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# Introduction and Summary

The essays in this volume, which further extend the National Bureau's work on interest rates,[1] fall broadly into three groups. These are concerned with patterns of interest rate fluctuation on a wide variety of instruments (Cagan and Diller), selected determinants of yield (or "quality") on risk instruments (Frankena, Fredrikson, and Cohan), and determinants of maturity structure on riskless securities (Kessel, Sargent, and Diller).

Much of the Bureau's work on interest rates has focused on changes in rate relationships. We have sought evidence of stability versus change in financial markets and institutions, and insights regarding interactions between real and financial processes. This focus on patterns of change characterizes much of our work on the mortgage market, for example, including earlier studies by Klaman as well as my own paper in Volume I of these essays.[2] The essays by Cagan and Diller in this volume are in this tradition. Cagan's essay (which was first published in 1966) examines changes in the cyclical behavior of interest rates relative to fluctuations in general business over a long period (some of his series extend to 1878). Ignoring atypical periods, including World War I and most of the 1930's and 1940's, he finds that in recent years "financial

[1] Publications to date include *The Behavior of Interest Rates: A Progress Report* by Joseph Conard, 1966; *The Cyclical Behavior of the Term Structure of Interest Rates* by Reuben A. Kessel, 1965; *Changes in the Cyclical Behavior of Interest Rates* by Phillip Cagan, 1966; *Yields on Corporate Debt Directly Placed* by Avery Cohan, 1967; *Essays on Interest Rates*, Vol. 1, edited by Jack M. Guttentag and Phillip Cagan, 1969; and *New Series on Home Mortgage Yields Since 1951* by Jack M. Guttentag and Morris Beck, 1970.

[2] Saul B. Klaman, *The Postwar Residential Mortgage Market*, Princeton, Princeton University Press for NBER, 1961; Jack M. Guttentag, "The Behavior of Residential Mortgage Yields Since 1951," in *Essays on Interest Rates*, Vol. I.

markets react more in unison with each other and closer to changes in business conditions than formerly." The change is particularly pronounced in the case of rates on long-term securities, which used to lag both short-term rates and general business at cyclical turning points, but do so no longer. In addition, "the amplitude of cycles in most interest rates has responded more and more sharply to fluctuations in business activity of a given severity." Cagan presents evidence (not included in this volume) indicating that the change in both cyclical timing and amplitude of interest rates can be explained in part by changes in the cyclical pattern of growth in the money supply, which in turn presumably "reflects greater emphasis by the Federal Reserve on counteracting cycles in output and prices. So long as this policy continues, the generally greater fluctuation of interest rates since World War II compared with earlier periods will, other things being the same, be a permanent feature of the money market." Experience during the years since Cagan first penned those words strikingly confirms the accuracy of his prediction.

While the focus of Cagan's analysis is changes over time in cyclical patterns, he might with perhaps equal justification have emphasized what has not changed. The recent conformity of interest rates to business cycles, for example, as indicated by the extent to which cycles in one can be matched against cycles in the other, is not new. "Call money and commercial paper rates had nearly perfect conformity to the ten reference cycles from 1885 to 1919." Diller's essay on seasonal fluctuations in interest rates provides even more dramatic evidence of stability in change. The significant seasonal pattern in rates that emerged in the early 1950's appears very similar to the pattern Macaulay found for call money rates early in the century. Diller suggests that in view of all the changes in financial practices that have occurred perhaps this is a coincidence; but perhaps it is not.

Diller's analysis indicates that a seasonal rate pattern emerged in the early 1950's, the seasonal amplitude rising during 1951–58 and declining thereafter. By 1965, the seasonal had fallen to very modest proportions, comparable to those of the period before 1951. At peak amplitude the seasonal pattern that emerged was most pronounced for short-term securities, next for high grade bonds, and weakest for low grade bonds. Diller shows that the largest part of the variation in seasonal amplitude of Treasury bills can be explained by changes in the seasonal amplitude of the money supply and of total Treasury bills outstanding. Thus, the rise in the bill rate seasonal through 1958 is largely explained by an increase in the seasonal of outstanding bills in the face of only a small

change in the money supply seasonal, while the subsequent decline in the rate seasonal during 1958–65 can be attributed largely to a rise in the money supply seasonal.

