Basic Yields of Bonds

1926-1947:

Their Measurement and Pattern

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and

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ACKNOWLEDGMENTS

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THE MEASUREMENT OF BASIC YIELDS

The Basic Yield Concept

THE basic yield concept was originally developed by the Corporate Bond Project[1] to provide a needed standard of comparison for the analysis of corporate bond yields. The yield of any bond is ordinarily affected both by its quality and its term to maturity, and one of the problems faced by the Project was that of ascertaining what portion of the yield is due to one or the other of these factors. A possible solution was to compare the yield of any bond with a standard yield representing the highest grade obligations *of the same maturity.* To determine this standard yield a careful analysis was made of the highest grade corporate bonds outstanding in the first quarter of each year, and a series of basic yield curves was derived to measure the yields and terms to maturity of these bonds. Therefore, in addition to serving as a standard of comparison, these basic yield curves have contributed to our knowledge of the relation between yield and maturity in the corporate market. Although the curves themselves attempt to measure the relationship between yield and maturity at a given moment of time, they have enabled us to construct series showing the yearly changes in yields for the highest-grade bonds of any specified maturity and to point out shifts in this yield-maturity relationship.

These year-to-year movements of the basic yields, it has been observed, are somewhat less subject to fluctuations than most series of bond yields. On the whole, high grade bond yields are distinctly less

[1] The analysis of basic yields was originally developed under the Corporate Bond Project, a Work Projects Administration undertaking sponsored by the Federal Deposit Insurance Corporation and supervised by the National Bureau of Economic Research with the cooperation of several public agencies and private investment services.

The most urgent need for basic yields occurred in connection with the measurement of "market ratings" of bonds, an essential part of the Periodic and Annual studies of the Corporate Bond Project. Instructions for the computation of market ratings were developed by W. Braddock Hickman and are reproduced in his *The Periodic, Annual and Monthly Records of Corporate Bond Experience,* 1900-40: *The Corporate Bond Project, Organization and Methods, Part V* (National Bureau of Economic Research, Financial Research Program, ms. December 1942) Appendix C, p. 147, memorandum of instructions dated May 6, 1941. For a detailed statement of the techniques used in selecting the basic yields and for discussions of the concept see David Durand, *Basic Yields of Corporate Bonds,* 1900-1942 (National Bureau of Economic Research, Technical Paper 3, June 1942) and W. Braddock Hickman, *The Term Structure of Interest Rates, An Exploratory Analysis* (National Bureau of Economic Research, ms. November 16, 1942).

sensitive to variations in business confidence than low grade bond yields. Although yields of all grades of bonds are essential to a comprehensive picture of the money markets, basic yields are particularly useful whenever it is desirable to minimize the effects of variations in quality and risk. For example, the substantial decline in corporate bond yields that occurred from about 1940 to 1946 did not represent a decline in interest rates so much as a rise in average bond quality and an increase in general business confidence. As a result of wartime prosperity, the credit positions of many obligors improved greatly, interest payments were resumed on defaulted bonds, and middle grade issues often attained the status of money bonds. Consequently, the changes in yields of the various grades of bonds in the market were far from uniform. While most of the lower grade issues were declining rapidly in yield, the highest grades, as measured by the basic yield, were almost unaffected.

At the turn of the century the corporate bond market occupied such a dominant position in American finance that the student of long- and medium-term interest rates would necessarily have devoted most, if not all, of his energies to the measurement of corporate bond yields. And he might even have restricted his attention to railroad bonds, the most important single class of securities within the corporate market. His task, furthermore, was made fairly easy by the general characteristics of the market. Since it was the dominant market, volume was large and trading was well organized, and quotations were systematically recorded and easily obtained. Although bonds varied considerably in quality, there was an adequate representation of the higher grades, which could be fairly readily identified — a process that became even easier a few years later with the advent of Moody's ratings. Bonds also varied in maturity, from a month or so to a hundred years, and occasionally longer, but this wide range posed no serious problems of analysis because of the insignificant variation in yield with term to maturity. For 1900 and several years after, almost any simple average of high grade bond yields, was sufficient to measure long- and medium-term interest rates with reasonable precision.

Since 1900 the picture has radically changed, and the American money markets have become far more complex. Within the corporate market, railroad bonds have lost their former dominant position, as utility and industrial bonds have become more prominent. The call feature seems to have increased in importance; at the present time virtually all corporate bonds issued are callable at a small premium, high grade bonds frequently sell above call price, and the exercise of the call provision is a common occurrence. Finally, the corporate bond market, like all other bond markets, has come to differentiate between long-

and short-term bonds so that a single series of average yields is inadequate to describe the entire market.

But the most revolutionary developments have occurred outside the corporate bond market. These include (1) the rise of the federal debt in World War I; (2) the rise in state and municipal debt in the decade following World War I; (3) the rise in income tax rates, which has put tax-exempt securities in a preferred position; and (4) the phenomenal rise in the federal debt during the great depression and World War II, which brought the United States government bond market to a position of pre-eminence. Unlike 1900, when the bond market was almost exclusively a corporate market, there are today at least three important bond markets, each having its own distinctive characteristics. Therefore, the student of interest rates today needs several series of high grade bond yields. He needs one series for tax-exempt state and municipal bonds, he needs another for the taxable corporates, and he may need two or three for Treasury bonds, which are now differentiated by tax provisions, eligibility for bank investment, and other considerations. Furthermore, in each of these three markets yields vary appreciably with term to maturity, and a completely satisfactory series must therefore include yields for several different maturities.

The purpose of the present study is to present a detailed description of the basic yields for corporate, municipal, and Treasury bonds in the first quarter of each year from 1943 to 1947, to compare the three yield structures, and to examine changes in the pattern of yields from year to year.[2] A less detailed analysis of the pattern of basic yields from 1926 to 1947 for selected maturities in the three principal sectors of the bond market is also presented. This study supplements and brings to date the study of basic corporate bond yields, 1900-1942, published by the National Bureau in 1942,[3] in which basic corporate bond yields were presented for the first quarter of each year of the period analyzed and some comparison was made between these yields and Treasury bond yields.

The Definition of Basic Yields

As indicated above, the basic yield is defined as the yield of the highest grade bonds of a given maturity free from extraneous influences.[4] Since the most practical criterion of quality for this analysis was current market appraisal, bonds with the lowest market yields were ordinarily assumed to be those of the highest quality. Of course, the analysis was restricted to bonds with high quality ratings, and a considerable effort

2 The expression "pattern of yields" is used to signify the collection of basic yield curves describing high grade bond yields in the various segments of the bond market at a point of time.

3 David Durand, op. cit.

4 Ibid., p. 4.

was made to eliminate all bonds with low yields that may have been attributed to the operation of some special feature, such as a conversion privilege or an active program of debt retirement. However, no attempt was made to justify quality by subsequent market performance. Practically speaking then, *the basic yield is the lowest limit of yields actually attained in the market by high grade bonds of a given maturity and a given class*. While the yields of a number of bonds approach the basic yield, the yields of only a few actually reach it.

The problem of relating yield to maturity is met by constructing continuous yield-maturity curves depicting the yields of the highest grade bonds of all maturities from the shortest to the longest. Perhaps the most widely used yield-maturity curves are those published currently by the Treasury Department.[5]

Corporate Bond Yields

The basic yields of corporate bonds were derived from the market prices of an extensive list of high grade bonds, including virtually all the high grade issues traded on the New York Stock Exchange and the New York Curb Exchange, as well as an appreciable representation of the high grade issues traded exclusively in over-the-counter markets and on out-of-town exchanges.[6] The original list of high grade bonds was compiled from the records of the Corporate Bond Project.[7] This list has been kept current and has been supplemented through reviews of the records of high grade bond offerings and of bonds listed on the exchanges. Some small, inactive issues may have been omitted unintentionally, but they are of little importance in this study because of the uncertainty and unreliability of their price quotations. Other issues were deliberately omitted because of convertibility provisions, active sinking funds, or other special features that unduly influenced the yield. Although another bond provision, the call feature, has had a considerable effect upon bond yields, particularly during the past few years, callable bonds as a group were not excluded from the sample. For the years 1900-1933, bonds actually selling above call price were excluded, but for the years 1934-47, this practice was not feasible because in this later period so many of the high grade bonds were selling above call price. Since the expectation of early call tends to keep the price down and the yield up, the basic yields are subject to an upward bias in such

[5] See, for example, *Treasury Bulletin*.

[6] Since the 1942 study, p. 8 ff., gives a complete description of the method by which the basic yields are determined and the yield-maturity structure is constructed, only a brief outline of the method is presented here.

[7] See footnote 1.

years as 1939 and 1940, when most high grade bonds were selling above call price. However, the basic yield is less affected by this bias than a general average of bond yields because the basic yield is determined from the lowest yielding bonds.

For each bond analyzed an average price for the first quarter of the year was computed from the high and low prices in January, February, and March, and from this average price the yield to maturity was computed. Each bond was then plotted as one point on a scatter chart, on which the horizontal axis represented years to maturity and the vertical axis represented yield. The basic yield curve was then drawn freehand to describe the relation between yield and maturity for the lowest yielding bonds, which are presumably the highest grade. The process is illustrated in Chart 1, which shows the scatter diagram and the basic yield curve for corporate bonds for the first quarter of 1946. It will be noted that an occasional bond yield falls below the fitted curve, whereas in some maturity ranges the curve lies well below the lowest yields. It was felt that a smoothing process was essential. Occasionally an isolated bond yields less than all other bonds in the same maturity, and although we were unable to attribute this directly to some clearly extraneous factor there is always a chance that some such factor may have been at work. Consequently, the basic yield curves were drawn through the lowest points of concentration rather than the lowest individual yields. Since many maturity ranges contain no points of concentration, some sort of interpolation was necessary, and this was achieved by the use of smooth curves.[8] All the basic curves in both the 1942 and the present study were drawn as simply as possible, and they all conform to one of four simple types. In the 1942 study, covering the years 1900-1942, one of the following three types was found to give a satisfactory fit: (1) a horizontal straight line, (2) a curve rising at a declining rate until it approaches a horizontal straight line, or (3) a curve falling at a declining rate until it approaches a horizontal straight line. In this study a fourth type is found to give a better fit for the years 1944-47 — a curve rising at the short-term end at a constant rate (a rising straight line), and then rising at a declining rate until it approaches a horizontal line.

[8] In constructing these freehand curves, great pains were taken to make them smooth. This was done by the process of differencing. After the preliminary curves were drawn, values along the curves were tabulated and successive differences were obtained. Adjustments of the curves were made until the successive differences (sometimes second or third differences were analyzed) became sufficiently regular.

It is realized that this process may have resulted in over-smoothing. However, the alternative was to fit the curves to the lowest observed yields in each maturity range, and it was felt that the possible errors of under-smoothing by this method were more serious than those of over-smoothing. For further discussion of this problem see Durand, *op. cit.*, pp. 10-12.

CHART 1 — Distribution of High Grade Corporate Bonds by Yield and Term to Maturity, and Basic Yield Curve, First Quarter, 1946
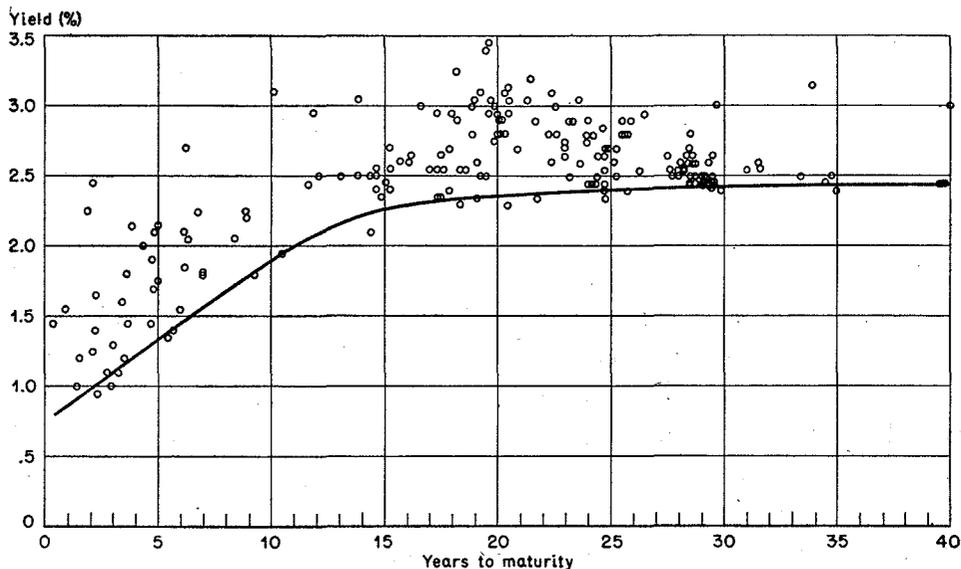
State and Municipal Bond Yields[9]

In principle the basic municipal bond yield is analogous to the basic corporate yield, being defined as the yield of the highest grade municipal bonds free from extraneous influences, or the lowest limit actually attained by municipal bonds of a given maturity. In practice, however, the process of fitting the basic municipal curves has differed somewhat from that used for the corporates.

