maturity of ten years should be divided by the yield on each direct placement bought in the same month of maturity of ten years, and so forth, for each other maturity and each other month. The output of this process would be a "probability," in the above sense, for each direct placement bought in each month. (4) Each probability, so obtained, should then be raised to the n^{th} power, where n is maturity. The resulting number would be the probability that the final payment would be made on time, given that all prior payments had been made on time. (5) Each such probability should then be weighted by the size of the issue and averaged by period (quarterly). The resulting weighted average probabilities would constitute an estimate of the over-all quality of the "aggregate direct placement" bought by the life insurance companies in each period.

In essence, the procedure which has been used is as follows: (1) Using the monthly series by maturity on long-term governments constructed by the Morgan Guaranty Trust, we have obtained simple probabilities, as above, for each direct placement.[22] (2) Each such simple probability has been weighted by the size of the issue to which it pertains, and weighted average simple probabilities have been obtained quarterly—for industrials, utilities, and finance companies, separately. These weighted average simple "probabilities" are given in Tables 5-2, 5-3, and 5-4 and are shown in Charts 5-1, 5-2, and 5-3 for industrials, utilities, and finance companies, respectively.[23]

[21] None of the direct placements under study here is convertible.

[22] The Morgan Guaranty series, in effect, reads yield by maturity off a curve, fitted by hand to issues of comparable coupon. For a description of the sample of direct placements, see Cohan, *op. cit.*, pp. 11–17.

[23] The usual market rating is simply an absolute yield *differential*, stated in basis points or percentage points, between a base series and the series being measured. The measure used here is the *ratio* of the two returns, i.e., the ratio of the expected return on a government to promised return on a risky security.

TABLE 5-2. *Industrial Direct Placements, Weighted Average Simple Probabilities, Quarterly, 1951–61*

	Quarter			
Year	1	2	3	4
1951	.990	.990	.988	.989
1952	.988	.988	.990	.988
1953	.985	.990	.985	.983
1954	.988	.984	.988	.989
1955	.988	.990	.990	.982
1956	.986	.987	.988	.985
1957	.982	.982	.982	.981
1958	.980	.983	.980	.988
1959	.984	.987	.987	.984
1960	.986	.986	.980	.984
1961	.983	.984	.984	.988

NOTE: Average, 1951–61 = .9858.

TABLE 5-3. *Public Utility Direct Placements, Weighted Average Simple Probabilities, Quarterly, 1951–61*

	Quarter			
Year	1	2	3	4
1951	.988	.990	.990	.990
1952	.991	.988	.989	.994
1953	.986	.993	.987	.989
1954	.986	.993	.992	.992
1955	.988	.989	.994	.987
1956	.988	.990	.987	.983
1957	.983	.985	.985	.985
1958	.989	.983	.987	.988
1959	.991	.992	.988	.984
1960	.987	.987	.988	.988
1961	.990	.987	.991	.993

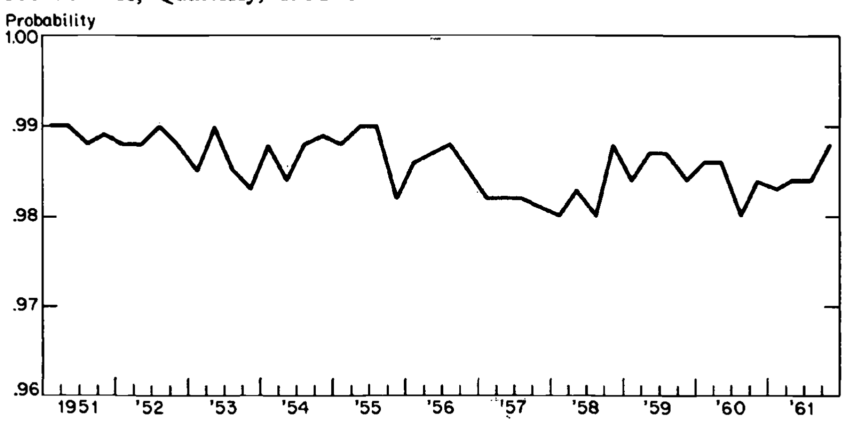
NOTE: Average, 1951–61 = .9885.

TABLE 5-4. *Finance Company Direct Placements, Weighted Average Simple Probabilities, Quarterly, 1951–61*

	Quarter			
Year	1	2	3	4
1951	.970	.988	.977	.984
1952	.977	.990	.987	.987
1953	.986	.983	.980	.981
1954	.987	.989	.993	.985
1955	.993	.989	.993	.990
1956	.986	.986	–	.982
1957	.985	.979	.983	.980
1958	.978	.979	.983	.982
1959	.985	.988	.987	.988
1960	.987	.987	.978	.982
1961	.980	.979	.989	.983

NOTE: Average, 1951–61 = .9843.

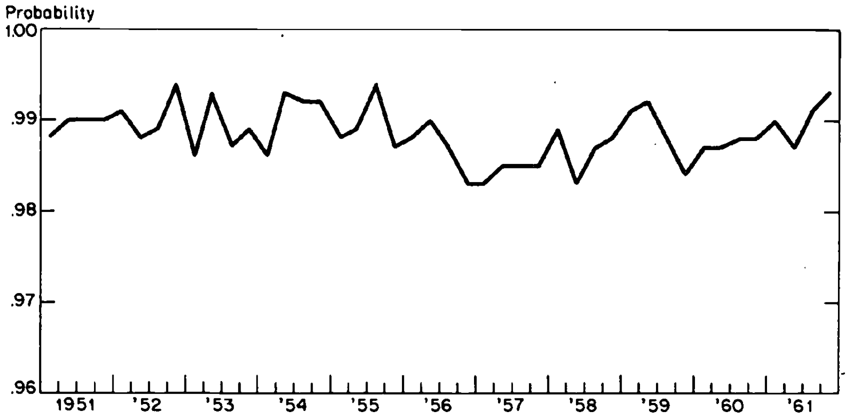
CHART 5–1. Industrial Direct Placements, Weighted Average Simple Probabilities, Quarterly, 1951–61



SOURCE: Table 5–2.

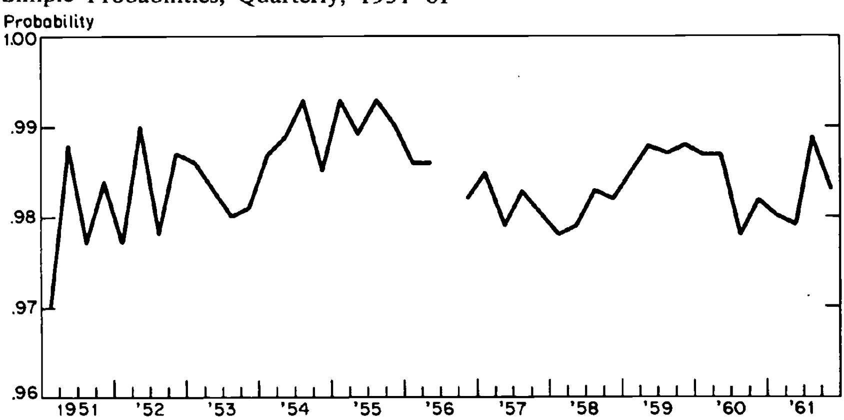
(3) Next, each individual simple probability was raised to the power equal to the maturity of the issue in order to obtain the probability that the realized yield on the issue would be equal to the promised yield. (4) Each such compound probability was then weighted by the size of the issue to which it pertained, and a weighted average compound probability was obtained quarterly for industrials, utility, and

CHART 5–2. Public Utility Direct Placements, Weighted Average Simple Probabilities, Quarterly, 1951–61



SOURCE: Table 5–3.

CHART 5–3. Finance Company Direct Placements, Weighted Average Simple Probabilities, Quarterly, 1951–61



SOURCE: Table 5–4.

finance company issues, separately. These compound probabilities are given in Table 5-5 and set forth in Charts 5-4, 5-5, and 5-6.

What the **P's** *Show*

The industrial and utility *P* series (Charts 5-1, 5-2, and 5-3) behave in much the same way. Each fluctuates more or less randomly around what is virtually a horizontal line from 1951 to mid-1956. Each then

TABLE 5-5. *Weighted Probabilities to Maturity, All Series, 1951–61*

Year and Quarter	Industrials	Utilities	Finance Companies
1951			
1	.809	.742	.784
2	.826	.767	.850
3	.844	.790	.830
4	.756	.743	.785
1952			
1	.792	.799	.788
2	.750	.801	.822
3	.799	.747	.766
4	.800	.867	.882
1953			
1	.776	.759	.808
2	.832	.825	.773
3	.799	.752	.772
4	.764	.765	.758
1954			
1	.753	.769	.817
2	.793	.818	.845
3	.795	.844	.865
4	.808	.826	.817
1955			
1	.802	.762	.897
2	.814	.787	.910
3	.845	.863	.892
4	.784	.795	.845
1956			
1	.740	.770	.821
2	.761	.798	.801
3	.811	.720	–
4	.734	.730	.799
1957			
1	.710	.673	.805
2	.680	.660	.760
3	.687	.686	.768
4	.663	.670	.695

(continued)