The substantial influence of the Treasury on the seasonal is not inconsistent with the proposition that the forces underlying the basic configuration of the seasonal—a lull close to midyear and a high in December—are much the same as in the period before 1913. The configuration of the seasonal reflects demand forces, and Treasury operations may simply be one mechanism through which these forces now operate. This is a nice problem for future research.

The rise and decline in the rate seasonal corresponds in a rough way with "tight money" and "easy money" policies of the Federal Reserve. It is somewhat surprising, in the light of recent discussions of the pervasiveness of the Federal Reserve's "defensive" open market operations, that tight money can leave such a substantial margin of seasonal demands unaccommodated. If the Federal Reserve focused exclusively on the condition of the money market as its short run objective we would expect a complete suppression of the rate seasonal regardless of whether policy was one of tightness or ease. While much remains to be learned regarding the interrelationship between the system's general ("dynamic") policy stance and its short run ("defensive") role in offsetting transient disturbances in the market, Diller's findings are consistent with the view that the Federal Reserve employs bank reserve targets in the short run.

A large part of the Bureau's work on interest rates, including the essays here by Frankena, Fredrikson, and Cohan, has been concerned with problems of yield structure. The general problem can be illustrated with an equation of the following form covering a number of individual instruments of a given type (such as residential mortgages or high grade corporate bonds) at a point in time:

$$\text{Yield} = C + a_1Q_1 + \ldots + a_nQ_n + b_1N_1 + \ldots + b_nN_n,$$

where the $Q$'s are variables that bear on the probability of repayment—in the aggregate they describe risk or ex ante "quality"; the $N$'s represent nonrisk factors that may affect yield such as options to repay prior to maturity or coupon rate; and the coefficients indicate the degree of sensitivity of the yield to variability in each yield determinant—in the case of quality variables they reflect the lenders' expectations regarding future economic conditions that may affect the ability of borrowers to repay.

Frankena's essay shows that the coupon rate (and to a lesser extent

call deferments) is an important nonquality determinant of yield on corporate bonds. The evidence for this rests in good part on the new time series that he constructed covering yields on seasoned public utility bonds, each series pertaining to a specified coupon rate. He finds, for example, that over the period January 1957 to October 1967 the yield to maturity on 5 per cent bonds averaged 32 per cent more than that on 2¾ to 2⅞ per cent bonds. Frankena views this relationship as reflecting the market's essential rationality. Higher coupon bonds are less attractive to investors because, in the event that market yields decline, they have less potential for price appreciation and they are more likely to be called for redemption, forcing lenders to reinvest at lower yields. He questions the reliability, for some purposes at least, of commonly used series on corporate bonds and yield spreads involving such bonds. Adjustment of series for changing coupon rates is not an easy matter, however, since the effect on yield of a given coupon rate differential (or a given call deferment) can vary markedly over time as a result of changes in yield levels, in expectations regarding future yield levels, and in other factors. The yield differential between 5 and 2¾ to 2⅞ per cent bonds referred to above ranged from .03 per cent during periods of high yields to 1.00 per cent during periods of low yields.