The prevalence of serial issues in the municipal market offers some great advantages for research. While the corporate analysis necessarily had to cover the bonds of a large number of obligors, the municipal analysis could be limited to a small number of obligors with highest credit. In fact, New York State obligations, which have high credit standing, constitute a large proportion of the total analyzed in determining the basic yields. These bonds are fairly actively traded, are outstanding in large volume, and cover a complete range of maturities from a few months to 45 years. But the analysis was not limited to New York State issues; bonds of other obligors — those of California, Connecticut, Massachusetts, Missouri, New Jersey, Pennsylvania, Baltimore, New York City, and Boston — were also included. While the basic yield curves thus derived might almost be regarded as New York State yield-maturity curves because of the prevalence of New York State bonds, they are believed to be reasonably comparable with the basic corporate yield curves.

9 Hereafter, in accord with prevailing market usage, the term "municipal" is used to designate the securities issued by state and local governments.

6

CHART 2 — Distribution of High Grade Municipal Bonds by Yield and Term to Maturity, and Basic Yield Curve, February 16, 1943

Yield (%)

○ New York State bonds
● Other municipal bonds

Years to maturity
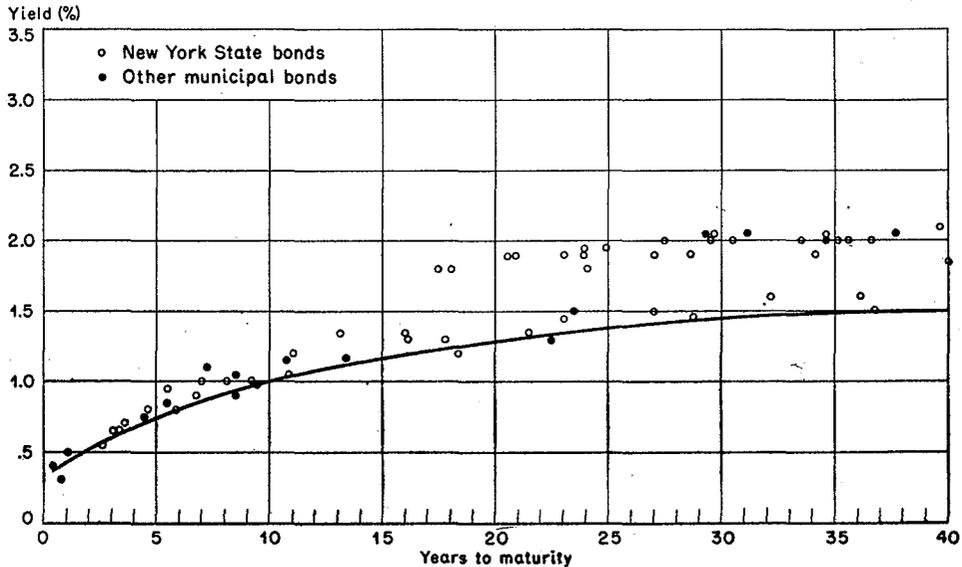
For the years 1943-47 a basic yield curve was drawn for each of the three months, January, February, and March, based on quotations taken from the *Blue List of Current Municipal Offerings,* for the middle Tuesday in each month.[10] Values taken from these three curves were averaged to obtain a basic yield curve for the quarter. For 1943 the curves drawn for each month of the first quarter were identical, and this was also true for 1945; for 1944, 1946, and 1947 the monthly curves differed slightly. Chart 2 shows the distribution of bond yields for February 16, 1943 and the basic yield curve, which is identical with that derived for January and for March of that year.[11]

In the analysis of municipal bond yields, the coupon rate of interest was an important factor. Investors apparently object to paying high premiums, with the result that low coupon bonds selling near par are preferred to, and yield less than, high coupon bonds of the same quality and maturity. In some years, the spread in yield for long-term New York State bonds is as much as .50 percent, and a large share of this is attributable to coupon differences. The practice of fitting the basic

[10] Since municipal bonds are not traded on the organized exchanges to any extent, price records of actual sales are difficult to obtain. *The Blue List* furnishes prices on an offered basis only, which may be slightly higher than the realized price, but the difference is so small that it has little, if any, effect upon the computed basic yield. Moreover, *The Blue List* has the great merit of giving quotations on individual maturities of serial issues, which are most desirable for the analysis of a market composed mainly of serials.

[11] The basic yield estimates of municipal obligations for the period 1926-42, discussed in Chapter 3, are based on over-the-counter quotations from *The Bank and Quotation Record.* For selected maturities monthly closing bid and ask quotations in January, February, and March were averaged. This method is entirely comparable with that used in the development of estimates of basic corporate bond yields.

yield curve to the lowest yield in each maturity class means that the curve was fitted to the low coupon bonds. This will be observed in Chart 2, where the basic yield curve has been fitted to a few scattered bonds with low coupons, although there is a much more pronounced clustering of high coupon bonds about ½ percent higher. Consequently, the basic municipal bond yields must be interpreted as the yields of high grade bonds with low coupons.

The relationship between yield and coupon rate is not peculiar to the municipal market, although it is particularly pronounced in that market. Treasury bonds have a rather small variation in the coupon rate and hence a small variation in yield. Corporate bonds have considerable variation in coupon rates, but the attendant variation in yield is very difficult to analyze because the yield differential between bonds may be due to quality, call provisions, and other factors as well as the coupon rate. But in the municipal market — where one obligor may have outstanding a number of noncallable bonds of the same maturity, presumably of the same quality, and with widely different coupon rates — the effect of coupon upon yield is susceptible to analysis.[12]

Treasury Bond Yields

The basic Treasury bond yield is analogous to the basic corporate and the basic municipal bond yields, yet it differs from them in three very important respects. In the first place, the use of the word "basic" is in a sense redundant because there is no quality differentiation among Treasury bonds. Thus, to all intents and purposes, the basic yields may properly be called average Treasury bond yields or simply Treasury bond yields. In the second place, not one but two basic yield curves had to be computed for this market for 1943-47, because the market is broken into two distinct segments. One consists of taxable issues; the other includes those that are partially tax-exempt.[13] This division did not exist prior to December 1940, when the taxable issues were introduced into Treasury offerings; by December 31, 1945 they comprised more than 85 percent of the marketable Treasury bonds outstanding. Finally, the basic Treasury yields were derived solely from the analysis of negotiable securities, by which we mean all marketable securities regardless of eligibility for bank investment. In the middle of the first quarter of 1946 the negotiable issues constituted approximately 72 percent of the United States government debt. The nonnegotiable Treasury issues — such as Series E, F, and G — have yields and yield curves sharply divergent from those of the negotiable bonds. Only the

12 For further discussion of this point, see Addendum.

13 Several issues of wholly tax-exempt securities are outstanding, but they are not outstanding in sufficient number to serve as the basis for a yield-maturity curve.

yields of negotiable Treasury issues are fully comparable with the yields of corporate and municipal securities.

The Treasury bond yield curves, which are familiar because of their use by the Treasury Department,[14] are based upon bond prices and yields on specific dates; they are not exactly comparable to the basic corporate bond curves. Therefore, for the present study, a new set of Treasury bond yield curves has been computed to show the average yield for the first quarter of each year, 1943-47. This average is derived from the high price and the low price of issues in each of the three months of every quarter.

The Basic Yield and the Concept of Pure Interest

While the basic yield represents an empirical approximation of a relatively riskless rate of return on investment and may therefore be likened to the pure rate of interest of economic theory, certain fundamental differences should be noted. The pure interest rate, which has never been unambiguously defined, includes two primary features — risklessness and uniqueness. Risklessness implies absolute safety and certainty of principal and interest, including freedom from losses occasioned by changes in the general price level, interest rates, and tax rates. Consequently, an essential prerequisite of risklessness is the perfect foresight of investors. Uniqueness implies a single fundamental rate underlying the entire structure of interest rates. This necessarily rests upon the assumption that all investors have complete freedom of investment action; that is, arbitrage transactions will be unhampered by legal restrictions, institutional investment practices, brokerage fees, cost of investment analysis and administration, size of bond issue, or any of the other barriers that hinder the flow of investment funds. In this ideal market, all sections would be directly related, and an investment in one section of the market would yield as much as an investment in any other section, after adjustment for costs and losses. Thus the entire interest rate structure would be based on a single rate — probably the discount rate on riskless short-term notes — and all other rates would be built up from this. The long-term rate on prime obligations would be an average of the future riskless short-term rates, and the rate for any but top quality bonds would be divisible into two distinct parts — the rate for riskless obligations of the same term and a premium to cover the risk of default.

The basic yield, however, implies neither risklessness nor uniqueness. Although it is derived from the yields of the bonds that by current market appraisal are considered to be of the highest quality, these bonds

14 Since the yield curves are published currently in the *Treasury Bulletin*, they are not reproduced here.

are not entirely riskless, nor are they so considered by investors. The basic yield reflects the market's somewhat uncertain evaluation of the risk of default, however small, plus the additional risks resulting from changes in prices, interest rates, taxes, etc.

Obviously, the basic yield is not unique. Investors do not comprise a homogeneous group, but are divided into many groups of widely varying character. Borrowers, likewise, are not a homogeneous group, and the securities they issue differ in many respects. As indicated above, most bonds available for investment in the American bond market fall into three broad categories each of which has distinguishing characteristics: domestic corporation bonds, Treasury bonds, and municipal bonds. This gives rise to three related yet distinct investment markets, in which the basic yield curves differ sharply. While arbitrage between the markets exists, it is hampered by many barriers, and, consequently, the empirically derived yields in these markets do not reflect the influence of identical investment forces.[15]

15 An explanation of the term structure of interest rates in terms of the institutional framework within which investment decisions are made has been developed by W. Braddock Hickman in his study, *The Term Structure of Interest Rates*. An understanding of the bond market as consisting of more or less distinct segments is one facet of this institutional theory.

THE PATTERN OF BASIC YIELDS, 1943-47

Charts and Tables of the Basic Yield

THE pattern of basic yields for the first quarter of each year, 1943-47, is given in Chart 3. The chart contains four or more yield-maturity curves for each year: one for corporate bonds, one for taxable Treasury bonds, one for partially tax-exempt Treasury bonds, and one for municipal bonds. The taxable Treasury curve breaks down into two distinct parts, one for short-term, bank-eligible issues and one for long-term, bank-ineligible issues. For 1946 there are two basic municipal curves, one based largely on New York State issues and comparable to the curves for the other years, the other based entirely on Massachusetts 1 percent issues; thus the 1946 experience includes six distinct basic yield curves.[1] Chart 3 also shows the pattern of yields for 1947 on a logarithmic yield scale. This chart, which points up percentage differences rather than absolute differences, makes the basic yield curves more nearly parallel, but not entirely so.

Table 1 gives the values of these various curves for selected maturities. Values for intermediate maturities can be interpolated from the table or read directly from the charts. The values in the table are quoted to the nearest .01 percent, although they are presumably subject to a larger error. For the long-term yields the margin of error may be about .05 percent, and in some instances this might be as high as .1 percent. For the short-term yields the error may be somewhat larger — perhaps .2 percent.[2]

For all five years the pattern of basic yields is substantially the same. In every year each yield curve has the same general shape — short-terms yielding less than long. Furthermore, the different yield curves always bear the same general relationship to one another, although the general levels of the curves and the differences between them vary considerably from year to year. The corporate yields are highest and are followed in order by those of taxable Treasury bonds, the partially tax-exempt Treasury bonds, and the municipals. The differences between the cor-

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[1] Since the Massachusetts 1 percent bonds were not actively traded in 1947 a similar curve could not be computed.

[2] For a detailed discussion of errors in the basic yields, see Durand, *op. cit.*, pp. 10-14.