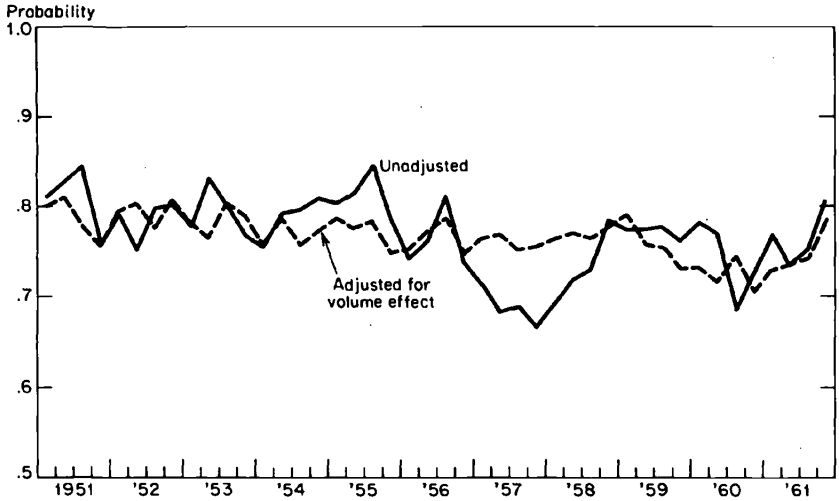
TABLE 5-5 (concluded)

Year and Quarter	Industrials	Utilities	Finance Companies
1958			
1	.690	.777	.800
2	.719	.711	.775
3	.729	.757	.736
4	.785	.719	.787
1959			
1	.773	.784	.755
2	.773	.848	.803
3	.776	.775	.831
4	.760	.626	.778
1960			
1	.782	.751	.792
2	.769	.731	.809
3	.683	.751	.713
4	.726	.702	.782
1961			
1	.770	.758	.776
2	.732	.751	.740
3	.752	.796	.804
4	.807	.816	.725
Average			
1951–61	.7671	.7632	.7991
1951–53	.7956	.7798	.8015
1959–61	.7586	.7574	.7757

moves persistently downward until 1957–58. Each then recovers and again begins to fluctuate randomly around a virtually horizontal line. The finance company *P* series fluctuates randomly around an upward trend from 1951 to the end of 1955. It then moves persistently downward until the first quarter of 1958; it then recovers and fluctuates erratically until the end of the period. The three compounded series show much the same pattern as their simple counterparts—although, in all three series, compounding has accentuated the persistent downward movement in the middle of the period.

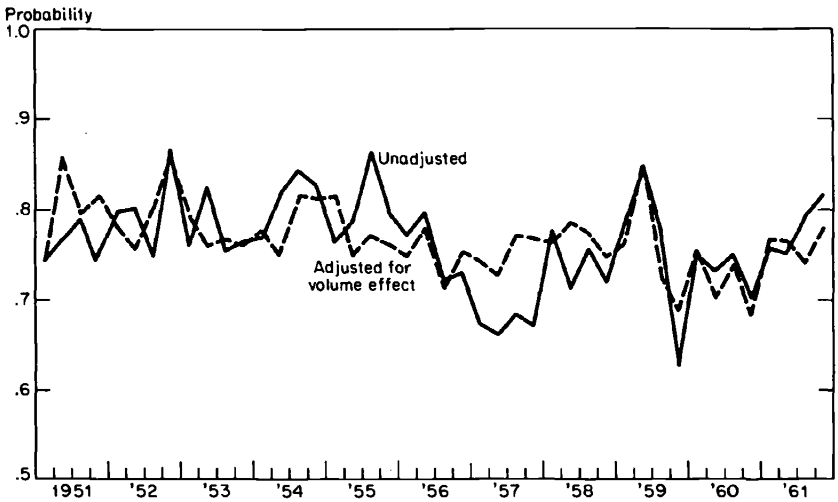
The persistent downward movement over a three-year period in all six series could, of course, be taken to mean that the quality of the

CHART 5-4. Industrials, Weighted Average Probabilities to Maturity, Quarterly, 1951–61



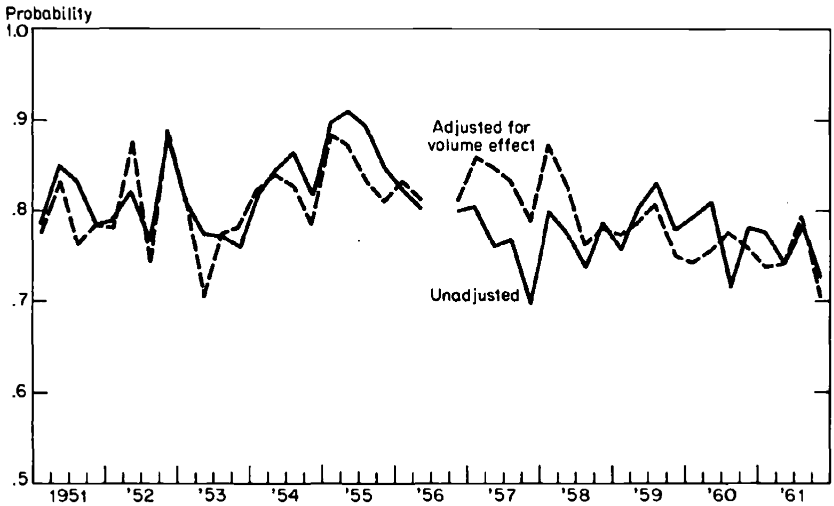
SOURCE: Tables 5-5 and 5-11.

CHART 5-5. Utilities, Weighted Average Probabilities to Maturity, Quarterly, 1951–61



SOURCE: Tables 5-5 and 5-11.

CHART 5–6. Finance Companies, Weighted Average Probabilities to Maturity, Quarterly, 1951–61



SOURCE: Tables 5–5 and 5–11.

direct placements bought from 1955 to 1958 declined steadily during that period or that, for other reasons (e.g., risk aversion), yields on direct placements rose, relative to yields on governments, as the volume of lower-grade securities purchased increased.

In an attempt to decide which of these two possibilities was more likely to be correct, probability ratios were constructed, separately for industrial, utility, and finance company issues, for an issue of fixed characteristics.

The procedure was as follows: Quarterly yield series had been constructed, for another purpose, for an industrial, a utility, and a finance company issue, each of fixed characteristics. Each of these series is analogous to a cost of living index based on a rigidly fixed basket of commodities.[24] Each quarterly return (1 + yield) for each of these series was then divided into the return during the same quarter on a comparable government. The resulting "probability ratios" are given in Table 5-6 and in Charts 5-7, 5-8, and 5-9. Inasmuch as each of the three series is, to repeat, based on a set of fixed characteristics, i.e., is of constant intrinsic quality, we would have expected the proba-

[24] The method by which these series were constructed is discussed in detail in *Yields on Corporate Debt Directly Placed,* New York, NBER, 1967, pp. 72–73.

TABLE 5-6. *Direct Placements, Return on Long-Term Governments Divided by Computed Return on Direct Placement of Fixed Characteristics, Quarterly, 1951–61*

Year and Quarter	Industrials	Utilities	Finance Companies
1951			
1	.987	.988	.985
2	.994	.990	.984
3	.984	.988	.985
4	.988	.982	.983
1952			
1	.986	.992	.983
2	.983	.991	.983
3	.985	.986	.983
4	.987	.984	.982
1953			
1	.985	.987	.983
2	.986	.987	.980
3	.987	.988	.980
4	.983	.989	.981
1954			
1	.983	.789	.982
2	.984	.988	.983
3	.984	.986	.983
4	.984	.988	.983
1955			
1	.989	.990	.987
2	.987	.989	.987
3	.987	.991	.987
4	.985	.990	.986
1956			
1	.985	.988	.987
2	.984	.987	.985
3	.983	.986	.984
4	.982	.985	.982

(continued)

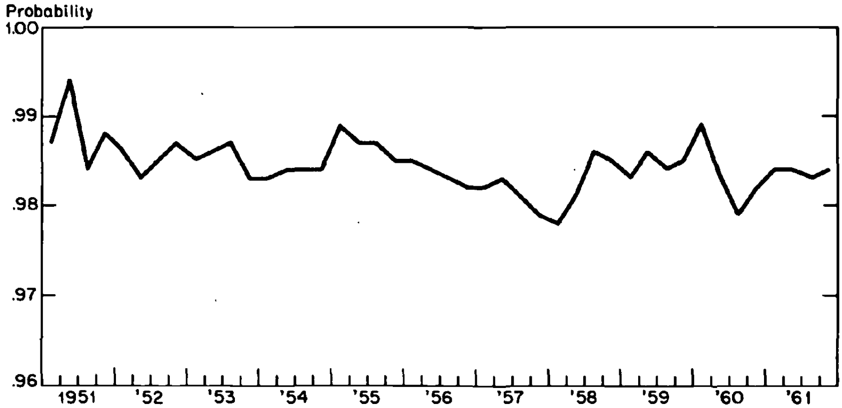
TABLE 5-6 (concluded)

Year and Quarter	Industrials	Utilities	Finance Companies
1957			
1	.982	.982	.981
2	.983	.984	.981
3	.981	.983	.979
4	.979	.983	.977
1958			
1	.978	.986	.983
2	.981	.984	.982
3	.986	.987	.983
4	.985	.988	.983
1959			
1	.983	.988	.984
2	.986	.988	.986
3	.984	.987	.983
4	.985	.984	.982
1960			
1	.989	.985	.983
2	.983	.986	.983
3	.979	.985	.911
4	.982	.984	.982
1961			
1	.984	.986	.982
2	.984	.985	.981
3	.983	.988	.981
4	.984	.990	.982

bility ratios to fluctuate randomly around a horizontal line if no extraneous influence, such as risk aversion, had been present. But in fact the three fixed characteristics series behave in much the same way as the weighted average probability ratios derived from actual issues: the ratio starts to fall in 1955 and continues downward for three years in the case of industrials, one and a half years in the case of utilities, and nearly two years in the case of finance companies.