The center-stage variable in Fredrikson's essay is the location of the property in securing a conventional residential mortgage loan. Just as Frankena's essay indicates that yield series on corporate bonds should hold coupon rate constant, Fredrikson's essay indicates that yield series on conventional mortgage loans may have to be adjusted for changes in geographical mix. While previous Bureau studies (by Wickens, Morton, and Grebler, Blank, and Winnick) found evidence of significant regional yield differentials in data covering outstanding loans, in-depth analysis of area differentials awaited the development of data on loan commitments of the type used here by Fredrikson. These data, compiled by the Federal Home Loan Bank Board beginning in 1962, indicate that the pattern of area differentials is extremely complex. First, differentials between metropolitan areas within regions are substantial, in some cases exceeding average regional differentials by large margins. In all probability intraregional differentials would be greater still if adequate data were available for nonmetropolitan areas. Second, area yield differentials are usually larger, sometimes substantially larger when measured in terms of effective rate (contract rate adjusted for fees and charges) than when measured in terms of contract rate alone. Third, area yield differentials vary markedly among various loan subsets when loans are classified by type of lender and purpose of loan.

Whether location of property is a quality or nonquality yield determinant is a moot point. Interregional yield differentials are smallest in loan subsets characterized by relatively low risk—notably loans on new homes and loans by life insurance companies—suggesting that area designation may be in part a proxy for risk. Fredrikson shows, however, that when yields are adjusted for the effect of those risk variables for which information is available (loan-value ratio, maturity and property value) area yield differentials are as likely to increase as to decrease. Loan subsets with small yield differentials furthermore are also those within which interregional flows are relatively large, suggesting that in part area differentials may reflect restrictive local market structures and factors segmenting local markets from outside competition. Fredrikson discusses several of these factors including high information costs, legal constraints on out-of-state lending, and the high costs of acquiring and servicing loans at a distance.

In his previous National Bureau study, Avery Cohan isolated specific quality and nonquality factors influencing the yield on directly placed corporate bonds.[3] He then held these factors constant over time to provide yield series on a homogeneous instrument. Referring to the equation above, Cohan in effect solved for $Y$ in each period using the same $Q$'s and $N$'s throughout. The adjusted series, while homogeneous with respect to objective characteristics, reflect changes in the coefficients of the $Q$'s and $N$'s. Cohan's essay in this volume extends this procedure in the following way. Assume for the moment that the $N$'s in the equation for direct placements can be ignored so that only risk variables affect yield, and that yields on a government bond are riskless. In this case, the yield differential between governments and directly placed corporate bonds of the same maturity measures $a_1Q_1 + \ldots + a_mQ_m$ on the direct placement, i.e., it measures the combined effect of all characteristics of the direct placement that affect risk, plus the lenders' evaluation of each characteristic. If it can be assumed further that the markets for direct placements and government bonds are competitive, and that investors in direct placements are not risk averse, Cohan shows that the ratio $[(1 + G)/(1 + r)]^m$, where $G$ and $r$ are the yields and $m$ the maturity, can be interpreted as the market's judgment of the probability that the realized yield on the direct placement will be equal to the promised yield. Thus interpreted, the ratio is the ideal measure of over-all ex ante quality of direct placements.

The assumptions required to interpret the ratio as a probability, how-

[3] *Op. cit.*

ever, are not completely met. In Cohan's view the main nonquality factors that affect the ratio are differences in call protection and risk aversion—the requirement of lenders that yield on a risk security exceed the "expected yield" (expected yield on a risk security is the yield on a riskless security plus a premium just large enough to meet expected losses on the risk security). Cohan argues that, in general, risk aversion is not an important factor in the market (although this may not have been true before World War II), but that it can become important when the volume of lower grade securities becomes abnormally large in a short period, as was the case during 1955–58. Hence, Cohan adjusts his probability series both for changes in call protection and for changes in the volume of lower grade corporate offerings. The adjusted quality series tended to decline very modestly over the 1951–61 period.

Three papers in this volume deal with the term structure of interest rates on riskless (government) securities. The question "Why do securities that are exactly the same in every respect but maturity carry different yields?" has long exercised a fascination for economists.