CHART 3—Pattern of Basic Yields, First Quarter, 1943-47

——————— Corporate bonds   ·················· Taxable Treasury bonds

—··—··—··— Municipal bonds   ————— Partially tax-exempt Treasury bonds
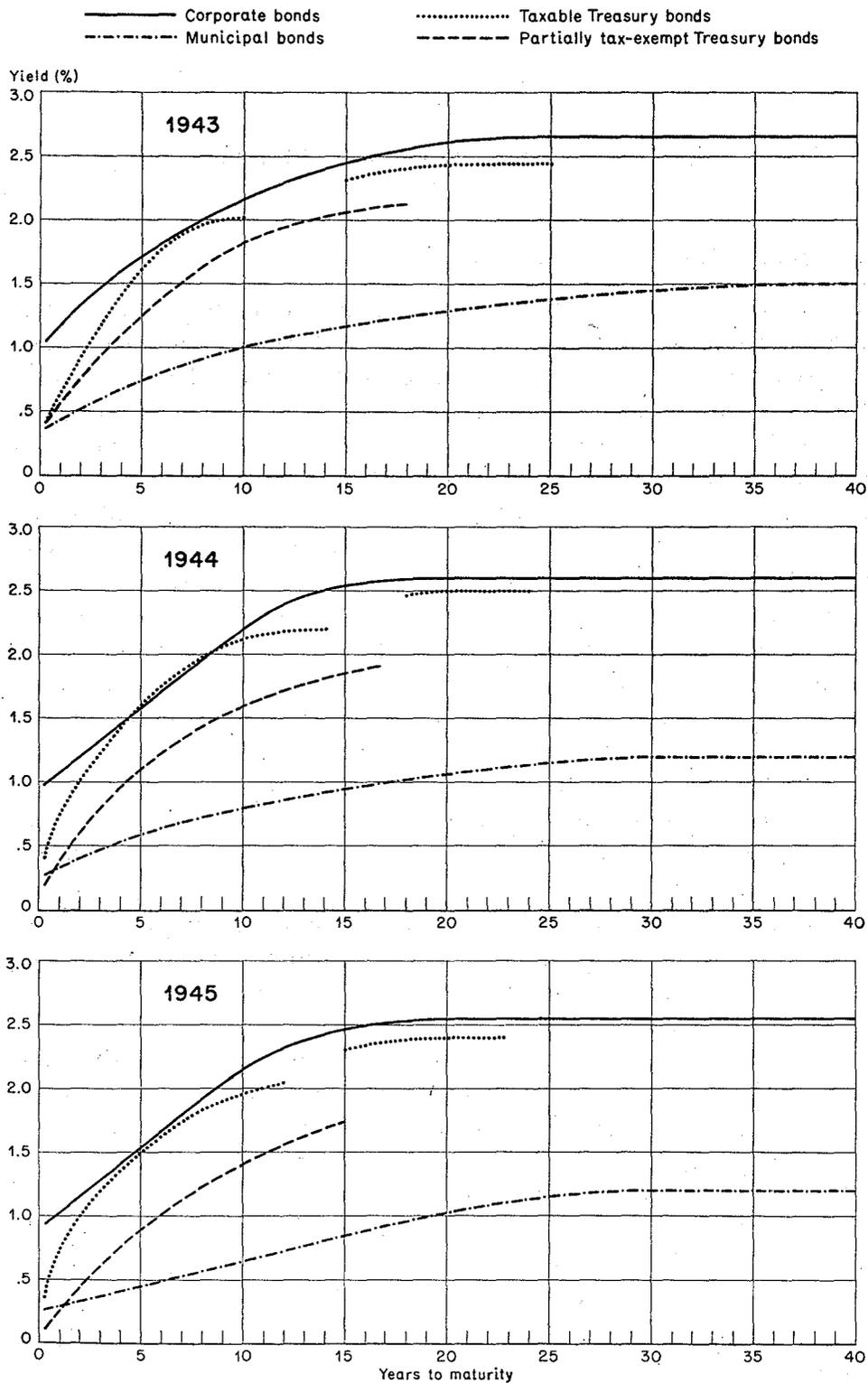
Years to maturity

CHART 3—Pattern of Basic Yields, First Quarter, 1943-47 (concluded)

———— Corporate bonds	················ Taxable Treasury bonds
—·—·—·—· Municipal bonds	———— Partially tax-exempt Treasury bonds

⟨⟨⟨⟨⟨⟨ Massachusetts 1% serials
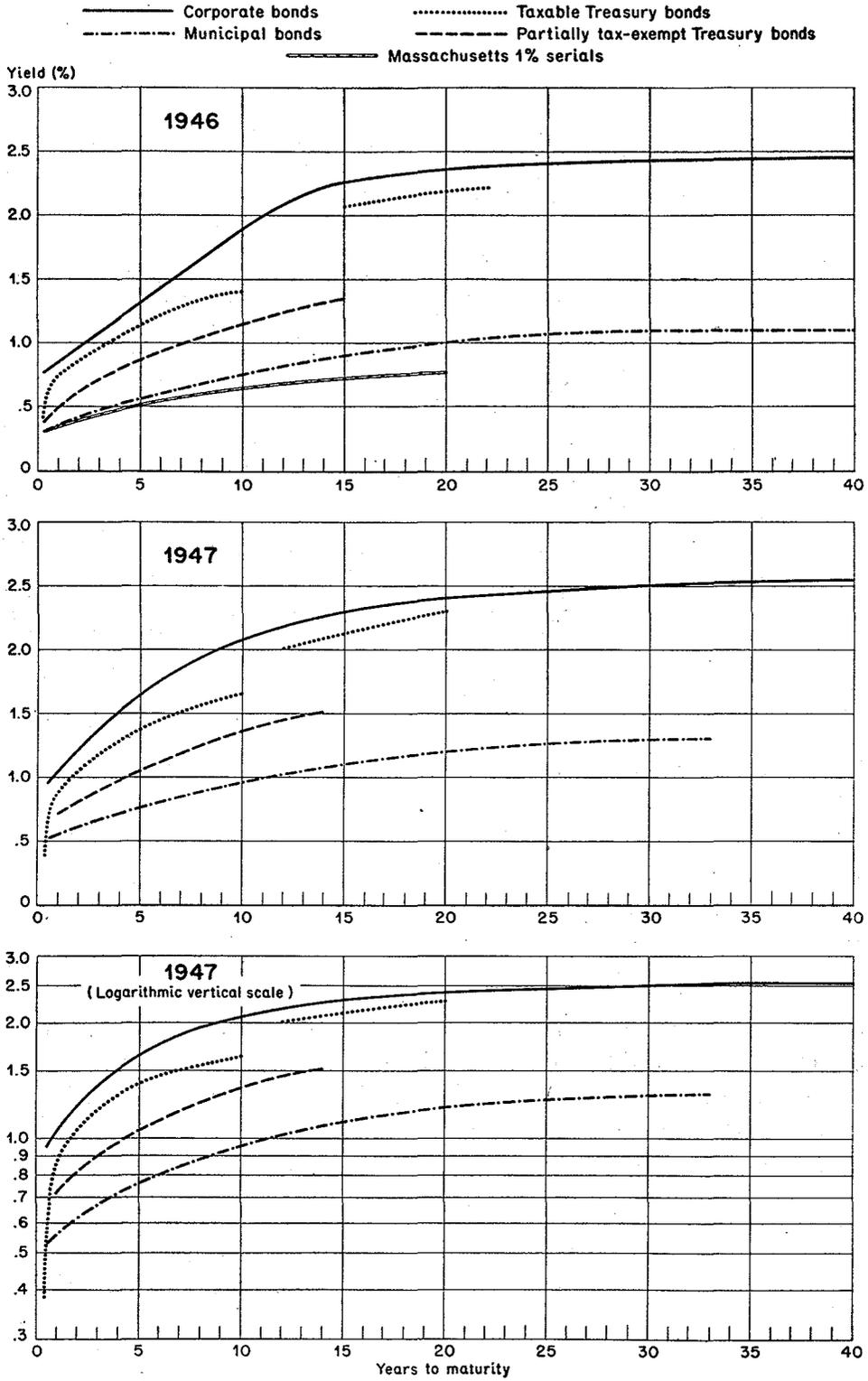
TABLE 1

BASIC YIELDS BY TERM TO MATURITY, FIRST QUARTER, 1943-47[a]

Years	1943	1944	1945	1946	1947	1943	1944	1945	1946	1946[b] (Mass.)	1947
	Corporate Bonds[c]					*Municipal Bonds*[c]					
1	1.17	1.08*	1.02	.86*	1.05*	.43	.33	.29	.36	.36	.56
2	1.33	1.20*	1.15	.97	1.22	.52	.40*	.33	.42	.40	.62
3	1.47	1.32*	1.27	1.09	1.38	.60	.47*	.37	.47	.45	.67
4	1.59	1.45*	1.40	1.20	1.52	.67	.53	.41	.52	.48	.72
5	1.71	1.58	1.53	1.32	1.65	.74	.58	.44	.56	.52	.76
6	1.82	1.70	1.66	1.43	1.77	.80	.63	.48	.60	.55	.80
8	2.00	1.95	1.92	1.66*	1.95*	.91	.72	.56	.68	.60	.88
10	2.16	2.20	2.14	1.88*	2.08*	1.00	.79	.64	.75	.65	.96
12	2.29	2.40	2.31	2.08*	2.18*	1.07	.85	.72	.82	.69	1.02
15	2.45	2.54	2.45	2.26	2.30	1.16	.95	.85	.90	.72	1.10
20	2.61	2.60	2.55	2.35	2.40	1.28	1.05	1.02	1.00	.77	1.20
25	2.65	2.60	2.55	2.40	2.46	1.38	1.15	1.15	1.07	—	1.26
30	2.65	2.60	2.55	2.43	2.50	1.45	1.20*	1.20	1.10	—	1.30
40	2.65*	2.60*	2.55*	2.45	2.55	1.50	1.20*	1.20	1.10	—	—
	Taxable Treasury Bonds[d]					*Partially Tax-exempt Treasury Bonds*[d]					
1	.64	.75	.74	.74	.88	.56	.37	.26	.50		.71
2	.93	1.00	1.00	.85	1.04	.76	.60	.44	.62		.81
3	1.18	1.22	1.19	.95	1.18	.93	.79	.60	.72		.89
4	1.41	1.42	1.35	1.05	1.30	1.09	.97	.75	.80		.97
5	1.60	1.58	1.49	1.14	1.38	1.25	1.10	.88	.86		1.05
6	1.75	1.73	1.62	1.20	1.45	1.38	1.22	1.00	.93		1.11
8	1.96	1.97	1.83	1.34	1.56	1.64	1.43	1.21	1.05		1.24
10	2.02	2.12	1.95	1.40	1.65	1.82	1.60	1.40	1.15		1.35
12	—	2.18	2.04	—	2.01†	1.95	1.72	1.55	1.24		1.45
15	2.31†	—	2.30†	2.07†	2.12†	2.06	1.85	1.74	1.35		—
20	2.44†	2.50†	2.40†	2.19†	2.30†	—	—	—	—		—
25	2.44†	—	—	—	—	—	—	—	—		—

[a] The values in this table are taken at various intervals along a smooth curve; intermediate values can be interpolated.

[b] Based entirely on 1 percent coupon bonds.

[c] Based on yields to maturity and terms to maturity.

[d] Based on yields and terms to earliest call date for callable bonds selling above par.

* These estimates may entail more than the normal amount of error because of lack of adequate data in these maturity ranges.

† Based on bonds not eligible for commercial bank investment.

porate curve and the taxable Treasury curve are usually small. In 1944, for example, the difference was only .1 percent for long-term bonds. Although the difference was larger in the other years studied, it was always small compared with the difference between Treasury bonds and municipals. In 1946, for example, 20-year corporates yielded 2.35 percent; 20-year Treasury bonds yielded 2.19 percent; and 20-year municipals yielded 1.00 percent.

Differences Between the Curves

The differences in the levels of the various basic yield curves are attributable to the joint influence of a number of forces, for each curve rep-

resents a distinct class of securities possessing several distinguishing features. The corporate market is characterized by fully taxable issues,[3] most of which are callable; maturities range up to about forty years, and occasionally much longer. The municipal market is characterized by tax-exempt issues, most of which are noncallable; maturities, which are usually serial, range to about forty years, rarely longer. Municipals moreover, are of special interest to commercial banks, which may operate as dealers in these securities. Finally, the Treasury market is characterized by a number of different kinds of securities, varying in tax status and eligibility for commercial bank investment, which necessitates the construction of more than one basic yield curve. For the years 1943-47 three curves are required, as indicated above: a long-term, taxable, bank-ineligible curve; a short-term, taxable, bank-eligible curve; and a partially tax-exempt, bank-eligible curve. (A curve for the fully tax-exempt bonds is not practicable because of the small number of such bonds outstanding.) Treasury bonds are either noncallable or are callable a few years prior to maturity. Maturities at the present time range up to about twenty-five years.

In addition to these characteristic differences between markets, some minor quality differentials may still exist even though each basic yield curve represents the highest grade of bonds in its respective market. Treasury bonds, for example, are probably a little more highly regarded than either the best corporates or the best municipals. There may also be a small quality differential between the municipals and the corporates.

Tax status is probably the most important single factor contributing to the differences in levels of the basic yield curves. For example, the rather spectacular difference, noted in all years, between the taxable Treasury-bond yields and the tax-exempt municipal yields is largely attributable to the tax privilege, although there are other factors that may have contributed to this difference, including desire for diversification on the part of investors, and the demand-supply situation in Treasuries as compared with municipals. Although the reason for the preferred position of tax-exempt bonds is easy to understand, it is difficult to explain the amount of the difference. If all incomes were taxed at a fixed rate, the differences between fully taxable bond yields and tax-exempt yields should be almost exactly determinable. With a 35 percent general tax rate, for example, tax-exempt bonds should yield 65 percent as much as fully taxable bonds, so that the return to the investor after taxes would be the same. But actually income tax rates vary

3 Prior to 1938 many corporate bonds were issued with a provision that a 2 percent income tax would be paid by the obligor. A few of these are still outstanding, but the effect of this tax exemption is of minor importance.

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widely. For individuals the 1946 rates ranged from zero on incomes of less than $500 to about 90 percent on incomes in excess of $200,000. Corporate incomes, including those of commercial banks and nonfinancial corporations, during 1946 were subject to federal income tax rates up to 38 percent,[4] but during the period of wartime excess profits taxes the upper limit was considerably higher. The investment incomes of many security holders, such as life insurance companies, mutual savings institutions, and universities, are tax-exempt or are subject to only a very nominal tax rate.

Clearly, the attractiveness of the tax-exemption privilege varies considerably from investor to investor. With the yield of top grade municipal bonds for 1943-47 approximately one-half that of taxable Treasury bonds, investors in the lower tax brackets cannot find the tax advantages of high grade municipals very attractive. Commercial banks, even those subject in 1946 to the maximum corporate income tax rate of 38 percent, could hardly have effected any great tax savings by buying high grade municipals on the basis of the 1946 yield differentials.[5] At the present level of tax rates and yield differentials, the chief beneficiaries of the tax-exemption feature are individuals in the higher income brackets. On the basis of 1946 tax rates, benefits could be realized by those with taxable incomes in excess of $20,000 (taxed at the rate of 53 percent or more on the excess over $20,000).