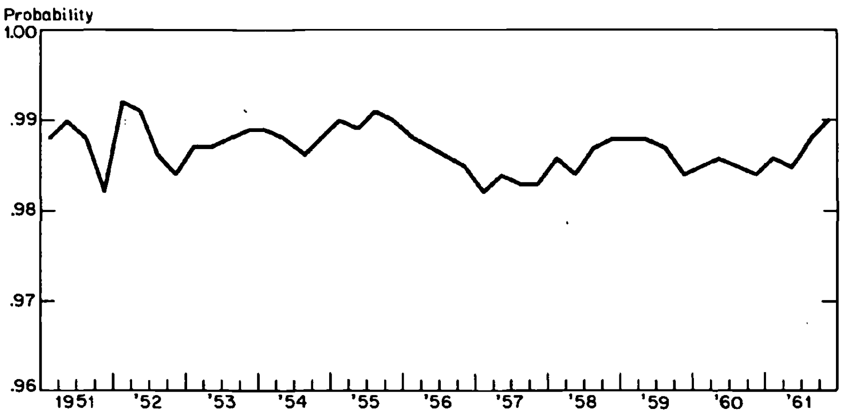
This must mean that, during this period, yields on an industrial issue, a utility issue, and a finance company issue, each of fixed char-

CHART 5–7. Industrials, Yield on Long-Term Governments Divided by Computed Yield on Fixed Characteristic Direct Placements, Quarterly, 1951–61



SOURCE: Table 5–6.

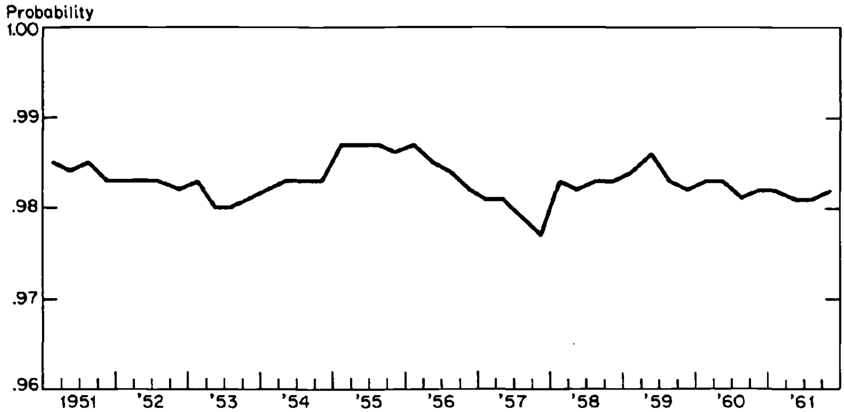
CHART 5–8. Public Utilities, Yield on Long-Term Governments Divided by Computed Yield on Fixed Characteristic Direct Placements, Quarterly, 1951–61



SOURCE: Table 5–6.

acteristics, rose relative to yields on governments. And this in turn would appear to mean that lenders, during the period, regarded an issue of fixed characteristics as being of progressively decreasing quality. But the period in question was fairly prosperous and, during such a period,

CHART 5–9. Finance Companies' Issues, Yield on Long-Term Governments Divided by Computed Yield on Fixed Characteristic Direct Placements, Quarterly, 1951–61



SOURCE: Table 5–6.

we would expect lenders to regard an issue of fixed characteristics as being of progressively improving quality rather than the reverse. This fact suggested the possibility that influences in addition to quality were affecting the behavior of the probability ratios—perhaps, as suggested above, the volume of lower-grade issues coming to market during the years 1955–57. Although the insurance companies themselves may not be risk averse, the National Association of Life Insurance Commissioners requires progressively higher loss reserves against "lower-grade" securities. This means, among other things, that in years in which the life insurance companies buy large amounts of lower-grade securities, their earnings and surplus are less than they otherwise would have been. This in turn, at least in the short term, may affect the ability of the insurance companies, both stock and mutual, to pay dividends, reduce premiums, and so forth.[25]

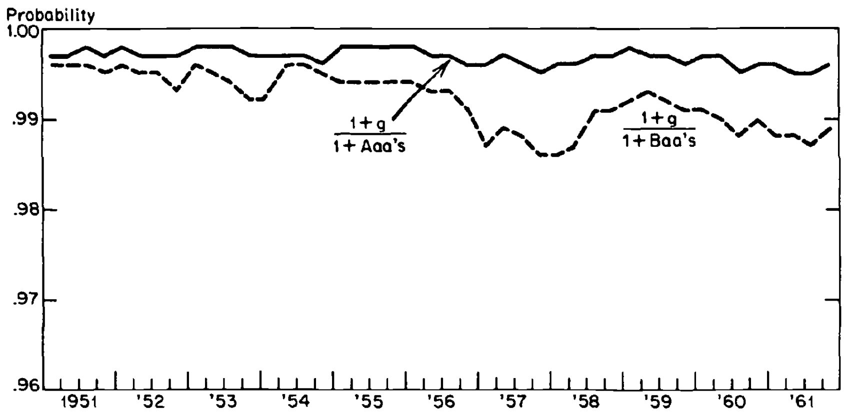
In other words, if insurance companies were risk-neutral, they would make a reasonably rapid adjustment to an increase in the demand for long-term money (regardless of quality) by selling governments and buying direct placements. The adjustment would not be instantaneous and, therefore, the probability ratio would fluctuate

[25] For a comprehensive discussion of this matter, see H. G. Fraine, *Valuation of Securities Holdings of Life Insurance Companies,* Homewood, Illinois, 1962, Chapter 1 and Appendix A.

randomly over time, unless lenders believed they were buying direct placements of progressively higher or lower quality. But if the insurance companies were risk averse, because of the restrictions imposed on them by NALIC or for other reasons, they would tend to require relatively higher yields, other things being equal, as volume rose.[26] They would, that is, require compensation for the expected value of the penalties they would incur or for the additional risk implicit in the purchase of additional securities with a higher-than-average variance of return. In order to throw some additional light on this hypothesis, probability ratios were constructed for Aaa and Baa publicly held outstandings. These ratios are set forth in Table 5-7 and Chart 5-10. The probability ratio for Aaa's despite a very slight downward trend in 1956–57 is for all practical purposes fluctuating randomly around a horizontal line. The probability ratio for Baa's, however, behaves in much the same way as the probability ratios for the three classes of direct placements, i.e., it moves sharply downward in the middle of the period.

If the foregoing hypothesis is correct, we should find a significant relationship between the volume of direct placement financing and the compounded probabilities, when allowance is made for changes in the various quality variables.

CHART 5–10. Return on Long-Term Governments Divided by Return on Moody's Aaa's or Baa's (Outstanding), Quarterly, 1951–61



SOURCE: Table 5–7.

[26] Relative to governments, i.e., the ratio of the return on governments to the return on direct placements would decline.

TABLE 5-7. *Return on Long-Term Governments Divided by Return on Moody's Aaa's and Baa's (Outstanding), Quarterly, 1951–61*

Year and Quarter	$\frac{1 + g}{1 + \text{Aaa}}$	$\frac{1 + g}{1 + \text{Baa}}$
1951		
1	.997	.996
2	.997	.996
3	.998	.996
4	.997	.995
1952		
1	.998	.996
2	.997	.995
3	.997	.995
4	.997	.993
1953		
1	.998	.996
2	.998	.995
3	.998	.994
4	.997	.992
1954		
1	.997	.992
2	.997	.996
3	.997	.996
4	.996	.995
1955		
1	.998	.994
2	.998	.994
3	.998	.994
4	.998	.994
1956		
1	.998	.994
2	.997	.993
3	.997	.993
4	.996	.991

(continued)

TABLE 5-7 (concluded)

Year and Quarter	$\frac{1+g}{1+\text{Aaa}}$	$\frac{1+g}{1+\text{Baa}}$
1957		
1	.996	.987
2	.997	.989
3	.996	.988
4	.995	.986
1958		
1	.996	.986
2	.996	.987
3	.997	.991
4	.997	.991
1959		
1	.998	.992
2	.997	.993
3	.997	.992
4	.996	.991
1960		
1	.997	.991
2	.997	.990
3	.995	.988
4	.996	.990
1961		
1	.996	.988
2	.995	.988
3	.995	.987
4	.996	.989
Average, 1951–61	.9968	.9920

NOTE: Return = 1 + yield.

The Time Series Regressions

For the purpose of testing the foregoing hypothesis, three series were available.

(1) *Deliveries.* This series, based on data collected by the SEC, gives the dollar volume of (presumably) all direct placements delivered

by borrowers to lenders. The date of delivery bears no necessary relationship to commitment date—the date on which the amount of the loan and its terms were agreed to by the borrower and the lender—but follows it by varying lengths of time depending on expectations as to the future course of interest rates. If interest rates are expected to rise, borrowers will try to anticipate their needs as far ahead as possible and, hence, the lag between commitment and delivery date will increase. The lag will tend to shorten when interest rates are expected to decline.

But yields on direct placements (and hence the probability ratios) should be sensitive not to deliveries—which, as indicated above, may take place long after yield has been fixed—but rather to commitments, which measure, albeit inversely, the supply of funds available at any given moment of time.