The centerpiece of all three essays is what has come to be called the expectations theory of term structure. This theory in brief states that term structure at a point in time is determined by the market's expectations prevailing at that time of future short-term rates. The theory implies that at a given point in time the expected yield is independent of term to maturity. The expected yield over, say, the next three years is the same regardless of whether one holds a twenty-year security purchased now and sold after three years, a three-year security purchased now, a two-year security purchased now and a one-year security purchased after one year, or any other combination. While this theory has a long and honored list of advocates, including Fisher, Keynes, Hicks, Lutz, and Macaulay, the recent upsurge in interest traces mainly to Meiselman, who first devised a means of testing the theory that did not require that expectations have some predictive content for the theory to pass. "He showed that expectations, whether or not they are correct, nevertheless affect the term structure of rates. His results constitute striking evidence that the expectations hypothesis has empirical validity."[4]

Kessel accepts the expectations theory, and presents some (admittedly limited) evidence that at least at the short end of the yield curve the expectations implied by the theory do indeed have predictive content. He argues, however, that some empirical characteristics of yield curves

[4] Kessel, *op. cit.*, p. 344.

are difficult if not impossible to reconcile with a "pure" expectations model, that is, a model which attempts to explain term structure entirely in terms of expectations. The tendency for curves to be upward sloping more often than not, for example, and the occurrence at times of "humped" curves where yields rise with maturity and then decline are facts difficult to reconcile with a pure expectations theory.

To explain these and other aspects of yield curve behavior Kessel joins the expectations theory to the liquidity preference theory, which states that the market on balance prefers short- to long-term securities because of the smaller risk of capital loss on the former. He shows that a combination of the two theories is consistent with a wider range of evidence including most importantly evidence on changes in the shape of yield curves over the business cycle.[5]

When Kessel's paper was first circulated in the early 1960's my impression was that it was an excellent piece of research (which I still believe today) and that little remained to be done on the subject, which was a mistake in judgment. Benefit of hindsight suggests several reasons for the recent upsurge of interest in the problem of term structure. First, there has been a widespread and well-justified conviction that the validity of the expectations hypothesis required additional testing. Malkiel and Kane note that "scientists are skeptical men who know that error of observation and questionable experimental technique are facts of life. If a law verified by one observer is truly valid, it should operate for anyone. Successful and independent repetition of a critical experiment increases our confidence in its supposed results."[6] Sargent's paper is in this spirit. Returning to an approach that has been abandoned after Meiselman's study, he considers the question of whether the expectations of future rates inherent in the yield curve (according to the theory) do in fact have any forecasting value. A negative finding in an inquiry of this type does not dispose of the theory, but a positive finding, to use Sargent's words, "provides a particularly convincing type of evidence confirming the expectations hypothesis."

Sargent turns to a situation where the market can be presumed to have some knowledge of future rates. Seasonal patterns in interest

[5] Some additional evidence is given by Phillip Cagan, "A Study of Liquidity Premiums on Federal and Municipal Government Securities," in *Essays on Interest Rates,* Vol. I.

[6] Burton G. Malkiel and Edward J. Kane, "Expectations and Interest Rates: A Cross-Sectional Test of the Error-Learning Hypothesis," *Journal of Political Economy,* July/August 1969, p. 453.

rates should be anticipated in some degree by speculators and, if there is any validity in the expectations hypothesis, the seasonal in longer maturities should lead the seasonal in shorter maturities. (This test of the expectations theory was first proposed and used by Macaulay who examined the timing seasonal in call rates and time rates during the period 1890–1913.) The reemergence of the seasonal in Treasury bills during the 1950's (see Diller's first paper) provides the materials for this test. Using spectral analysis, Sargent finds, as Macaulay did, that the timing patterns are generally consistent with those predicted by the expectations theory.[7]

A second reason for the recent step-up in work on term structure is the relevance of the problem for monetary policy. In 1961, the Federal Reserve adopted the policy of attempting to raise yields on short-term securities while lowering yields or at least limiting increases on long-term securities. This policy, which came to be known as "operation twist," was an attempt to deal simultaneously with the problem of encouraging expansion in the domestic economy, which required low long-term rates, and the problem of restraining capital outflows abroad, which required high short-term rates. A crucial issue was whether a swap transaction by the Federal Reserve, involving simultaneous purchase of long-term securities and sale of short-term securities, could have an appreciable nontransitory effect on the yield curve.