But interest in municipal bonds is not limited to this small group of high income individuals. Lower grade municipals with higher yields may have positive tax advantages to some investors who do not find the yields of the top grade bonds attractive. Commercial banks, which are permitted to act as dealers in municipals, may derive considerable profit from trading positions as distinct from investment positions. Furthermore, they may invest in local municipal bonds as a form of community service or public relations. Finally, some investors, who would not find the tax advantage in any one year a sufficient attraction, may be motivated to buy long-term municipal bonds because of expected increases in taxes.

The call provision also may contribute to the differences in levels between basic yield curves, although the effect is certainly less pronounced than that of the tax provision. Since most municipal bonds are noncallable, they protect the purchaser against a possible fall in interest rates. In this they differ materially from the corporates. During periods of substantial decline in interest rates, a portfolio of corporates is apt to

[4] Corporations with taxable incomes between $25,000 and $50,000, the so-called "notch bracket," constitute an exception; the excess income over $25,000 is taxed at the rate of 53 percent.
[5] Banks with taxable incomes between $25,000 and $50,000 would probably effect a much greater saving. See footnote 4.

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be partly liquidated as a result of calls, and reinvestment will almost necessarily be at a lower rate. Treasury bonds occupy an intermediate position for most of them are callable a few years before maturity. Compared with corporates and municipals, long-term Treasuries are little more than medium-term bonds. At this time (1947) the longest term Treasury bond outstanding matures in 1972, 25 years hence, and it is callable in 1967, 20 years hence. Nevertheless, these bonds offer an assured yield to call for 20 years, and thus provide a hedge against a fall in long-term interest rates. An investor desiring an assured long-term yield might well prefer one of these bonds to a 40-year callable corporate. The basic yield curves for both the municipals and corporates are based upon yield to maturity. This is entirely appropriate for municipals, which will presumably be paid at maturity. Though less appropriate for corporates, it is expedient because of the difficulty of predicting if and when a corporate bond will be called. The basic Treasury curves, however, are based upon yield to the earliest call date. The assumption underlying this procedure is that when Treasury issues are selling above par, as all of them were in the period studied, they will be called at the earliest opportunity.

The differences between the various basic yield curves often vary with term to maturity. For example, the difference between corporate and Treasury yields is greatest for the very short maturities. An explanation of this phenomenon can be found in the fundamental differences between the two short-term markets. The Treasury market — consisting mainly of bills, certificates of indebtedness, and notes — is a volume market in which the banks trade actively. This market, furthermore, has been supported by the open market operations of the Federal Reserve System. From April 30, 1942, until July 1, 1947, the Reserve System operated under a stated policy of supporting bills at $3/8$ percent and during much of this period, it was supporting certificates at $7/8$ percent. The corporate short-term market, on the contrary, consists mainly of former long-term bonds approaching maturity. The market is not active, and there is no direct support from the Federal Reserve System.

In the middle-term maturity range, the differences between the corporate curve and the Treasury curve have usually been small. The basic corporate yields for 5- to 8-year bonds actually fell below the yields of Treasury securities in the first quarter of 1944, and they were only slightly above the Treasury yields in 1943 and 1945. In 1946 and 1947, however, they were considerably above. This shift, it appears, is closely tied up with the changing pattern of demand by commercial banks for Treasury bonds. From late 1943 through most of 1945 new bank purchases in the 5-10 year class were relatively slight. Late in 1945, how-

ever, and on an increasing scale during the first quarter of 1946 (and also subsequently) the banks came in to make fairly significant new purchases in the 5-10 year class.

These small differences in the earlier years are difficult to explain. One pertinent factor is the volume of high grade corporate bonds in this range, which is small in comparison with the very large volume of Treasury bonds outstanding. Moreover, this shortage of corporates is aggravated by the habits of some investors, who hold their bonds to maturity regardless of their market yield. Trading activities in this sector are confined mainly to Treasury securities, and consequently the basic Treasury yields are probably much more sensitive to changes in demand than basic corporate yields. For example, if yields of the actively traded issues decline or increase during the second half of the month, and if no sales of the inactively traded issues take place during this period, only the former change in yield is reflected in the basic yield.

The Shape of the Basic Yield Curves

The characteristic shape of the basic yield curves for 1943-47, rising at the short-term end and leveling off at the long-term end, has been typical of the yield maturity relation in the American money markets ever since the middle thirties. Since the forces that determine this general shape have been discussed extensively by market analysts, public officials, and economic theorists, a systematic treatment of the question is not presented here. A brief statement of the principal contributing forces is in order, however.

On the practical side, the low level of short-term rates may be attributed to a preponderance of demand for short-term securities relative to the supply, which is the result of the volume of excess reserves, the institutional needs of the commercial banks, and the policies of the Federal Reserve System. On the theoretical side two explanations have been given for the preponderance of demand for short-term bonds relative to the supply. One is that investors desire liquidity and willingly sacrifice yield in order to obtain it; they therefore bid up the prices of the short-term issues, relative to the longer-term issues. The other is that investors attempt to discount expected future changes in yields. In so doing they bring about a yield-maturity curve in which the long-term yields are an average of the expected future short-term yields. According to this second view the rising curve indicates that investors must be expecting an increase in interest rates, and that they prefer short-term bonds now so that later they can switch into long-term bonds on more favorable terms.

A complete reconciliation of these two views is possible if the relevant forces are conceived as exerting different influences on separate

groups of investors. One group, for example — and this includes most of the banking system — desires liquidity for its own sake, either because of institutional requirements, custom, or considerations of safety. This demand for liquidity may have no relation to any conscious evaluation of the future course of bond yields. A second group may expect a rise in bond yields and anticipate this rise by buying short-terms. A third group expects a fall and anticipates this fall by buying long-terms. And finally a large fourth group, without any urgent need for liquidity and with no strong convictions about future changes in interest rates, attempts to obtain the highest possible current yield by a suitable arrangement of maturities. As indicated above, another influence of primary importance is that exerted by federal agencies in the management of the public debt. Therefore, the basic yield curve becomes a see-saw or balance that tips one way or the other, depending upon the influence of these various groups and the supply of securities of different maturities. Thus the low short-term rate would be properly attributable to the influence of federal debt policy and to the combined weight of the first two groups, those desiring liquidity and those anticipating a rise in yields.

It is worth noting that the shape of the basic municipal yield curve may be affected by the expectation of changes in tax rates, as well as by the desire for liquidity or the expectation of changes in interest rates. If income tax rates or investors' incomes were expected to rise drastically, some investors would buy municipals to protect themselves, and others would buy them as a speculation. For these purposes long-term municipals would be preferable to short, and a downward pressure would be exerted on the long-term end of the municipal curve. This pressure would tend to counter-balance the pressure on the short-term end exerted by the desire for liquidity or the expectation of a rise in interest rates: consequently the expectation of higher tax rates would tend to make the basic municipal curve flatter than either the taxable Treasury or the corporate curves. Conversely, of course, an expected fall in tax rates would tend to lift the long-term end of the municipal curve.

THE CHANGING PATTERN OF BASIC YIELDS, 1926-47

WHILE CHART 3 gives a good picture of the pattern of basic yields at a given time — namely, the first quarter of each of the years 1943-47 — yearly movements cannot be readily detected from it. Charts 4 and 5 have been designed to overcome this deficiency; they show the changes from year to year in the first-quarter basic yields of corporate and municipal bonds of 3-year, 10-year, and 30-year maturities, and also of Treasury bonds of 3-year, 10-year, and long-term maturities.[1]

Limitations of the Basic Yield Estimates

Full recognition of the limitations of basic yields is essential in any analysis of these charts. In the first place, basic yields are better adapted to describing the general pattern of rates at a particular time than the variation of rates over time. A time series composed of basic yields for the first quarter of each year depicts the changes in yields that have occurred in that quarter from year to year, but it provides no indication of the changes that may have taken place during the three other quarters of the years studied. An examination of other interest rate series, however, indicates that the trend pictured by basic yield data does not differ from that obtained from these other measures. The basic yield is also subject to the limitation, growing out of its derivation from the average of the high and low prices of each month of the first quarter, that there may have been a few actual sales of bonds during the quarter at yields slightly lower than the basic yield figure shown.

In the second place, the estimates of short- and medium-term yields are subject to an indeterminable error, which may be quite large in some instances. This is due in part to an occasional inadequacy in the number of bonds for which data are available in some particular maturity range, and in part to the use of simple curves in fitting a basic yield curve. The short- and medium-term municipal yields are some-

[1] There have not been any 30-year Treasury bonds outstanding since 1931. The longest-term Treasury bond outstanding in the first quarter of 1947 matured in 25 years and was callable in 20 years; the longest-term, partially tax-exempt, Treasury bond matured in as little as 18 years and was callable in 13 years.

what less reliable than comparable corporate yields, and in turn the corporate yields are somewhat less reliable than short- and medium-term Treasury bond yields. The long-term yield estimates in all market segments are thought to be more accurate than the short-term.

For the entire period covered by this study there have been a large number of high grade municipal and corporate bonds clustering in the 25- to 35-year maturity range. The estimated basic yield for 30-year bonds has always been superior to estimates of both the short-term and the very long-term yields. However, since the 30-year basic yields are ordinarily estimated to the nearest .05 percent, and since an error of estimation of another .05 percent is quite conceivable, the 30-year basic yields are not sufficiently accurate to show minor variations in yield of .02 to .03 percent. Comparable data for Treasury issues in this maturity range are lacking, but the long-term Treasury bonds provide an accurate measure of yields in the maturity classes for which such bonds are available.

Changes in the Pattern of Basic Yields

Although the basic yield curves changed considerably during the period under review, the tendency was for the relationship among the curves in each segment of the market to be similar at any one time (Chart 4). In 1926 and 1927 the yield of short-term issues equaled that of long-terms in each of the three segments — Treasury, municipal, and corporate. In 1929 short-terms were higher than long in all three segments; and since 1933 yields of long-term issues have been the highest. However, when the three segments are considered in relation to one another, significant differences are evident. From 1926 to 1930, for example, the normal hierarchy of yields seems to be corporates highest, municipals next, Treasury bonds lowest (Chart 5). But during the thirties municipal yields for all except the shortest maturities began to slip below those of Treasury issues, and by 1944 they were clearly lower.

The period from about 1932 to 1947 is marked by two conspicuous developments: first, a fall in yields, and second, a yield curve in which short-term rates are consistently below long-term rates. In fact, the consistency of the low, short-term rate curve during the last 15 years has often led to the conclusion that it is the normal curve form. This conclusion may be an accurate generalization of the present, but it is certainly not an accurate generalization of the past. The low short-term rate curve was not normal from 1926 to 1930 according to Chart 4, and it was not normal in the corporate market from 1900 to 1926.[2]

[2] David Durand, *Basic Yields of Corporate Bonds*, 1900-1942 (National Bureau of Economic Research, Technical Paper 3, June 1942) Chart 3, p. 16, and basic charts. See Also W. Braddock Hickman, *The Term Structure of Interest Rates, An Exploratory Analysis* (National Bureau of Economic Research, ms. November 16, 1942) Chapter IV, pp. 29-31 especially.

CHART 4—Basic Yields of Bonds by Type, First Quarter, 1926-47

——————— 30-year bonds
═══════════ Longest-term Treasury bonds
– – – – – – 10-year bonds
••••••••••••••••• 3-year bonds

Yield (%)

Corporate Bonds

1926 '27 '28 '29 '30 '31 '32 '33 '34 '35 '36 '37 '38 '39 '40 '41 '42 '43 '44 '45 '46 '47

Municipal Bonds

1926 '27 '28 '29 '30 '31 '32 '33 '34 '35 '36 '37 '38 '39 '40 '41 '42 '43 '44 '45 '46 '47