(2) *New Commitments.* Data are available monthly, since September 1952, on new commitments made by a large sample of life insurance companies to corporate borrowers.[27] This series measures the dollar volume of new commitments, to be delivered then or at some subsequent time, made during the month in question by the life insurance companies to corporate borrowers.[28]

(3) *Total Outstanding Commitments.* To arrive at total outstanding commitments at the end of any given period, measure the dollar volume of funds previously committed but not yet delivered to (corporate) borrowers, i.e., the dollar volume of funds newly committed, but not delivered, during the period just ended plus commitments made in all periods prior thereto, but not yet delivered. Total commitments will increase from one period to the next if new commitments exceed deliveries and will fall if deliveries exceed new commitments.[29] Because a substantial percentage of direct placements

[27] This does not include business and commercial mortgages.

[28] "A forward investment commitment is a binding agreement on the part of a lending institution to make available a given amount of funds, upon given credit terms, at specified dates or over an agreed-on period of time varying from just over a month to two or three years. The agreement gives the interest rate, maturity, redemption privileges, and so forth and sets forth a schedule of disbursement or 'take-down' of funds. . . ." The "data include some commitments to bond houses to purchase a given amount of a *public* issue. Normally, however, public issues of corporate securities do not give rise to a forward commitment partly because, to appear in the data, the commitment must have a life of over one month." James J. O'Leary, "Forward Investment Commitments of Life Insurance Companies," in *The Quality and Economic Significance of Anticipations Data,* New York, NBER, 1960, pp. 325–326.

[29] $TC_1 - TC_0 = NC_1 - D_1 - K_1$, where TC_1 = total commitments at the end

is below investment grade, this series is, in effect, an index of the volume of lower-grade securities the life insurance companies will take into their portfolios during the ensuing six to twelve months.[30] It is drawn from the same sample as the series on new commitments and it also is available only since September 1952.

The three series described above are given in index number form in Table 5-8 and Chart 5-11.[31] Chart 5-11 makes clear that new commitments, which had been fluctuating more or less randomly (except perhaps for the third quarter of 1954), began a sharp sustained rise in the second quarter of 1955. They "peaked" in the second quarter of 1956 and then fell steadily until the fourth quarter of 1957. This rise in new commitments was reflected, with a lag, in the volume of total commitments which itself peaked in the first quarter of 1957. Total commitments fell off much more slowly than new commitments and did not reach bottom until the fourth quarter of 1959.

Regressions were run on the volume of deliveries and the various quality variables. One regression was run for industrials and one for utilities over the period 1951–61, with the quarterly compounded probabilities as the dependent variable and the quarterly volume of deliveries and quarterly averages of the ten quality variables as the explanatory variables. The volume of deliveries was lagged one quarter in an attempt to make it comparable with the probability ratios, which were, of course, based on commitment date.

of period 1; TC_0 = total commitments at the end of period 0; NC_1 = new commitments made during period 1; D_1 = deliveries made during period 1; and K_1 = cancellations, during period 1, of commitments previously made.

There is an analogy here, of course, between shipments (deliveries), new orders (new commitments), and unfilled orders (total outstanding commitments). Pressure on prices will be greatest when both unfilled orders and new orders are both high and rising. The correlation between the deliveries series and the total commitments series is —.059 or, for all practical purposes, zero. The fact that this correlation is low does not mean, of course, that it could not have been improved by establishing "appropriate" lag or lead relationships between them. But given the results presented below, experimentation along these lines did not seem worthwhile.

[30] See T. R. Atkinson, *Trends in Corporate Bond Quality*, New York, NBER, 1967, pp. 29–30.

[31] The coverage of the two commitments series changed somewhat during the period. In 1952, for example, 58 companies representing 66.6 per cent of the assets of all U.S. life insurance companies reported commitments. In 1961, 64 companies representing 65.2 per cent of the assets of all U.S. life insurance companies did so. No attempt has been made to adjust the commitment figures for these small differences.

TABLE 5-8. *Deliveries, Total Commitments, and New Commitments of Direct Placements to Corporate Borrowers, Quarterly, 1951–61 (1953 quarterly average = 100)*

Year and Quarter	Deliveries	Total Commitments[a]	New Commitments[b]
1951			
1	140.8	NA	NA
2	92.1	NA	NA
3	126.3	NA	NA
4	102.6	NA	NA
1952			
1	125.0	NA	NA
2	105.3	NA	NA
3	148.7	123.0	NA
4	119.7	96.3	84.5
1953			
1	94.7	105.9	119.6
2	110.5	102.2	119.7
3	97.4	100.0	78.8
4	97.4	91.9	81.9
1954			
1	94.7	101.5	115.1
2	131.6	99.3	91.7
3	119.7	108.9	153.9
4	118.4	87.4	82.3
1955			
1	88.2	85.9	79.2
2	125.0	95.6	120.8
3	105.3	97.0	119.7
4	114.5	92.6	102.8
1956			
1	152.6	99.3	118.6
2	126.3	117.8	177.7
3	119.7	135.6	173.1
4	115.8	140.7	127.9

(continued)

TABLE 5-8 (concluded)

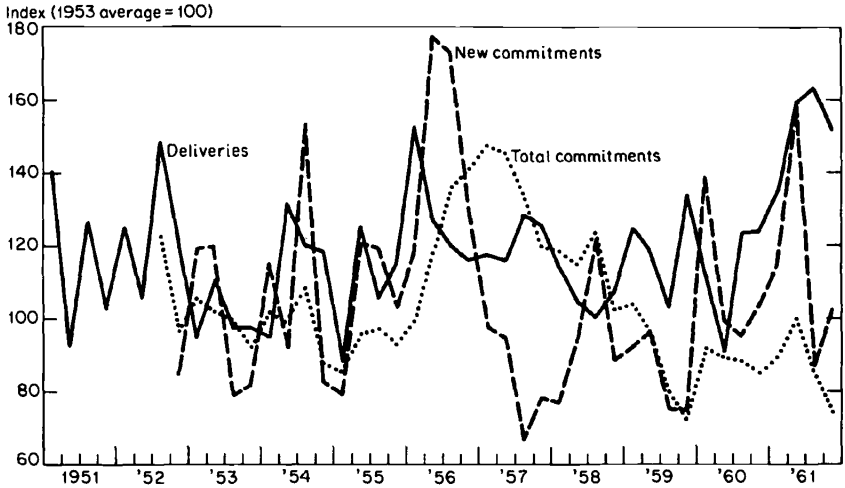
Year and Quarter	Deliveries	Total Commitments[a]	New Commitments[b]
1957			
1	117.1	147.4	97.4
2	115.8	145.9	95.0
3	128.9	134.1	66.4
4	125.0	119.3	78.6
1958			
1	113.2	118.5	77.1
2	103.9	114.8	94.8
3	100.0	123.7	122.3
4	106.6	102.2	88.4
1959			
1	125.0	103.7	92.2
2	118.4	96.3	96.5
3	102.6	80.0	74.9
4	134.2	72.6	74.5
1960			
1	111.8	91.9	138.9
2	90.9	89.6	99.3
3	123.7	88.9	95.4
4	123.7	85.2	104.2
1961			
1	135.5	89.6	114.8
2	159.2	100.0	159.0
3	163.2	85.2	86.9
4	151.3	74.1	102.8

[a]Total commitments outstanding at end of quarter.
[b]New commitments made during quarter.
NA = not available.

The quality variables included were those which when calculated quarterly had shown significance in the cross-section analysis of yields, as follows:[32] X_2 = the mean of the log of the total capital of each borrower; X_3 = the mean of the log of the average term of each issue;

[32] These variables, except X_{16} and X_{17}, are numbered as they are numbered in the Bureau's study of yields on direct placements (Cohan, *op. cit.*). They are discussed in detail and defined in Chapter 2 of that study.

CHART 5-11. Deliveries, New Commitments, and Total Commitments of Direct Placements, Quarterly, 1951–61



SOURCE: Table 5-8.

X_4 = the mean of the log of times proforma interest was earned, for each borrower; X_5 = the mean of the lien position of each issue; X_6 = the mean of the industrial classification of each issuer; X_8 = the mean of the log of the size of each issue; X_{12} = the mean of the log of the average earnings of each borrower, before interest and taxes; X_{13} = the mean of the log of the maturity of each issue; X_{15} = the mean of the log of the ratio of total long-term debt to total capital of each borrower; X_{16} = the standard deviation of X_8 above; X_{17} = the standard deviation of X_{13}, above.[33]

The last two variables were included in order to try to detect any variation in the dependent variable due solely to an unusually large issue or an unusually long maturity. The individual probabilities, as explained above, were raised to the power represented by the maturity of the issue in question and then weighted by the amount of that issue. This procedure meant that the weighted average probability for any given quarter could be materially affected by a large issue with a long maturity—if the sample in that quarter happened to be small.

[33] The values used for the above variables (X_2 through X_{17}) are given in Tables B-6 through B-13 of the study of yields on direct placements. X_5 and X_6 were coded.

The results given by the foregoing regressions were not really satisfactory and the volume of deliveries showed no significance in either of them. The R for industrials was .699 and only two variables showed significance: X_4 and X_{15}. The results for utilities were even less satisfactory than those for industrials: R was .511 and no variable was significant when all were run simultaneously—although average term (X_3) and coverage (X_4) were on the border of being so.

Very high R's had not really been expected primarily because the dependent variable, a subjective probability, was subject to substantial errors of measurement. On the other hand, the delivery data did not really respond to the hypothesis primarily because, as indicated above, delivery can and often does occur with a substantial lag after commitment date. And this lag itself will tend to vary over time depending on expectations on the future course of interest rates. This variability of the lag between commitment and delivery meant that a simple adjustment, such as lagging the deliveries series some fixed interval, would probably not be satisfactory.