The various theories of how the yield curve is determined appeared to give opposing answers to this question, thus providing *prima facie* justification for extensive efforts to determine which theory was "correct." For a time it was believed by many that the expectations theory implied that the Federal Reserve could not affect the shape of the yield curve while the so-called "segmentation theory" of term structure carried the opposite implication. (This theory states that borrowers and lenders are constrained by institutional factors to prefer specific maturities, so that the rate at each maturity is determined by the supply and demand at that maturity, which is independent of the supply and demand at any other maturity.) It is now evident, however, that this view was overly simplistic. Wood showed that the expectations theory did not imply the inability of the Federal Reserve to twist the yield curve if expectations of future rates embodied in the yield curve are affected by changes in the current rate levels.[8] By the

[7] Kessel also ran a test of this sort (see Chapter 6, p. 370).

[8] John H. Wood, "The Expectations Hypothesis, The Yield Curve, and Monetary Policy," *Quarterly Journal of Economics*, August 1964.

same token, the institutional preference of most investors for a given maturity does not necessarily imply that the Federal Reserve has wide latitude to change the yield curve, since enough investors might be enticed from their preferred maturity by small yield premiums on adjoining maturities to make the yield curve relatively insensitive to Federal Reserve swaps.[9] Much the same point can be made regarding the liquidity preference theory; as Kessel notes, this theory implies that a Federal Reserve swap will affect the yield curve but does not imply that the effect is likely to be quantitatively significant.[10] Thus, no amount of testing of the validity of the individual theories is likely to shed much light on the question of the degree of Federal Reserve influence on the shape of the yield curve; the question remains wide open.

The third and perhaps most important reason for continuing interest in the term structure problem is that it is a fascinating intellectual puzzle—or set of puzzles—that ramifies in many directions. Meiselman's original test of the expectations theory was facilitated by prior work in related fields of economics on the formation and revision of expectations. Future work on the expectations theory will surely reverse the flow and contribute to general knowledge in this important area. Diller's paper on "The Expectations Component of the Term Structure" is a significant step in this direction. Diller focuses on the nature of the forecasts that (according to the expectations theory) are embodied in the term structure. He poses the question, What techniques of forecasting future rates does the market use? He distinguishes an autoregressive or extrapolative component of a forecast, which is dependent on the current and prior values of the variables being forecast and on prior values of forecasts of that variable; and an autonomous component, which is dependent on the current values of other variables. He shows that various theories of forecasting, including the error-learning theory used by Meiselman and the "return to normality" theory that has had numerous advocates, can be viewed as specific variants of a general autoregressive model. "There are, in principal, as many models as there are combinations of weights from an autoregression, although the word 'model' is ordinarily used only when the particular combination of weights is consistent with a plausible behavioral hypothesis." This approach allows Diller to examine various "behavioral theories" of forecasting

[9] See Franco Modigliani and Richard Sutch, "Innovations in Interest Rate Policy," *American Economic Review,* May 1966, p. 184.

[10] See Kessel, *op. cit.*, p. 57.

within a single analytical framework, which has the great advantage that alternative theories can be clarified as well as tested.

Other ramifications of the term structure problem are just beginning to be explored. It should be possible to expand the liquidity preference theory, for example, to take account of default risk. This suggests the possibility of a general theory of yield structure in which maturity would be only one (and perhaps not the most important) dimension. Beyond this is the intriguing possibility of merging term structure theory with portfolio selection theory, which has developed rapidly in recent years. (What are the implications for term structure theory of postulating that investors have a diversification incentive for holding several maturities?) If ultimately the several term structure theories are absorbed by broader theories of financial processes we would have to view it as a triumphant demise.

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