Treasury Bonds*

1926 '27 '28 '29 '30 '31 '32 '33 '34 '35 '36 '37 '38 '39 '40 '41 '42 '43 '44 '45 '46 '47
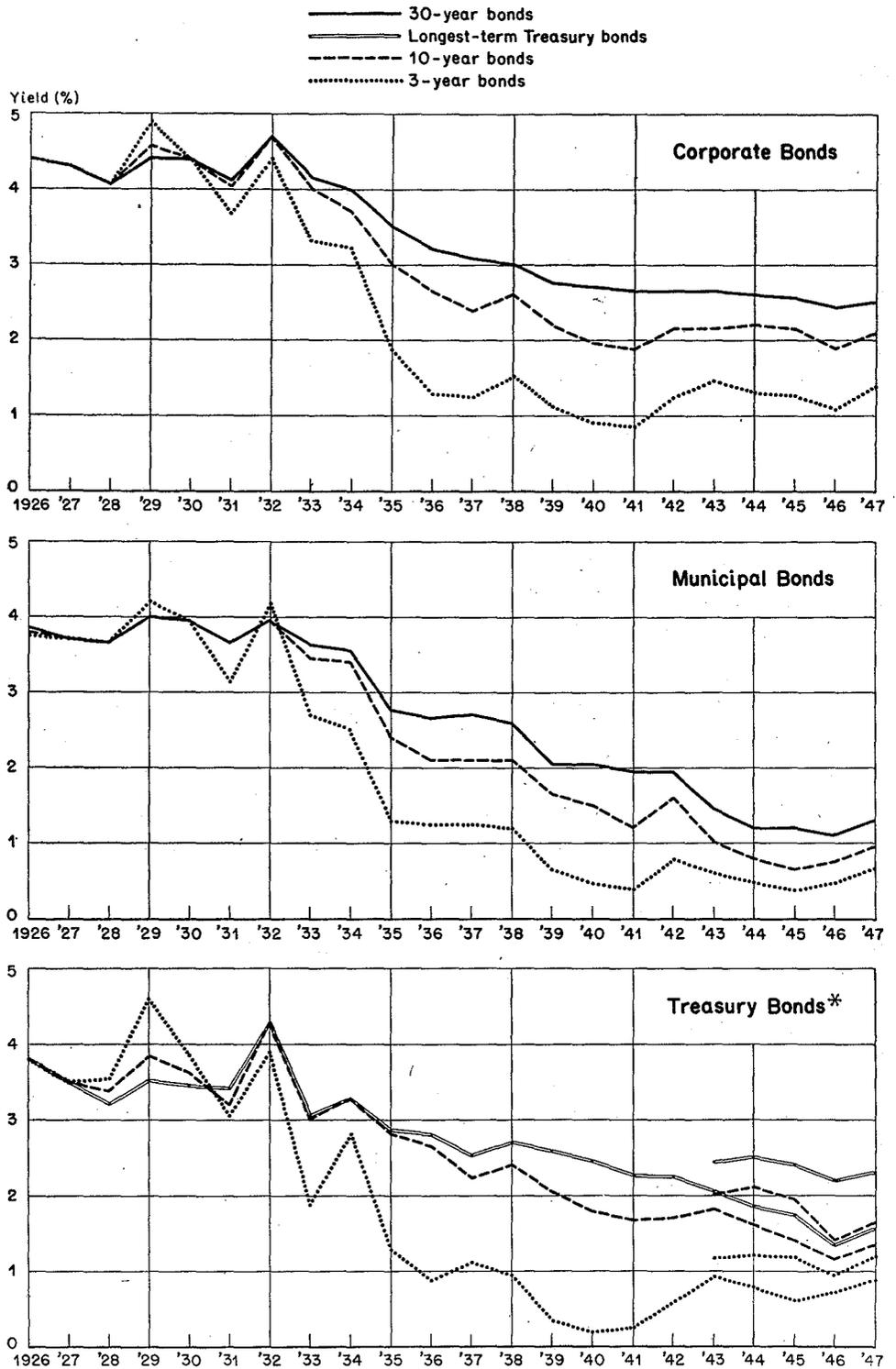
* Curves, 1926-47, are for partially tax-exempt data; 1943-47 for taxable.

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CHART 5 — Basic Yields of Bonds by Term to Maturity, First Quarter, 1926-47

——————— Corporate bonds
—·—·—·—· Municipal bonds
··············· Taxable Treasury bonds
— — — — — Partially tax-exempt Treasury bonds

Yield (%)

Long-term Bonds*＊

1926 '27 '28 '29 '30 '31 '32 '33 '34 '35 '36 '37 '38 '39 '40 '41 '42 '43 '44 '45 '46 '47

Medium-term Bonds
(10-year)

1926 '27 '28 '29 '30 '31 '32 '33 '34 '35 '36 '37 '38 '39 '40 '41 '42 '43 '44 '45 '46 '47

Short-term Bonds
(3-year)

1926 '27 '28 '29 '30 '31 '32 '33 '34 '35 '36 '37 '38 '39 '40 '41 '42 '43 '44 '45 '46 '47
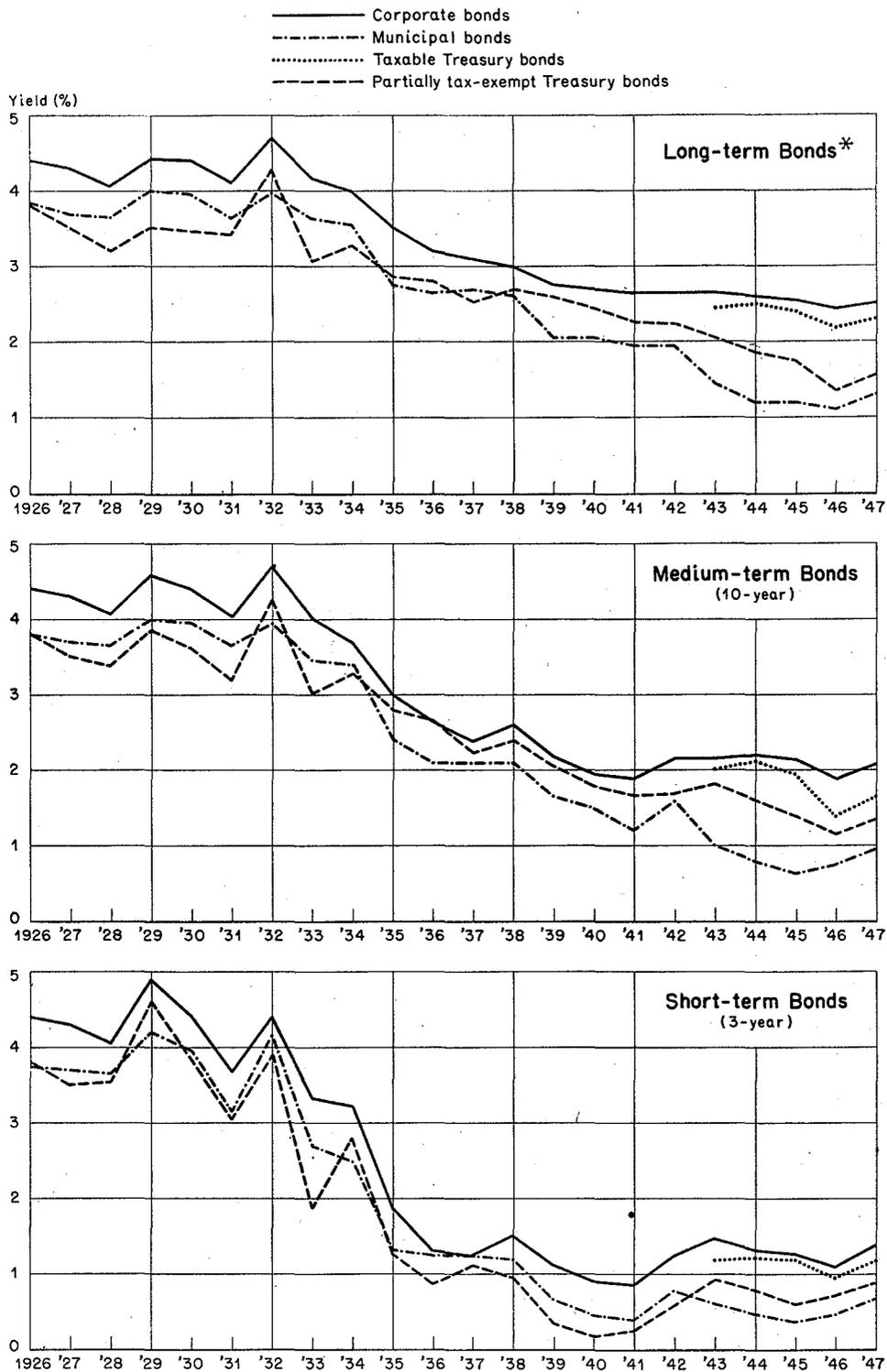
＊ 30-year corporates, 30-year municipals, and the longest-term Treasury bonds outstanding.

The period 1932-47 divides itself into three parts: one from 1932 to 1941, when the fall in basic yields was abrupt and widespread; the second from 1941 to 1946, when the downward tendency was not pronounced in all sectors of the market; a third in 1947, when basic yields increased for all maturities and all market segments. (See Chart 4.)

Between 1932 and 1941 short-term basic yields declined more sharply than long-term; furthermore, the decline in basic short-term bond yields relative to long-term yields was greater in the Treasury bond market than in the other market segments. This was due, in part, to the conversion privileges which arose through the Treasury policy of permitting the holder to exchange maturing Treasury obligations for new issues on a preferential basis. This privilege, in fact, was equivalent to the payment of a premium on the bond at maturity although the value of this premium could not be predicted exactly. In addition, the growing excess reserves of the commercial banking system gave rise to an increase in demand for short-term Treasury obligations which was more than proportionate to the increase in demand for short-term obligations in other segments of the market.

After the sharp and consistent declines from 1932 to 1941, the basic yield series followed no consistent tendency throughout the second period, 1941-46. Some of the basic yield series actually rose, some remained relatively stable, and others fell (Charts 4 and 5). Medium- and short-term corporate yields were higher throughout most of the period than they were in 1940. Short-term Treasury yields rose sharply from 1940 to 1943 and 1944, largely because of the volume of new short-term financing and the discontinuance of the conversion privilege, and then fell off somewhat. Long-term corporate yields moved downward very slowly with no suggestion of an interim rise. The only evidence of a continuation of the downward trend, which was so persistent in the earlier years, is in the municipal market and the partially tax-exempt Treasury market, where the tax-exemption privilege exerted a strong downward pressure during the period of high war taxes. Long- and medium-term bond yields in both these markets moved rather sharply downward after a slight rise around 1942-43.

In contrast to the behavior in the preceding periods, basic yields increased in all maturity classes and in all market segments in 1947. All short- and medium-term yields rose more rapidly than the longer-term yields. These relatively larger increases in the short-term yields were due, in part, to the Treasury policy of retiring part of the federal debt. The issues retired were those which were largely owned by the Federal Reserve banks and the commercial banks. The effects of this policy upon bank reserves and bank demand for securities in the shorter-term market segments more than counterbalanced the reduction in the sup-

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ply of short-term Treasury securities. In addition, the growing uncertainty in the minds of many investors about the continuance or extension of the wartime interest rate policies followed by the Treasury and the Federal Reserve banks, particularly those applicable to the short-term yields, retarded the tendency of the investors in the shorter-term issues to extend the maturity of their holdings.

Basic Yields versus Low Grade Bond Yields

The lack of a consistent downward trend in basic yields from 1940 to 1946 will stand out in sharp contrast to the experience of many investors, who found that both bond yields in their portfolios and interest income declined considerably during the period. This apparent contradiction is readily explained, however, by the prevalence of corporate refundings and by the fall in yields on low grade bonds.

The general improvement in credit standings of most companies, the wartime policies of stabilizing yields of Treasury obligations, and other fiscal policies of the government were conducive to very extensive bond refunding operations. The volume of corporate refundings from January 1, 1940 to December 31, 1945 is estimated to have been in excess of $10.7 billion; refundings were particularly heavy in 1944, 1945, and the first half of 1946.[3] These refundings involved a substantial reduction in coupon rates of interest. High coupon bonds matured, were called prior to maturity, or were even bought up in the open market; and they were replaced by new low coupon issues or low-rate bank loans. With the reduction in coupon rates came an effective reduction in interest costs to borrowers and in interest income to bondholders, both of which were entirely compatible with a stable level of basic corporate yields. Evidently these refunding operations were a process of correction to bring the coupon rates of interest into line with the basic yields. From 1933 to 1940 bond prices rose sharply with an attendant fall in market yields. There were some refundings to lower coupon rates, but because of the continuous decline in basic yields, on the whole, coupon rates remained well above basic yields. But in 1940, after the fall in basic yields had spent itself, refundings began to bring coupon rates down into line with market yields. For many investors the decline in market yields meant very little, as long as their portfolios remained intact and their interest income continued as before. They began to be aware of the trend only when the refunding of bonds bought in the days of higher yields began to cut down their income.