A second set of regressions was then run with the "total commitments" series substituted for the deliveries series. This series was lagged two quarters, e.g., the volume of commitments at the end of the third quarter of 1953 was presumed to exert its effect on yields during the first quarter of 1954, and so forth.[34] A two-quarter lag produced a somewhat better fit than a one-quarter lag or no lag at all. This can be rationalized, readily enough, on the grounds that it simply takes time for lenders to decide whether an increase in loan applications is merely random and temporary or is likely to be sustained.[35]

[34] These regressions were run for the period 1953–61 instead of for the period 1951–61 because, as indicated above, the commitments series begins in 1952.

When the regressions were run with no lag, R was .810 for industrials and .765 for utilities. The coefficient on the volume of financing was −.0976 ($t = -4.11$) for industrials and −.0861 ($t = -3.04$) for utilities.

[35] The outstanding commitments series began in September of 1952 and, for this reason, six observations of the original forty-four (four in 1951 and two in 1952) had to be eliminated. Two additional observations on the dependent variable had to be eliminated because of the two-quarter lag.

This left thirty-six observations on the dependent variable, i.e., the thirty-six weighted average P^n's, beginning in the first quarter of 1953. These thirty-six were regressed, step-wise and separately for industrials and utilities, on the eleven quarterly averages listed above.

This process separated the significant from the nonsignificant independent variables and provided estimates of the coefficients for those that had shown

TABLE 5-9. *Industrial Direct Placements, Regression of Compound Probabilities on Total Outstanding Commitments and Various Quality Variables, Significant Coefficients and Standard Errors*

	Variables	b_i	σ_{bi}	t
X_1	Volume of financing	−.1261	.0216	−5.84
X_2	Total capital	+.0414	.0189	+2.19
X_4	Times charges earned	+.1239	.0299	+4.14
X_8	Size of issue	−.0349	.0265	−1.32
X_{15}	Dollars of long-term debt per dollar of total capital	+.1433	.0584	+2.45
X_{16}	Standard deviation of size of issue	−.0605	.0292	−2.07

NOTE: R = .854; R^2 = .730; F = 13.04; P_F = .01; standard error of estimate = .0257; degrees of freedom = 29.

The substitution of the commitment series for the deliveries series improved the results markedly. Table 5-9 summarizes results for industrials and Table 5-10, for utilities. The R for industrials has risen to .854 (from .699) and five variables, including the volume of commitments, now show significance at .025 (one tail) or better. The volume of commitments shows itself to be by far the strongest variable.

TABLE 5-10. *Public Utility Direct Placements, Regression of Compound Probabilities on Total Outstanding Commitments and Various Quality Variables, Significant Coefficients and Standard Errors*

	Variables	b_i	σ_{bi}	t
X_1	Volume of financing	−.1256	.0258	−4.87
X_3	Average term	+.0735	.0366	+2.01
X_4	Times charges earned	+.1447	.0503	+2.88
X_5	Type of Security	−.0738	.0375	−1.97
X_8	Size of issue	−.0244	.0156	−1.56
X_{16}	Standard deviation of size of issue	+.0746	.0244	+3.06
X_{17}	Standard deviation of maturity	+.2010	.0679	+2.96

NOTE: R = .805; R^2 = .648; F = 7.36; P_F < .01; standard error of estimate = .0366; degrees of freedom = 28.

significance (see Tables 5-9 and 5-10). No regressions could be run on the finance company P^n's because satisfactory averages of the independent variables could not be constructed.

Similar results were obtained for utilities: R rose from .511 to .805 and six variables showed significance at .025 or better. One variable, X_8, showed significance at approximately .05. Again, as for industrials, the volume of commitments showed itself to be the strongest variable.

Computed Probabilities

In order to eliminate the effect on the P^n's of fluctuations in the volume of total commitments, P^n's were computed, for both industrials and utilities, with the volume of financing held constant at its mean value for the period. The quality variables that had shown significance were, of course, allowed to vary. The computed P^n's are given in Table 5-11 and in Charts 5-4 and 5-5 where they are plotted against the actual P^n's. These computed P^n's respond to the question: In the subjective view of lenders, was the quality of new direct placements, on the average, improving or worsening after allowance was made for the effect of the volume of financing? An answer to this question is provided by Charts 5-4 and 5-5. In both series, the "sag" in the middle has totally disappeared. Both series now show a slight downward trend until 1959, then a drop followed by a recovery beginning in the last quarter of 1960. In the computed series, of course, only the quality variables are allowed to vary and therefore the movement of the two series reflects variation in them alone (plus, of course, a random component).[36]

[36] The adjusted series in Chart 5-6 for finance company issues was obtained by using the regression coefficient on volume of financing for industrials. This regression coefficient was virtually identical to the regression coefficient on volume of financing for utilities (see Tables 5-9 and 5-10). It seemed reasonable, therefore, to suppose that, had time series regressions been run for finance company issues, the regression coefficient on volume of financing would not have differed materially from the other two. In any case, the adjustment affects the finance company series in much the same way as it affects the other two series: The systematic downward movement between 1955 and 1957 has disappeared. The series now shows a slight upward trend from 1951–57, and a downward trend thereafter.

The computed probabilities are, in effect, weighted indexes of characteristics adjusted for the volume of lower-grade financing, the weights given to the characteristics being held constant through the period. The procedure assumes, of course, that expectations about future business conditions did not change systematically in one direction or the other during the period. Experiments with adjusting the *actual* P^n's for the effect of the volume of financing suggest that the foregoing assumption is reasonable.

TABLE 5-11. *Direct Placements, Weighted Average Compound Probabilities, Quarterly*

Year and Quarter	Industrials	Utilities	Finance Companies
1951			
1	.800	.743	.775
2	.809	.858	.833
3	.775	.793	.761
4	.755	.815	.784
1952			
1	.795	.778	.781
2	.803	.755	.875
3	.775	.802	.742
4	.807	.859	.889
1953			
1	.777	.788	.809
2	.762	.757	.703
3	.802	.767	.775
4	.787	.758	.781
1954			
1	.757	.778	.821
2	.788	.749	.840
3	.757	.816	.825
4	.773	.811	.782
1955			
1	.787	.813	.882
2	.775	.748	.871
3	:783	.772	.830
4	.747	.761	.808
1956			
1	.752	.747	.833
2	.772	.780	.812
3	.787	.712	–
4	.745	.753	.810

Adjustment for Differential Call Deferment

The probabilities assigned by lenders to new direct placements were really somewhat higher than those given in Tables 5-2, 5-3, 5-4,

TABLE 5-11 (concluded)

Year and Quarter	Industrials	Utilities	Finance Companies
1957			
1	.764	.741	.859
2	.767	.726	.847
3	.751	.772	.832
4	.754	.767	.786
1958			
1	.763	.762	.873
2	.770	.786	.826
3	.753	.773	.760
4	.777	.746	.780
1959			
1	.791	.761	.773
2	.756	.849	.786
3	.753	.721	.808
4	.729	.687	.747
1960			
1	.731	.755	.741
2	.715	.701	.755
3	.745	.741	.775
4	.703	.682	.759
1961			
1	.730	.768	.736
2	.732	.765	.740
3	.742	.740	.794
4	.785	.780	.703
Average			
1951–1961	.7655	.7667	.7977
1951–53	.7872	.7894	.7923
1959–61	.7427	.7458	.7597

NOTE: Probabilities were computed on the assumption that total outstanding commitments remained unchanged during the period.

5-5, and 5-11 above, because the probabilities given in those tables do not take account of differential call deferment between governments and direct placements. As indicated above, governments are generally protected from call throughout their lives. The direct placements under study here were protected only for varying relatively small portions of their lives. Table 5-12 indicates that industrial direct placements had an average maturity, during the period, of about 16 years. In the first part of the period (1951–55) they were protected against call, on the average, for 4.9 years and in the last part of the period (1956–61) for 7.5 years. But the sixteen-year governments with which they are compared were, in effect, protected against call through virtually

TABLE 5-12. *Direct Placements, Calculation of Adjustment for Differential Call Deferment Between Direct Placements and Long-Term Governments*

	1951–55	1956–61
Industrials and Finance		
Average maturity (years)	16.1	16.4
Average period of noncallability (years)	4.9	7.5
Difference	11.2	8.9
Adjustment[a] (basis points)	5-14	20[b]
Utilities		
Average maturity (years)	25.2	24.7
Average period of noncallability (years)	1.4	5.2
Difference	23.8	19.5
Adjustment (basis points)	11-23	41[b]

SOURCE: Avery Cohan, *Yields on Corporate Debt Directly Placed,* New York, NBER, 1967, Tables B-8 and B-12.

[a]See pp. 319-320.

[b]For eight quarters only. See pp. 319-320.

their whole lives. Some attempt must be made therefore to adjust for this difference—especially because, instinct suggests, its impact on the compounded probabilities may be large.

The question we are asking here, therefore, is: If direct placements had been protected against call for their whole lives, instead of for some shorter period, what would the effect have been on the probabilities, simple and compound, given above.

Protection against call is desired by lenders, especially when interest rates are high, to prevent refunding should interest rates decline. Most lenders are willing to pay a price, in terms of lower yield, in order to obtain such protection. Presumably, the longer the period of call deferment the higher the price they are disposed to pay, that is, the larger the amount of yield they are willing to sacrifice. Presumably also, if direct placements had been protected against call for their whole lives, the yields on them would have been lower and the probabilities derived above, higher. We adjust the simple probabilities first.