As indicated, one of the factors contributing to the large volume of corporate refundings since 1940 was the growth in business confidence

3 *Federal Reserve Bulletin,* July 1946, p. 782.

and the improvement in the financial position of most corporate obligors. These developments also evidenced themselves in a decline in the yields of lower grade bonds. This tendency is clearly shown in Chart 6, which traces the movement of Moody's Aaa and Baa bond yields

CHART 6 — Movements of Moody's Aaa and Baa Bond Yields, First Quarter Averages, 1938-47
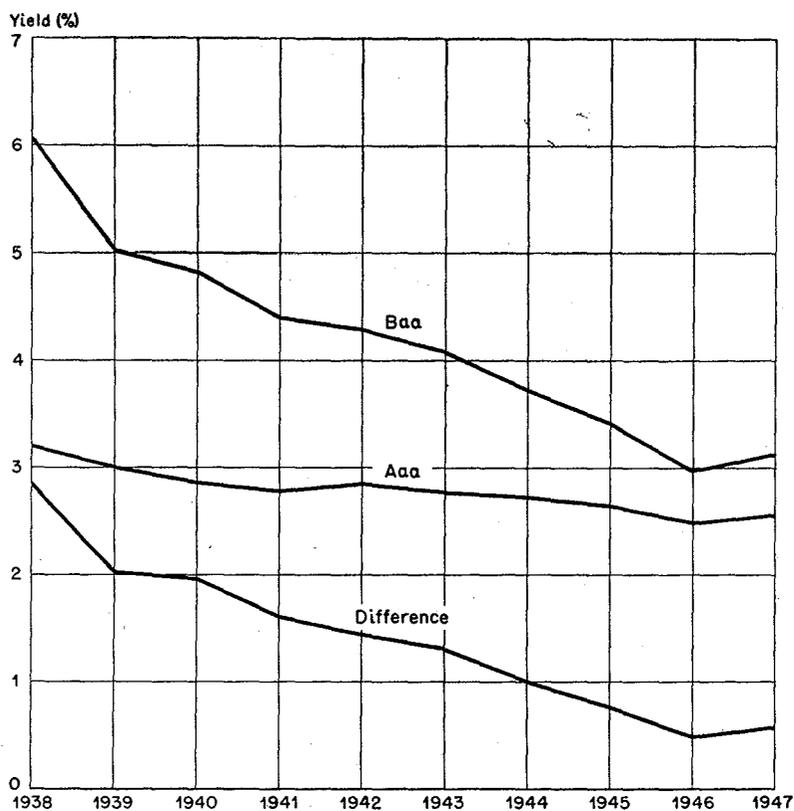
from 1938-47. Further evidence of this tendency is given by the change in yield depth that occurred in the corporate market from 1940 to 1946. This change in depth is shown in Charts 7, 8, and 9 which present the yield distribution of corporate bonds of all grades in selected maturity ranges in the first quarter of 1940, 1946, and 1947. In the construction of these charts a tally was first made of short-term bond yields, represented by 1- to 5-year maturities; medium-term bond yields, 8 to 14 years; and long-term bond yields, 24 to 30 years. The maturity ranges had to be made fairly broad in order to include an adequate number of bonds. In making this tally the differential between the actual yield to maturity of each bond and the basic yield for bonds of like maturity was taken, and the bonds were grouped in yield classes according to this

TABLE 2

CHANGES IN CORPORATE BOND YIELDS, 1940-47

Classification	Basic Yield	First Quartile Bond Yield	Median Bond Yield	Third Quartile Bond Yield
Short-term Bonds: 1-5 Years (mid-point value: 3½ years)				
1940	1.00	1.80	4.25	9.00
1946	1.15	1.73	2.97	4.25
Net Change	+.15	—.07	—1.28	—4.75
1947	1.45	2.12	3.06	3.98
Net Change over 1946	+.30	+.39	+ .09	— .27
Medium-term Bonds: 8-14 Years (mid-point value: 11½ years)				
1940	2.10	3.90	5.43	9.30
1946	2.05	2.92	3.89	4.64
Net Change	—.05	—.98	—1.54	—4.66
1947	2.17	3.00	3.80	4.63
Net Change over 1946	+.12	+.08	— .09	— .01
Long-term Bonds: 24-30 Years (mid-point value: 27½ years)				
1940	2.70	3.03	3.45	4.39
1946	2.40	2.55	2.74	2.97
Net Change	—.30	—.48	—.71	—1.42
1947	2.50	2.60	2.73	3.01
Net Change over 1946	+.10	+.05	—.01	— .04

differential: o to .19 percent above the basic yield, .20 to .39 percent above the basic yield, etc.[4]

An examination of Charts 7, 8, and 9 indicates a considerable decrease in the dispersion, or depth, of bond yields between 1940 and 1946 for each of the selected maturity groups. The lower grade bonds declined in yield more rapidly than the higher grade, and the yields on all bonds tended to concentrate in a narrowing range above the basic yield. This tendency is sharply evident when an examination is made of the changes for three maturity groups from 1940 to 1946 in the basic yield, the yield on the bond at the first quartile, the yield on the median bond, and the yield on the bond at the third quartile as shown in Table 2. In 1947 the basic yield rose while the third quartile bond yields for all three maturity groups fell. In other words the yield depth continued to decrease in the first quarter of 1947 even though basic yields moved

[4] The distribution of 1940 bonds was obtained from the records of the Corporate Bond Research Project, which include all adequately quoted issues of $5,000,000 or more, and a 10 percent sample of smaller issues. The distribution of 1946 and 1947 bonds was made from Fitch's bond record for the month of February in each year. Distributions of bond yields, by industry groups, are being prepared under the Corporate Bond Research Project for the entire period 1900-1946. In making these distributions the following types of bonds were omitted: serials, income bonds, bonds of foreign corporations, and most real estate bonds.

CHART 7—Frequency Distribution of 1-5 Year Corporate Bonds by Yield Differentials, First Quarter, 1940, 1946, and 1947*

Percent of all bonds

1940 — $Q_1 = 0.80$ $M = 3.25$ $Q_3 = 8.00$

1946 — $Q_1 = 0.58$ $M = 1.82$ $Q_3 = 3.10$

1947 — $Q_1 = 0.67$ $M = 1.61$ $Q_3 = 2.53$

Difference between bond yield and basic yield
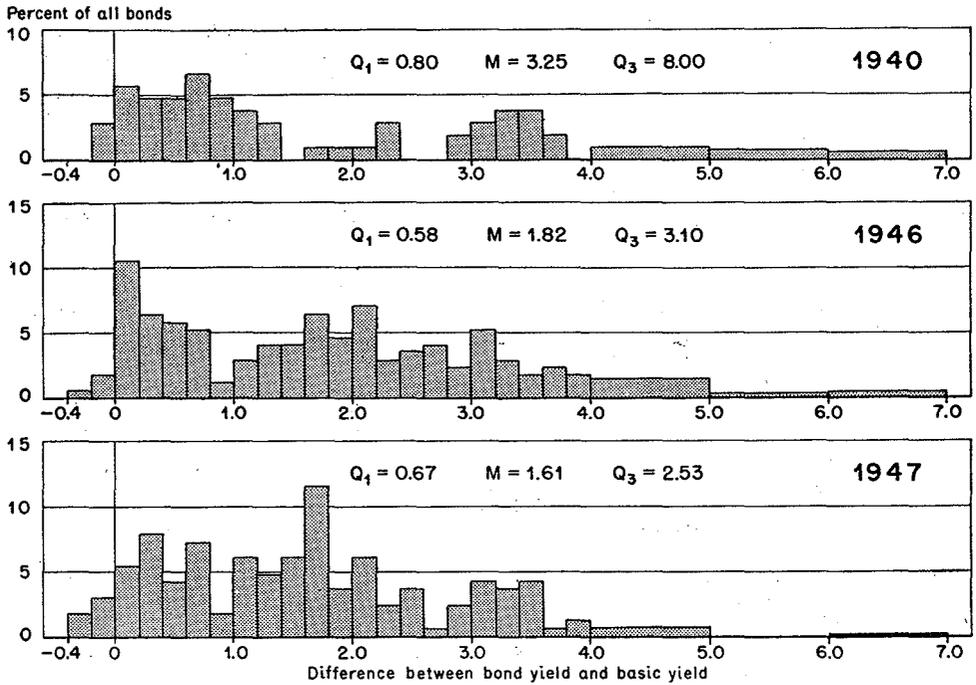
CHART 8—Frequency Distribution of 8-14 Year Corporate Bonds by Yield Differentials, First Quarter, 1940, 1946, and 1947*

Percent of all bonds

1940 — $Q_1 = 1.80$ $M = 3.33$ $Q_3 = 7.20$

1946 — $Q_1 = 0.87$ $M = 1.84$ $Q_3 = 2.59$

1947 — $Q_1 = 0.83$ $M = 1.63$ $Q_3 = 2.46$

Difference between bond yield and basic yield

* Bonds with differences of 7% or more have been omitted from this chart.

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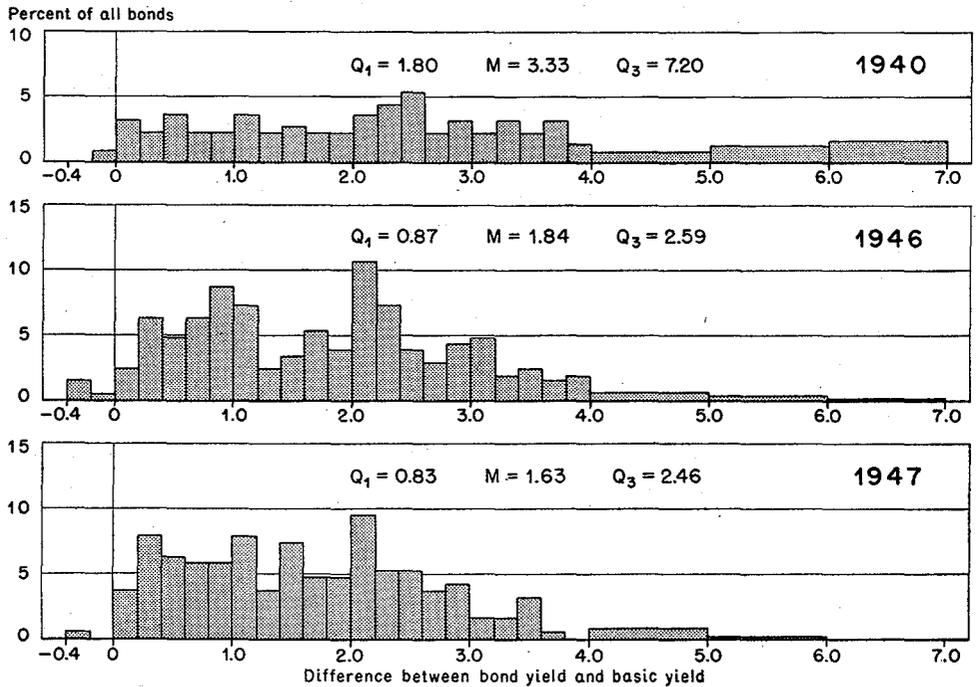
CHART 9—Frequency Distribution of 24-30 Year Corporate Bonds by Yield
Differentials, First Quarter, 1940, 1946, and 1947*

Percent of all bonds

1940

$Q_1 = 0.33$ $M = 0.75$ $Q_3 = 1.69$

1946

$Q_1 = 0.15$ $M = 0.34$ $Q_3 = 0.57$

1947

$Q_1 = 0.10$ $M = 0.23$ $Q_3 = 0.51$

Difference between bond yield and basic yield
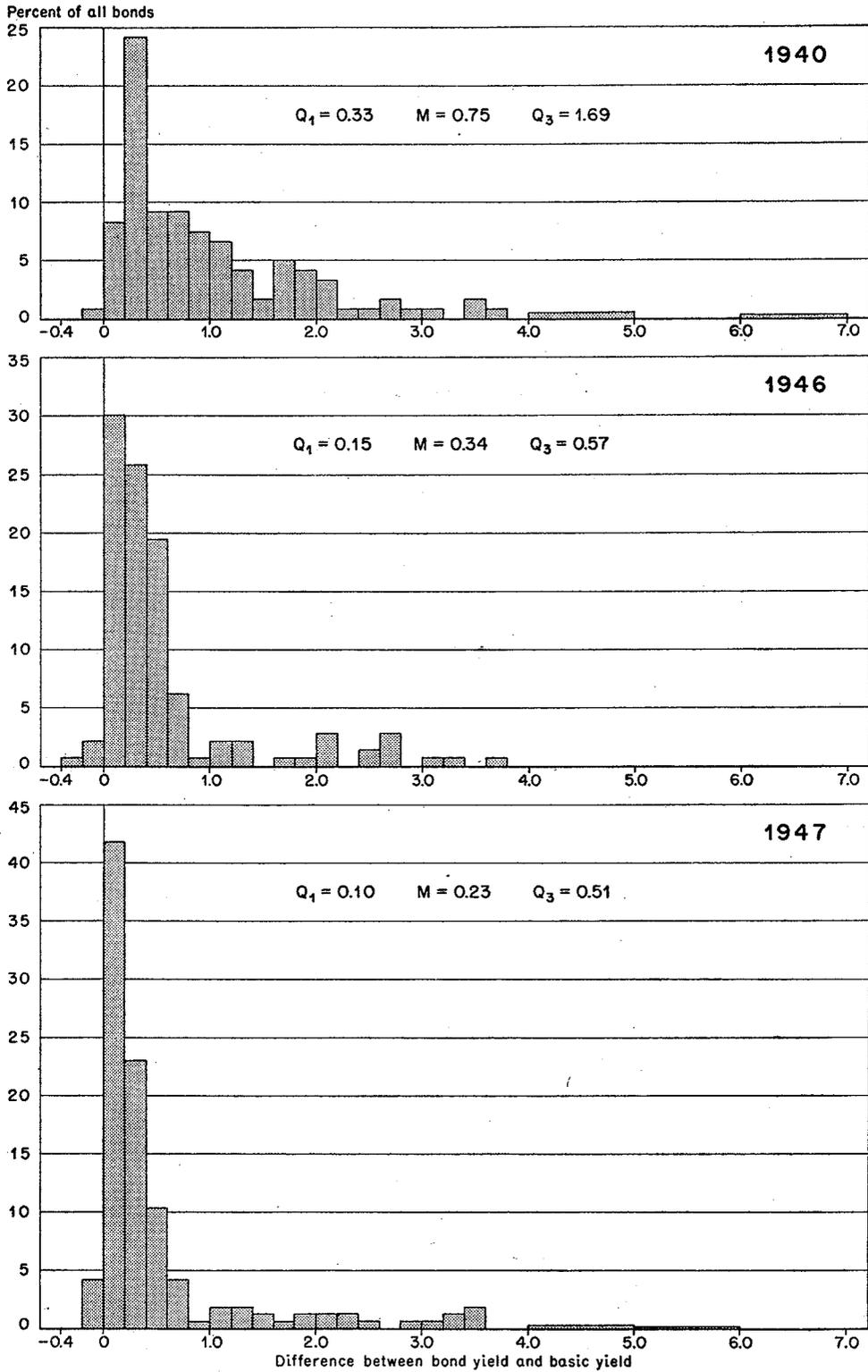
* Bonds with differences of 7% or more have been omitted from this chart.

upward. This evidence, however, is apparently in conflict with that given in Chart 6 which shows that the difference between yields on Moody's Aaa and Baa bonds increased in 1947.

With respect to this apparent difference in results it should be noted, first, that Table 2 and Chart 6 are not directly comparable because the former is based on a count of individual bond yields, while the latter is an average of bond yields in a given rating grade. Furthermore, it is not possible to determine whether there is a real conflict in results since the bonds rated Baa by Moody's cannot be identified in Table 2. One possible cause of such a conflict is corporate refundings, which might have shifted the position of Baa bonds in the distribution of all bonds.

This discussion of the period 1940-47 should illustrate the rather evident principle that a comprehensive description of the behavior of interest rates during any period necessarily involves a complete treatment of all major types of bonds of all maturities and of all qualities; and it may involve an analysis of refunding operations and coupon rates. The basic yield analysis attempts to give a comprehensive picture of highest grade bond yields only, in which the effects of quality variations are reduced to a minimum. The result is that the basic yield series do not reflect the very extensive movements of the yields of the lower grade bonds. Clearly, any appraisal or interpretation of the basic yield series is more significant if the movements of the underlying, lower grade, bond yields are also taken into consideration.

In fact, the purpose of the basic yield is to provide a standard of comparison against which the movements of all bond yields can be more effectively analyzed.

RELATION OF BASIC YIELDS TO COUPON RATES

IN THE DEVELOPMENT of the estimates of basic yields for municipal bonds, a marked tendency was observed for yields to vary with coupon rates. Although this tendency has been observed in the corporate market and in the United States government market, it is primarily a characteristic of the municipal market, where noncallable bonds of the same obligor are frequently found with similar maturities but widely differing coupon rates. An illustration is given in Charts 10 and 11. Chart 10, for example, shows the coupon rates and yields in mid-February of 1944 and 1945 for New York State bonds maturing between 1970 and 1979. Despite the small number of available quotations for this maturity range, the association between yields and coupon rates is clearly evident. These bonds are all noncallable and presumably of uniform quality, and although there may be some variation in yields attributable to difference in maturity, this variation is nearly negligible in this limited maturity range. A better example is given in Chart 11, which shows

CHART 10 — Relation Between Coupon Rate and Yield, New York State Bonds Maturing
1970-79, for Selected Dates, 1944-45
(curves fitted by eye)
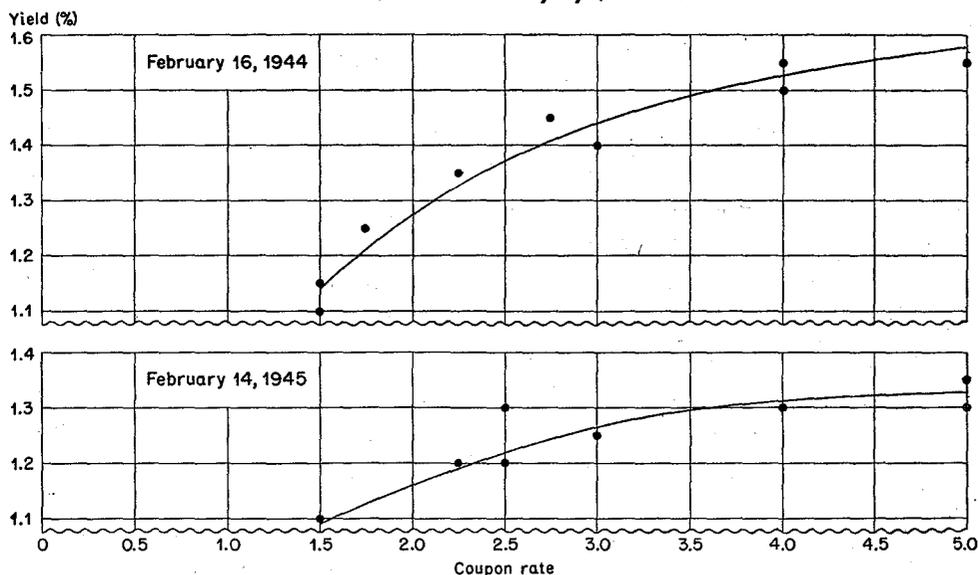
CHART 11 — Relation Between Coupon Rate and Yield, New York City Bonds and Corporate Stock Maturing 1970-75, for Selected Dates, 1945-46
(curves fitted by eye)

Yield (%)

February 14, 1945

February 13, 1946

Coupon rate
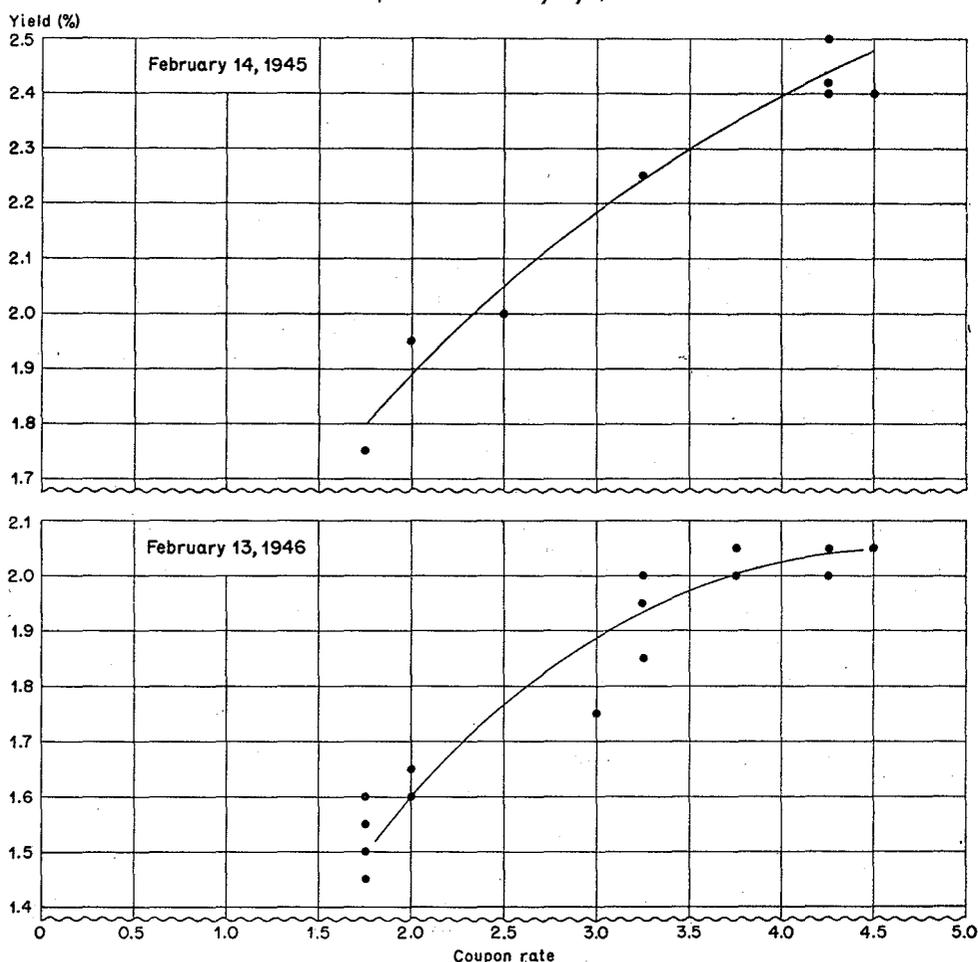
the behavior of New York City bonds and corporate stock.[1] These securities, though not of quite so high quality as New York State issues, have good uniform credit standing and are noncallable. Moreover, they are actively traded, and an adequate number of quotations can be found in the six-year maturity range from 1970 to 1975 so that the possible effects of variation in maturity are even further reduced.

Two examples of the yield-coupon relationship for corporate bonds are given in Tables 3 and 4. The first of these traces the yields for the period 1924 to 1936 of three Louisville and Nashville Railroad bonds issued under one mortgage and having the same maturity. The second traces two Union Pacific bonds, also issued under one mortgage and having one maturity, from 1924 to 1937. Although the tendency is clear

[1] Certain New York City obligations described as "corporate stock" are generally considered equivalent to bonds.

TABLE 3

FEBRUARY YIELDS OF LOUISVILLE AND NASHVILLE FIRST AND REFUNDING 4½'s, 5's AND 5½'s OF 2,003, 1924-36

(Yields computed from average of high and low prices in February)

	Year	Yield to Maturity		
		4½'s	5's	5½'s
	1924	—	5.02	5.21[a]
	1925	4.85	4.87	5.16[a]
	1926	4.59	4.78[a]	5.00[a]
	1927	4.48	4.69[a]	5.07[a]
	1928	4.30	4.59	4.99[a]
	1929	4.60	4.83	5.21[a]
	1930	4.69	4.79	5.16[a]
	1931	4.49	4.78	5.19[a]
	1932	6.99	6.83	7.02
	1933	6.70	7.01	7.29
	1934	4.96	5.13	5.40
	1935	4.38	4.71[a]	5.18[a]
	1936	4.13[a]	4.54[a]	5.23[a]

[a] Average price was above call price. The 5½'s were callable at 102 on or after October 1, 1936; the 5's at 105 on or after October 1, 1938; and the 4½'s at 105 on or after October 1, 1939.

TABLE 4

FEBRUARY YIELDS OF UNION PACIFIC FIRST AND REFUNDING 4's AND 5's OF 2,003, 1924-37

(Yields computed from average of high and low prices in February)

	Year	Yield to Maturity	
		4's	5's
	1924	4.80	4.95
	1925	4.68	4.75
	1926	4.54	4.63[a]
	1927	4.30	4.56[a]
	1928	4.12	4.35[a]
	1929	4.53	4.65
	1930	4.46	4.63[a]
	1931	4.21	4.49[a]
	1932	4.96[b]	5.13[b]
	1933	4.57	4.88
	1934	4.19	4.66
	1935	3.73	4.19[a]
	1936	3.62[a]	4.23[a]
	1937	3.67[a]	4.44[a]

[a] Average price was above call price of 107½.
[b] Based on March prices because 5's did not sell in February.

for the high coupon bonds to yield more than the low coupon bonds, these examples are less convincing than the New York State and New York City examples because of the effects of the call provision. The Louisville and Nashville bonds were callable at 102 to 105, the Union Pacific bonds at 107½. And during the periods covered by the examples,

the high coupon bonds of both railroads frequently sold above their call prices.

The relationship between yield and coupon is readily translated into a similar relationship between yield and price; high premium bonds, which are normally high coupon bonds, usually sell on a higher yield basis than low premium bonds. This is clearly illustrated in Charts

CHART 12 — Relation Between Price and Yield, New York State Bonds Maturing 1970-79, on February 16, 1944
(curve fitted by eye)
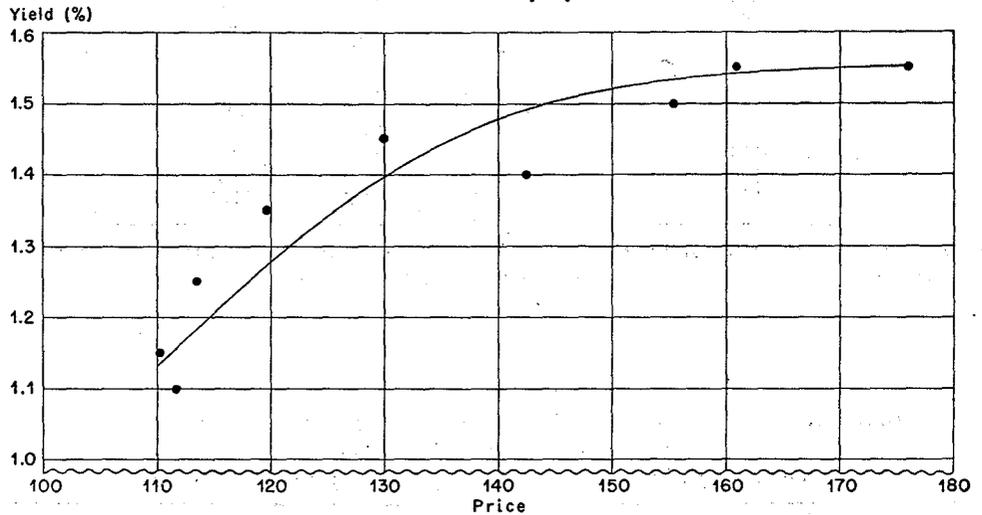
CHART 13 — Relation Between Price and Yield, New York City Bonds Maturing 1970-75, on February 13, 1946
(curve fitted by eye)
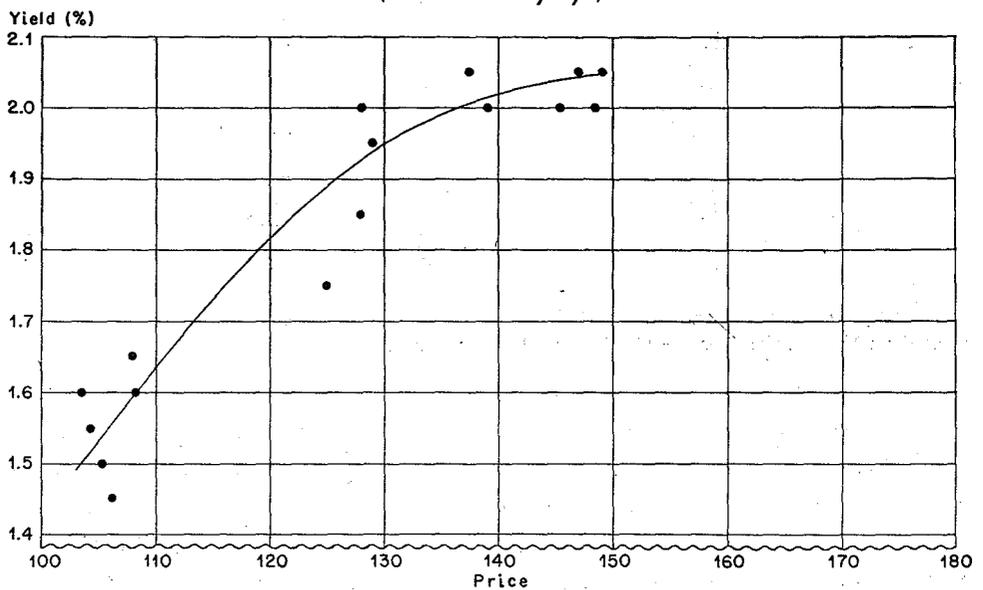
12 and 13, presenting yields and prices on February 16, 1944 for New York State issues maturing from 1970 to 1979 and on February 13, 1946 for New York City issues maturing from 1970 to 1975. The yield-coupon relationships for these same bonds on these dates were shown on Charts 10 and 11.