In his recent article, Pye has suggested that, holding quality constant, "for a typical long-term bond with typical call features a discount of about four basis points is produced by a five-year deferment (of call) . . . when the one year interest rate is in the lower range (2¾–4 per cent) of those observed form 1959 through 1965. . . . When the interest rate is in the upper range . . . (4–5¼ per cent), a discount of about thirteen basis points is produced."[37] Pye also suggests that when interest rates are in the lower range, "discounts may be in the area of forty basis points" for a thirty-year bond. When interest rates are in the higher range, the discount for such a bond might be as much as seventy basis points. Pye made his estimates by comparing high-grade corporates with varying deferments—maturity and quality rating held constant. These estimates purport to represent the price of pure call deferment and we should be able to use them, therefore, to obtain rough estimates of that part of the yield differential, between direct placements and governments, that is due to differential call deferment.[38]

During the period under study the rate on one-year governments was above 3⅜ per cent during the last three quarters of 1957, the last three quarters of 1959, and the first two quarters of 1960, or for eight quarters in all.

Using this fact, the figures given in Table 5-12, and Pye's Table III,[39] we can make rough adjustments in basis points for those quarters during which the one-year government rate was above 3⅜ per cent and those quarters during which it was at or below 3⅜ per cent, separately for industrials, utilities, and finance company issues. In making the adjustment, we have assumed that the difference between maturity and period of noncallability for both periods (see Table 5-12) was 10 years for industrials and 20 years for utilities. This assumption has been made in order to avoid the hazards of interpolating between Pye's estimates, which are for successive five-year periods in the relevant range.

The adjustments are given in Table 5-12.[40] They were obtained for

[37] Gordon Pye, *op. cit.*

[38] We assume, in what follows, that governments are noncallable.

[39] *Op. cit.*, p. 630.

[40] There are two adjustments under the column 1951–55. One is for those quarters during which the one-year rate was in the neighborhood of 2⅛ per

industrials and finance company issues, by first obtaining the discount for noncallability for fifteen-year bonds from Pye's Table III for each period—namely, 8 to 18, and 29 basis points, respectively. These figures represent estimates of the prices, in basis points, lenders were disposed to pay for fifteen years of protection against call when one-year interest rates were 2⅛ per cent (8 basis points), 3⅜ per cent (18 basis points), and 4⅝ per cent (29 basis points). But industrials during the period had 5 to 7 years of call protection worth, depending on the level of the one-year rate, respectively, about 3, 4, and 9 basis points. The latter figures were therefore substracted from the former to obtain the adjustments for industrials for differential call of about ten years, namely, 5, 14, and 20 basis points, for the three levels of the one-year rate. Finally, the adjustment in basis points was used to adjust the probabilities both simple and compound. The adjustment for utilities was obtained by analogous procedure.

How do the adjustments given in Table 5-12 affect the simple probabilities given in Tables 5-2, 5-3, and 5-4? The individual probabilities are affected by one-tenth or one-fifth of one per cent or, for practical purposes, not at all, and the three averages by about one-tenth of one per cent, as shown in the table below.

	Unadjusted	Adjusted
Industrials	.9858	.9868
Utilities	.9885	.9904
Finance companies	.9841	.9855

The Compound Probabilities

The quarterly compound probabilities adjusted for the volume effect (Table 5-11) were adjusted as follows for differential call deferment: first, weighted average maturities were obtained for each quarter, separately for industrials, utilities, and the issues of finance companies; second, the maturities so obtained were used to reduce the compound probabilities (adjusted for the effect of the volume of financing) to simple form. For example, the compound probability given in Table

cent and the other when it was in the neighborhood of 3⅜ per cent. There is only one adjustment under the column 1956–61, because the one-year rate did not rise above 4⅝ per cent in any quarter during the period 1956–61.

5-11 for industrials for the first quarter of 1951 was .800. The weighted average maturity of all industrial direct placements in the first quarter of 1951 was 21 years.[41] The twenty-first root of .800 was then extracted and found to be approximately .9894. To this simple probability was added .001 to adjust for call. The resulting figure, .9904, was then raised to the twenty-first power, yielding a compound probability of about .817. The figures given in columns 2, 4, and 6 of Table 5-13 are the result of this process, i.e., they have been adjusted both for the effect of the volume of financing and for differential call deferment. Charts 5-12, 5-13, and 5-14 compare the compound probabilities adjusted for both effects with those adjusted for the effect of the volume of financing alone.

The compound probabilities adjusted for call and the volume of financing are all perceptibly higher than those adjusted for the volume of financing alone. The average probabilities over the 44 quarters are as follows:

	Adjusted for Volume Only	Adjusted for Both Volume and Call
Industrials	.7655	.7831
Utilities	.7667	.7954
Finance Companies	.7977	.8111

The probabilities continue to show some slight deterioration from the beginning of the period. The average compound probability for the direct placements bought in 1951–53 was .807 for industrials, .809 for utilities, and .803 for finance company issues. For 1959–61, these probabilities were, respectively, .763, .781, and .778, or a deterioration of 5.5 per cent for industrials, 3.5 per cent for utilities, and 3.1 per cent for finance company issues. Atkinson's findings (especially his chart describing the average rating class for the Bureau's sample of direct placements) conforms, in general, to the findings here. Atkinson qualifies his findings as follows: ". . . apart from the fact that the two beginning years (1951–52) were relatively high in quality and the last two years of low quality, it could be said that there was no change based on this measure. . . ."[42]

[41] Weights were the dollar amount of each issue.

[42] Atkinson, *op. cit.*, pp. 30–31.

TABLE 5-13. *Direct Placements, Weighted Average Simple Probabilities Adjusted for Differential Call Deferment and Weighted Average Compound Probabilities Adjusted for Differential Call Deferment and for the Volume of Financing, Quarterly, 1951–61*

Year and Quarter	Industrial		Utilities		Finance Companies	
	P (1)	P^a (2)	*P* (3)	P^n (4)	*P* (5)	P^n (6)
1951						
1	.989	.809	.988	.762	.964	.778
2	.989	.817	.994	.879	.987	.839
3	.982	.781	.990	.812	.966	.764
4	.989	.765	.993	.838	.984	.790
1952						
1	.988	.803	.990	.798	.976	.785
2	.991	.813	.984	.768	.993	.884
3	.989	.784	.992	.823	.985	.750
4	.989	.815	.994	.880	.987	.893
1953						
1	.985	.784	.988	.804	.986	.815
2	.986	.769	.990	.778	.977	.708
3	.985	.808	.987	.783	.981	.780
4	.985	.793	.988	.777	.984	.787
1954						
1	.988	.766	.987	.793	.987	.827
2	.983	.794	.990	.770	.988	.846
3	.986	.764	.990	.833	.990	.833
4	.986	.780	.991	.831	.983	.788
1955						
1	.987	.794	.991	.831	.992	.889
2	.987	.783	.988	.766	.985	.875
3	.986	.790	.990	.792	.988	.836
4	.978	.752	.985	.775	.987	.815
1956						
1	.986	.768	.986	.779	.987	.845
2	.988	.789	.989	.815	.987	.825
3	.986	.801	.986	.749	–	–
4	.985	.760	.984	.781	.983	.820

(continued)

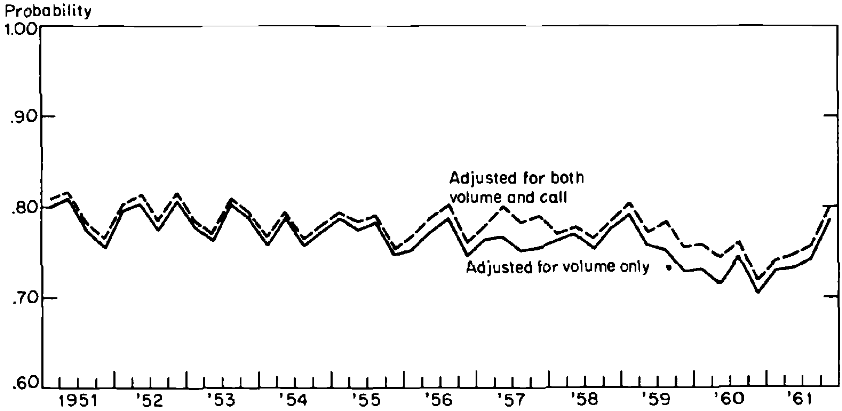
Table 5-13 (concluded)

Year and Quarter	Industrial		Utilities		Finance Companies	
	P (1)	P^n (2)	P (3)	P^n (4)	P (5)	P^n (6)
1957						
1	.986	.779	.987	.813	.989	.871
2	.987	.800	.988	.810	.987	.870
3	.986	.782	.990	.854	.988	.858
4	.988	.790	.990	.852	.987	.815
1958						
1	.985	.770	.988	.780	.986	.877
2	.986	.777	.988	.802	.984	.831
3	.982	.765	.988	.807	.985	.774
4	.988	.793	.989	.788	.981	.790
1959						
1	.986	.804	.990	.804	.986	.788
2	.986	.771	.992	.884	.982	.796
3	.985	.783	.984	.785	.985	.831
4	.982	.755	.987	.759	.985	.776
1960						
1	.983	.758	.987	.825	.984	.769
2	.982	.743	.985	.773	.983	.780
3	.985	.760	.988	.778	.983	.787
4	.982	.717	.986	.722	.979	.769
1961						
1	.979	.741	.990	.811	.977	.746
2	.984	.746	.988	.800	.979	.751
3	.984	.756	.988	.778	.988	.810
4	.987	.799	.991	.825	.983	.717
Average						
1951–61	.9856	.7798	.9886	.8018	.9839[a]	.8088[a]
1951–53	.9872	.7951	.9899	.8087	.9808	.7978
1959–61	.9838	.7611	.9880	.7962	.9827	.7767

NOTE: 1951–53 – Utilities computations based on N = 17 and N = 19. 1951–61 – Utilities average rounds the same for N = 17 or N = 19.