All indications are that the fundamental causal relationship is between price and yield, rather than coupon and yield. Investors seem to be price conscious. They tend to prefer bonds selling at discount to bonds selling around par, and the latter in turn to bonds selling at a substantial premium. This price consciousness, which results in an appreciable differential in yield, is attributable to a number of factors. These may be grouped into four broad categories: (1) the possibility of redemption prior to maturity; (2) barriers to systematic amortization of premiums; (3) expectations of changes in interest rates; (4) a more or less irrational belief on the part of a few investors that low priced bonds are bargains merely because they are low priced.

In the corporate bond market the possibility of redemption prior to maturity, a very common occurrence, is a real force affecting both prices and yields of premium and discount bonds. Most corporate bonds may be called prior to maturity, at the option of the obligor, in accordance with the provisions of the bond indenture. Corporates may also be prepaid by court order in the course of a voluntary or involuntary reorganization. In particular, utility holding company bonds may be prepaid in reorganizations ordered by the Securities and Exchange Commission in the administration of the Public Utility Holding Company Act. In these reorganizations the relationship of the liquidation value of the bond to the coupon rate has been one of the troublesome problems confronting the administrative authorities.

The possibility of prepayment ordinarily tends to enhance the attractiveness of low priced bonds. A good example of this principle is provided by the Union Pacific 4's and 5's mentioned in Table 4. Over the six-year period 1932 to 1937 these bonds varied considerably in price; in 1932 both bonds were selling at discount, and in 1936 and 1937 both were selling above the call price of 107½. During these six years the 5's always yielded (in February) more than the 4's, which implies that the 5's were the more attractive investment. But these yields were computed on the assumption that the bonds would be held to maturity and retired at par; whereas actually both bonds were retired on September 1, 1940 at 107½. It is therefore instructive to examine the yields to actual retirement over the same period. (These are the yields that were realized by investors who bought the bonds in February of each year and held them until September 1, 1940.) These yields,

tabulated below, show that the 4's produced a better realized return than the 5's.

Year	4's	5's
1932	7.69%	6.07%
1933	6.86	5.45
1934	5.76	4.72
1935	3.86	2.66
1936	3.27	2.46
1937	3.49	3.37

Although the retirement of these bonds in 1940 could not have been precisely forecast in 1932, or even in 1937, the possibility of such an outcome was certainly sufficient to give the 4's an element of speculative appeal in periods of low prices, and to render them less likely to produce a loss in periods of high prices.

While the prepayment of high grade corporate bonds is a common occurrence, the prepayment of high grade municipal bonds is rare indeed. Most municipals are not subject to call, and the possibility of prepayment by court order is remote, especially for the higher grade obligors. It is therefore unlikely that the expectation of prepayment is sufficient to produce an appreciable effect on the prices and yields of municipal issues.

Somewhat related to the possibility of prepayment is the possibility of artificial market support. The Federal Reserve System, for example, has the power to support the Treasury bond market by its open market operations. A feeling among investors and market analysts that the Reserve System would attempt to support the market at par in the event of a rise in interest rates would provide grounds for preferring low coupon Treasury bonds selling near par.

The preference for low priced bonds is at least partly attributable to the accounting problems encountered in dealing with bond premiums. When a bond is bought at premium, as most of the high grades are in the present market, the purchaser may choose among three general accounting procedures. First, he may neglect the premium at the time of purchase, which will involve a capital loss or write-off at maturity (or date of sale). Second, he may write off the premium at the time of purchase. Finally, he may maintain his capital account intact by any one of several systems of amortization. In effect, the bond purchaser who wishes to maintain his capital intact at all times must either avoid premiums or choose the third accounting device — amortization.

Although the present trend of accounting is toward amortization, the practice is far from universal, and there are a number of barriers that prevent it from becoming universal. Prior to the Revenue Act of 1942, amortization was not permitted for income tax purposes. Even today, amortization is not permitted for trust funds in a number of

states, such as Pennsylvania; and in states where it is permitted, trustees often prefer to avoid amortization because of the conflicting interests of beneficiaries, or even because of the difficulties of explaining the process of amortization to an uninformed beneficiary. Finally, amortization ordinarily involves a certain amount of trouble or expense, which may induce many small investors without good knowledge of accounting principles to prefer the simpler method of writing off premiums. It is evident, therefore, that strong legal and institutional forces induce many investors to seek low premium, low coupon bonds as the simplest solution to their accounting problems. These forces, furthermore, are quite as relevant to the purchase of municipals as to the purchase of corporates.

It is worth noting that cross currents and counter forces are sometimes present. A trustee, for example, may be prohibited under the terms of the trust from expenditure of capital, even to meet emergencies; and the purchase of a high premium, high coupon bond may offer a legal loophole to circumvent the prohibition. Or again, security dealers may derive a small advantage from high coupon, tax-exempt bonds. Prior to the Revenue Act of 1942, almost any investor could derive an advantage. Since amortization was not allowed, the investor could buy a high premium municipal, enjoy a tax-exempt coupon income, and then incur a capital loss for tax purposes when the bond matured or was sold. But after 1942, the average investor was required to amortize his premiums on tax-exempt bonds. Dealers in municipals, however, are still permitted to deduct premium losses as long as they are merely maintaining a trading position in the market.

It is widely recognized that short-term bonds are more attractive if interest rates are expected to rise and that long-term bonds are more attractive if interest rates are expected to fall. It is not so widely recognized that high coupon bonds are more attractive than low coupon bonds of the same maturity if rates are expected to rise, and that low coupon bonds are more attractive if interest rates are expected to fall. An illustration is given in Table 5, which shows the prices of three bonds with coupon rates of 1½, 3, and 5 percent when the rate of return is 1, 1½, and 2 percent to maturity. The table also shows the percentage change in price that would follow from a fall in yields from 1½ to 1.0 percent and the change that would follow from a rise in yields from 1½ to 2 percent. For example, the 3 percent bond sells at $131.17 to yield 1.5 percent to maturity; if the yield should fall to 1.0 percent the price would rise to $144.14, an increase of 10.99 percent in the market price. The table clearly shows a small but real advantage for the low coupon bond in a period of falling rates, for the capital gain on the 1½ percent bond is greater than that on the 3 percent bond, which is in

turn greater than that on the 5 percent bond.[2] Conversely, the high coupon bonds have a small but real advantage in a period of rising rates, for the capital loss is less on these bonds.

TABLE 5

CHANGES IN PRICES AND YIELDS TO MATURITY FOR 25-YEAR BONDS WITH COUPON RATES OF 1½, 3, AND 5 PERCENT

Coupon Rate	Price When Yield to Maturity Is			Percent Change in Price When Yields	
	1.0%	1.5%	2.0%	Decline from 1.5 to 1.0%	Increase from 1.5 to 2.0%
1½%	$111.04	$100.00	$ 90.20	+11.04%	−9.8%
3	144.14	131.17	119.60	+10.99	−8.8
5	188.29	172.74	158.79	+10.90	−8.1

F. R. Macaulay has pointed out that a low coupon bond has a longer period of "duration" than a high coupon bond of the same maturity.[3] The reason is that a high coupon bond sells at a premium that must be amortized out of interest income, and this amortization is in effect a repayment of principal. For example, a 5 percent bond 37½ years from maturity should sell at $2,001 to yield 1.5 percent to maturity. When the bond is finally redeemed 37½ years later, almost exactly one-half of the principal of the investment will have been repaid; only one-half of the original investment remains invested for the entire period. This transaction may be regarded either as an average investment of about $1,500 for the entire 37½ years or, alternatively, as an investment of the entire $2,001 for an average period of about 28 years.[4]

In the 1947 market, characterized by low short-term rates, high coupon bonds should yield less than low coupon bonds of the same maturity because their "duration" is shorter, but actually they yield more. This contradiction is not so real as it appears. Investors who expect a fall in interest rates will prefer long-term bonds in general, and long-term, low coupon bonds in particular; those who expect interest rates to rise will prefer short-term bonds. Neither group will prefer the long-term, high coupon bonds.

[2] A much more detailed analysis is given by W. Braddock Hickman in *The Term Structure of Interest Rates, An Exploratory Analysis* (National Bureau of Economic Research, ms. November 16, 1942) Chapter 5. Hickman's treatment covers the relation of coupon rates to the profits obtainable by "riding the interest curve"—i.e., buying medium- to long-term bonds and selling them before they mature.

[3] Frederick R. Macaulay, *Some Theoretical Problems Suggested by the Movements of Interest Rates, Bond Yields and Stock Prices in the United States Since 1856* (National Bureau of Economic Research, 1938) pp. 44-53.

[4] These approximations to the average amount invested and the average period of investment are extremely rough. Macaulay describes a method of computing the average duration, but the details are not necessary for this analysis.

As an explanation of the coupon-yield relationship, this analysis of expectation and bond duration is not particularly conclusive. The implications of the analysis are probably not understood by enough investors with sufficient funds to affect the market appreciably. Furthermore, the possibility of gain from application of these principles is too limited to warrant much attention from any but the largest investors. Although a low coupon bond does offer the best opportunity for capital gain in a period of falling interest rates, the relative advantage is small. In Table 5 the capital gain (11.04 percent) on the 1½ percent bond, which results from a fall in yield from 1.5 to 1.0 percent, is very little more than the gain for the 5 percent bond (10.90 percent).

The final reason suggested for the market's dislike for high premiums was a more or less irrational preference for low priced securities merely because they are low priced. This was not intended to imply that some investors choose low priced bonds without regard to their intrinsic value, but rather that many investors make decisions based partly on careful analysis and partly on whim or temperament. Even the most astute and assiduous analyst cannot hope to be entirely rational or completely informed. When a doubt arises, will the low priced security get the benefit? The forces of investment psychology cannot be ignored. Because of the many valid reasons that make low coupon bonds more attractive under certain circumstances, investors may be led to believe that they are more attractive under other circumstances. If an investor realizes that a low coupon corporate has a clear advantage because of the possibility of repayment, is he not apt to conclude that a low coupon municipal has at least a small advantage for the same reason?

The implications of the coupon-yield relationship to the basic yield analysis and to interest theory in general should not be overlooked. According to traditional theory any two bonds of different coupon rates but alike in other respects, especially quality and maturity, should yield the same return.[5] In practice, however, this principle clearly does not hold; bonds selling near par are definitely preferred to those selling at a high premium, and consequently they yield appreciably less. Therefore, a realistic discussion of interest rates should specify some consistent treatment of coupons. Since the basic yields are computed from the lowest yields of bonds actually traded in the market, they automatically tend to reflect the lowest coupon bonds, which sell at the lowest premiums. In the ideal analysis, the basic yields would be computed entirely from bonds with coupons just low enough to permit the bonds to sell at approximately par. But over the past fifteen years coupon rates

[5] Perhaps the maturity of high coupon bonds should be adjusted in accordance with Macaulay's principle of duration. The comparison would then be between bonds having the same duration but different coupon rates.

have not kept pace with the fall in bond yields, and most of the high grade issues, from which the basic yields are determined, have sold at a premium.[6]

Since coupon rates have not always kept pace with yields, the coupon-yield relationship introduces an additional note of noncomparability into the basic yields for different years. In 1946, for example, a special basic yield curve for 1 percent municipal bonds was computed, based on a single issue of the Commonwealth of Massachusetts. But no corresponding 1 percent bonds were outstanding in previous years, and therefore this special Massachusetts curve does not seem properly comparable with the basic yield curves for earlier years, which were determined from bonds with higher coupons.

[6] The problem of bonds selling at a discount has not come up in this analysis. If interest rates ever rise substantially so that high grade bonds are selling at less than par, the coupon-yield relationship may present new problems for analysis.