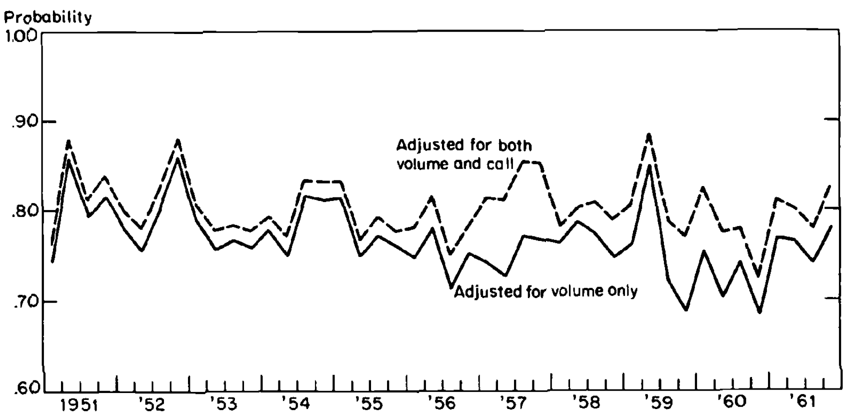
[a]Based on 43 quarters.

CHART 5–12. Industrials, Weighted Average Probabilities to Maturity, Adjusted for Volume Effect and for Effect of Both Volume and Differential Call Deferment, Quarterly, 1951–61



SOURCE: Tables 5–11 and 5–13.

CHART 5–13. Public Utilities, Weighted Average Probabilities to Maturity, Adjusted for Volume Effect and for Effect of Both Volume and Differential Call Deferment, Quarterly, 1951–61

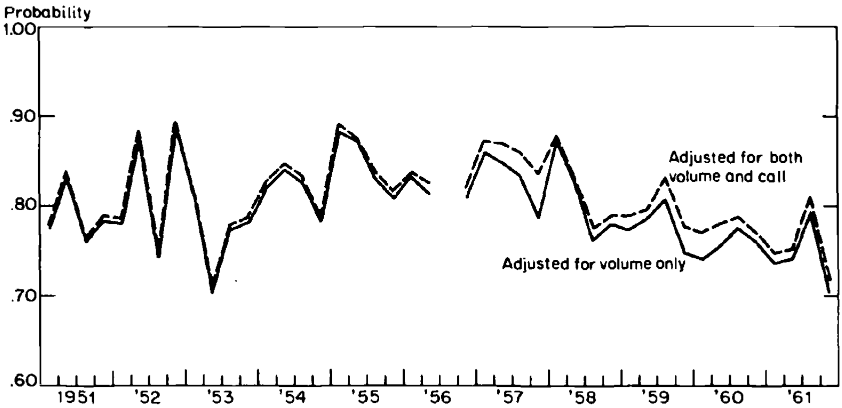


SOURCE: Tables 5–11 and 5–13.

EVALUATION OF RESULTS

Subject to certain qualifications, assumed to be minor, the results presented above purport to represent the subjective probability assigned by lenders to the composite (aggregate) new direct placement

CHART 5–14. Finance Companies, Weighted Average Probabilities to Maturity, Adjusted for Volume Effect and for Effect of Both Volume and Differential Call Deferment, Quarterly, 1951–61



SOURCE: Tables 5–11 and 5–13.

bought by them in each of the 44 quarters from January 1, 1951, to December 31, 1961, i.e., the subjective probability that all payments of interest and principal would be made in full and on time.

In principle, the results should be evaluated by trying, a priori, to decide (a) whether all significant extraneous influences have been removed and (b) whether the assumptions on which the model rests are reasonably accurate. If these two prerequisites were satisfied, we would be able to conclude that the results must, in fact, represent a reasonably accurate image of the subjective views of lenders of the quality of the issues they bought during the period, at the time they bought those issues.

But, unhappily, we cannot be sure, a priori, that the prerequisites are in fact satisfied and therefore a second test has been applied: Are the probabilities, both simple and compound, reasonably close to recent realized experience? We would expect "recent realized experience" to be virtually decisive in estimating current probabilities. We discuss the simple probabilities first.

Simple Probabilities

Hickman's data, as adjusted by Fraine, make it possible to estimate ex post simple "probabilities" for various classes of issues extinguished during the period of 1900–43, i.e., the respective probabilities that lenders would have assigned to each issue in each risk class had they had perfect foresight.[43] These probabilities are given, separately for industrials and utilities, by agency rating in Table 5-14. These probabilities were obtained by dividing the realized yield by the promised

TABLE 5-14. *Estimated Simple Probabilities for Industrials and Utilities by Agency Rating, 1900–43*

Agency Rating	p^a (1)	Percentage[b] (2)	Column 1 x Column 2 (3)
		INDUSTRIALS	
Aaa	1.000	–	–
Aa	1.000	.042	.0420
A	.994	.076	.0755
Baa	.991	.376	.3726
Ba	.975	.505	.4924
B and below	.980	–	–
Total		1.000	.9825
		UTILITIES	
Aaa	.999	.008	.0080
Aa	1.000	.030	.0300
A	.999	.272	.2717
Baa	.992	.222	.2202
Ba	.976	.468	.4568
B and below	.954	–	–
Total		1.000	.9867

[a]Computed from data given in H.G. Fraine, *Valuation of Securities Holdings of Life Insurance Companies*, Homewood, Illinois, 1962, Table 2-8.

[b]From Avery Cohan, *Yields on Corporate Debt Directly Placed*, New York, NBER, 1967, Table C-3.

yield for each agency rating.[44] Each such probability, as explained above, is the average probability that any single payment will be made in full and on time and is comparable to the simple probabilities presented in Tables 5-2, 5-3, and 5-4, above.

[43] Perfect foresight with respect to each risk class but not, of course, with respect to each issue in each class.

[44] These yields are weighted average yields. See Hickman, *Corporate Bond Quality*, *op. cit.*, pp. 54ff.

What is the rationale of this procedure, i.e., of obtaining an ex post probability by dividing the actual realized yield by the promised yield? The procedure simply assumes that the yield actually realized should have been used as the discount rate at issue. If it had been, the present value equation would have been:

$$1 = \frac{rP}{(1+g')} + \cdots + \frac{(1+r)P^n}{(1+g')^n},$$

where r is the promised yield on the direct placement and g' is the realized yield on it. Solving this equation for P gives:

$$P = \frac{(1+g')}{(1+r)},$$

or the realized yield divided by the promised yield. Table 5-14 shows that the realized probabilities decline more or less systematically as quality declines.

We know from the National Bureau's study of direct placements that about 72 per cent of utility direct placements would probably have been rated Baa or below by the agencies.[45] Moreover, about 50 per cent of industrials and about 48 per cent of utilities would have probably been rated Ba or below. If we take weighted averages of the probabilities in the first column of Table 5-14, using as weights the percentages given in Table C-3 of the National Bureau's yield study, we obtain a weighted average of .9825 for industrials and of .9867 for utilities.[46] The details of the calculation are given in column 3 of Table 5-14. Tables 5-1, 5-2, and 5-3 tell us that the average simple probability for 1951–61 for industrials was .9858, for utilities, .9885, and for finance companies, .9841. In other words, during the period 1951–61, lenders assigned to new direct placements simple probabilities that were slightly higher than prewar experience suggested should have been assigned to them. Given the favorable experience since World War II, this is, of course, what we would have expected a priori.[47]

[45] Cohan, *op. cit.*, pp. 158–161.

[46] In other words, the realized probabilities by quality class, out of the Hickman sample, are weighted by the percentage of each quality class in the direct placement sample. The procedure answers the question: If, during the period 1951–61 lenders had assigned, to each new direct placement, the probability indicated by experience to be "appropriate" to it, given its quality, what would the average probability over all direct placements bought in the years 1951–61 have been?

[47] See Atkinson, *op cit.*, pp. 42ff.

Compound Probabilities

How do the compound probabilities compare with the compound probabilities implicit in the Hickman-Fraine results? In order to answer this question, weighted average maturities were computed, separately for industrials and utilities, for the Hickman sample.[48]

These averages were 16 years for industrials and 24 years for utilities. When the simple realized probabilities, given above, derived from the Hickman results are raised to the appropriate power, the results are approximately: industrials, .754, and utilities, .721; as compared with .783 for industrials, .795 for utilities, and .811 for finance company issues for the period 1951–61.[49]

The Hickman-Fraine data bear, of course, on the period 1900 – 43. What about the period since then? Atkinson has shown that between 1943 and 1965, default rates were very low—about one-tenth of one per cent on the average for the 22 years.[50] This is very much less than the default rate experienced in any of the four decades between 1900 – 39.[51] This highly favorable experience, of course, implies much higher probabilities than lenders fixed during the period, 1951–61. But in interpreting the behavior of lenders in this regard, we should bear in mind that they have doubtless weighed heavily the fact that borrowers have experienced little, if any, real adversity since World War II, i.e., borrowers have not had to weather a serious recession. In addition, of course, the data included in this study do not go beyond 1961. If data for subsequent years were available they probably would show that, with quality held constant, the probabilities have trended further upward since 1961.

In sum, we have now found that both the simple and the compound ex ante probabilities for the period 1951–61 are perceptibly higher than the realized probabilities implicit in the Hickman-Fraine results covering the years 1900–43, for approximately comparable issues. This undoubtedly reflects the highly favorable experience of lenders since World War II.

[48] Hickman, *Statistical Measures, op. cit.,* Table 94.

[49] The figures used for 1951–1961 are from Table 5-13, i.e., they are adjusted for the effect of both volume and differential call deferment.

[50] That is, of the amount in good standing at the beginning of each year. Atkinson, *op. cit.,* p. 43.

[51] Atkinson gives the following rates: 1900 – 09 — 0.9 per cent; 1910 – 19 — 2.0 per cent; 1920 – 29 — 1.0 per cent; 1930 – 39 — 3.2 per cent.

But now, do the results presented above represent also a reasonably accurate image of the objective probabilities—as distinct from what lenders, ex ante, thought the objective probabilities were? This is equivalent to asking whether the subjective probabilities are likely to turn out to be good predictors of the eventual outcome.

The short answer to this question is, of course, that the subjective probabilities do not purport to be predictors: in assigning probabilities to issues being bought currently, lenders can obviously be wrong, one way or the other, about the probabilities they assign to the various "states of nature."[52] And if they are wrong, realized results will be different from expected results.

Nevertheless, we may learn something about the relationship between the subjective and the objective probabilities by comparing the subjective ex ante probabilities implicit in the Hickman-Fraine data with the estimated "realized probabilities" given above. In other words, the comparison is between the ex ante probabilities and the realized probabilities both derived from the Hickman-Fraine data. This comparison is a precarious undertaking, at best, primarily because Hickman calculated market ratings by using yields on the best corporate bonds (which, in fact, are not riskless) rather than yields on governments.[53] Moreover, the great bulk of the bonds in his sample were callable in less than one year. The procedure here is based on the assumption that these two effects are approximately offsetting. Thus, if the return on the best corporates were 1.04 and the promised return on a callable risky security were 1.06, Hickman's market rating would be the difference between the two, multiplied by 100. A corresponding probability would be .9811 $(1.04/1.06 = .9811)$. Now, if each of the two returns is reduced by 25 basis points, in order to reduce the numerator to approximately the level of a government and in order to adjust the denominator for differential call deferment, the result is the same to the fourth decimal place $(1.0375/1.0575 = .9811)$. In calculating the Hickman-Fraine ex ante probabilities, the midpoints of their class intervals have been used.[54]

For each of their market-rating classes the following steps were taken: first, a comparable riskless return was obtained by subtracting the midpoint of the market rating from the promised return, e.g., for

[52] It seems highly likely that lenders would be able to assign probabilities, with a high degree of accuracy, to the risk of default given the state of nature.

[53] Hickman, *Corporate Bond Quality, op. cit.,* p. 282.

[54] See Fraine, *op. cit.,* Table 2-9, pp. 50–51.

market-rating class 1, industrials, 1.0330 — .0025 = 1.0305.[55] An estimated ex ante probability was then obtained by dividing this figure by the promised return, 1.0305/1.0330 = .998 (see Table 5-15).

Unhappily, we cannot obtain the corresponding compound ex ante probabilities for the Hickman sample because data on maturity by market rating are not available. But the results suggest that the differences between the ex ante simple probabilities and the eventual outcome for the Hickman sample were substantial—especially in the lower grades.[56]

TABLE 5-15. *Hickman–Fraine Sample of Corporate Bonds, Estimated Ex Ante and Realized Probabilities, 1900–43*

Market Rating (basis points) (1)	Ex Ante Probability P (2)	Realized Probability P (3)
	INDUSTRIALS	
Under 50 (25)[a]	.998	1.000
50–100 (75)	.993	.999
100–150 (125)	.988	.995
150–200 (175)	.983	.989
200–250 (225)	.979	.991
250 and over (275)	.974	.987
	UTILITIES	
Under 50 (25)[a]	.998	.999
50–100 (50)	.993	.997
100–150 (125)	.988	.995
150–200 (175)	.983	.989
200–250 (225)	.970	.992
250 and over (275)	.975	.981

[a]Midpoint of class interval.

[55] Subtracting the midpoint produces an estimated yield on a best bond of the same maturity. See Hickman, *Corporate Bond Quality, op. cit.*, pp. 282–283.

[56] For example, for industrials, if we assume that the issues in the poorest class had an average maturity of 10 years, the compound ex ante and "realized" probabilities would be respectively $(.974)^{10}$ and $(.987)^{10}$ or .768 and .877. This would mean that although 23.2 per cent of the issues in that class were expected to default, only 12.3 per cent actually did so. At fifteen years the corresponding figures would be .673 (ex ante) and .821 (realized).

Fraine does, however, give weighted average promised and realized yields over all utilities and all industrials separately. And we are able, with his figures, to compute a weighted average market rating. This is done in Tables 5-16 and 5-17. With these three figures, namely, weighted average promised and realized yields and weighted average

TABLE 5-16. *Hickman–Fraine Sample of Corporate Bonds, Derivation of Mean Market Rating for Utilities, 1900–43*

Market Rating (basis points) (1)	Dollar Amount (billions) (2)	Column 1 x Column 2 (3)
25	5.7	142.5
75	7.6	570.0
125	4.8	600.0
175	2.9	507.5
225	1.1	247.5
275	0.8	220.0
Total	22.9	2287.5

NOTE: $\frac{2287.5}{22.9}$ = 100 basis points, mean market rating.

SOURCE: Column 1–Table 5-15, column 1; column 2–H.G. Fraine, *Valuation of Securities Holdings of Life Insurance Companies,* Homewood, Illinois, 1962, Table 2-9.

TABLE 5-17. *Hickman–Fraine Sample of Corporate Bonds, Derivation of Mean Market Rating for Industrials, 1900–43*

Market Rating (basis points) (1)	Dollar Amount (billions) (2)	Column 1 x Column 2 (3)
25	1.2	30.0
75	3.1	232.5
125	3.0	375.0
175	2.7	472.5
225	1.4	315.0
275	1.1	302.5
Total	12.5	1727.5

NOTE: $\frac{1727.5}{12.5}$ = 138 basis points, mean market rating.

SOURCE: Same as Table 5-16.

market ratings (and using the weighted average maturities computed above for the Hickman-Fraine sample), we are able to compute ex ante and realized compound probabilities for all utilities separately and for all industrials separately. These are given in Table 5-18. In interpreting these figures we should bear in mind that lower grade bonds obviously did much less well than high grade bonds. We may guess that for bonds graded Baa and below the ex ante probabilities were 10–15 per cent below "realized" probabilities. Perhaps this will also turn out to be the case for the direct placements bought during the years 1951–61.

TABLE 5-18. *Hickman–Fraine Sample of Corporate Bonds, Comparison of Estimated Simple and Compound Ex Ante Probabilities With "Realized" Simple and Compound Probabilities, 1900–43*

Probabilities	Industrials	Utilities
Simple		
Ex ante	.990	.990
Realized	.991	.991
Compound		
Ex ante	.787	.811
Realized	.826	.851
Realized as percentage of ex ante		
Simple	100.10	100.10
Compound	104.96	104.93

SOURCE: Same as Table 5-16.

In summary:

(1) The simple subjective probabilities found here, covering the period 1951–61, are somewhat higher than the simple "realized probablities" implicit in the Hickman-Fraine results for the period 1900–43. This is true for the simple probabilities both unadjusted and adjusted for differential call deferment.

(2) When the simple probabilities, adjusted for differential call deferment are compounded, they (the compound probabilities) are found to be considerably higher than the compound "realized probabilities" implicit in the Hickman-Fraine results.

(3) Both (1) and (2) are what one would expect given the favor-

able climate and experience that have characterized the period since 1943.

(4) When the Hickman-Fraine "realized" simple probabilities are compared with rough estimates of the ex ante simple probabilities implicit in their data, the latter are found to be smaller than the former—and the difference increases as quality worsens. This result may mean that lenders anticipated economic conditions substantially worse than those that in fact occurred.[57] But it may mean that during the period 1900–43 lenders were strongly risk averse and therefore insisted on extra risk premium, especially on lower grade issues. In trying to decide whether and to what extent this factor has influenced the results for direct placements for the period 1951–61, we should bear in mind that during the period 1900–43 the buyers of corporate bonds were, to a large extent, a multitude of individual investors who were, for the most part, unable to diversify. The buyers of direct placements, on the other hand, are sixty or more large financial institutions who, for the most part, understand diversification and practice it.[58]

(5) Compound ex ante probabilities could not be computed, by market rating, for the Hickman-Fraine sample because data on maturity by market rating were not available. Compound probabilities were computed, however, for all industrials together and all utilities together. They were found to be about 5 per cent below the "realized" probabilities implicit in the Hickman-Fraine results.

CONCLUSION

As indicated at the outset, this study has been exploratory. It has attempted to ascertain whether the subjective probabilities present (if only subconsciously) in the mind of lenders when they fix yields on new issues can be derived from the observed ratios between ex ante returns on government bonds, presumed riskless, and ex ante returns on direct placements of the same maturity. Two major adjustments of the observed ratios have been made, one for the effect of the volume of financing and the other for the effect of differential call deferment.

[57] In assessing this possibility we should bear in mind that $27,151 million of the bonds in Hickman's sample were extinguished before 1931. This was just slightly less than the volume of bonds still outstanding on January 1, 1931—$28,555 million.

[58] They are presumed here to be "risk averse" only because of the penalties imposed by the NALIC on purchases of low grade securities. See above, p. 304.

On the whole, the results seem reasonable. Perhaps, therefore, the conclusion is warranted that the techniques used merit further consideration—especially for the purpose of assessing the ex ante quality of new issues—and especially if more refined adjustments could be made for call deferments and if an adjustment could be included for differential transactions costs.