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THE DETERMINANTS OF YIELD VARIATIONS
IN THE MUNICIPAL BOND MARKET

by

JOHN R. KNIGHT

A dissertation submitted to the Graduate
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ABSTRACT

THE DETERMINANTS OF YIELD VARIATIONS IN THE MUNICIPAL BOND MARKET

by

JOHN R. KNIGHT

Adviser: Professor Steven Katz

The interest rate theories - classic or real, monetary, and term structure - are examined to see if there are any theoretical reasons why they should not apply to the yields of municipal bonds in a manner similar to their application to yields of other bonds. The goal is to confirm their application to the average yields on long-term municipal bonds during the past two decades and to use them to identify the principal determinants of the variations in the municipal bond market during that period. Additionally, the stock or flow of municipal bonds and the demand are considered as a means of determining the variations in municipal bonds' yields.

Three models were developed using the yields to maturity on high grade (first four grades as rated either by Moody's Investors Service, Inc. or by Standard and Poor's Co.) long-term municipal bonds. Model I develops the demand for municipals by considering the independent variables that indicate flow. The demand function for the largest purchasers of municipals (commercial banks and private households make up 75% of the market) was written and the explanatory variables were then weighed against a proxy

variable for municipal bond supply to determine variations in average yield. It was shown that the persistent forces or determinants were the Prime Rate, Dividend Yield on common stock, Net Acquisition of Financial Assets by commercial banks and the New Issues of municipals.

Model II applied the liquidity preference theory of interest rates and the market equilibrium theory to municipal bond yields. The stock of money and the amount of Income were combined with the amount of marketable debt of corporations and the U. S. Government to identify the determinants of municipal bond yield fluctuations. Municipal bond yields were found to vary directly as Income and negatively as Money Supply. The increase in the amount of municipal bond substitutes (corporate bonds and U. S. Government bonds) was also significant in explaining the variations of municipal bond yields. Money Supply was a determinant only (1) when defined as maximum potential money (Government demand debt/required reserve ratio of banks) or (2) when currency was considered an exogenous variable and subtracted from Government demand debt then later added to the amount of money. M_1 , demand deposits plus currency outside of Government, was not a significant determinant.

Model III investigated the expectation hypothesis of the term structure of interest rates theory and extended the application to municipal bond yields. The operational test devised by Meiselman, D. to show that changes in long-term corporate bond interest rates varied directly as the error between the expected and actual short-term interest rates was repeated using municipal bonds. The error between actual and expected interest rates of bonds of one-year maturity was then extended to the error between the actual and expected interest rates of ten-year maturity municipal bonds in order to test the relationship between changes

of yields of twenty-year municipals and ten-year municipals. Meiselman's results were replicated when municipal bonds' interest rates were used, his suggestion that the changing of data observation frequency from yearly to monthly might strengthen the proof of the hypothesis proved to be true to a modest degree. The attempt to use the error between actual and expected ten-year maturity municipal bond yield rates to explain the variations in the yields on twenty-year municipal bonds was unsuccessful. The term structure of interest rate theory was found to apply when changes in long-term municipal bond yields were compared with changes in one-year municipal bond yields and to be most useful in explaining secular trends.

Finally, a survey was made of the largest municipal bond houses. Dealers and brokers were given a list of the economic and financial variables most frequently used by financial writers and analysts in explaining the variations in the municipal bond market and asked to arrange them in order of significance based upon experience during the past 10 years. Results were in general agreement with results from empirical tests of Models I, II and III, except that the dealers rated supply of municipal bonds as more critical than demand in determining yield variations, whereas the models showed that the opposite has been the case over the last two decades. Dealers and brokers also frequently had difficulty choosing between variables which, although they appeared to resemble each other, actually had different values as predictors.

CHAPTER I

INTRODUCTION

As of September, 1972 there were \$162.9 billion of tax-exempt bonds outstanding. When compared with \$140.4 billion of corporate and \$105.4 billion of U. S. Government bonds, the tax-exempt sector is easily the largest in the bond market.¹ The reliance on debt is as much a part of the nation's economy as the reliance on raw materials. State and local governments are able to meet the financial needs of their communities and municipalities by issuing bonds and then levying taxes in order to make the interest payments. Debt allows the schools and other community facilities to be built when they are needed and to be paid for later by those who are using them. It allows for order and planning in community projects. State and local governments borrow money by issuing tax-free² (municipal) bonds. Investors who purchase municipal bonds do not have to pay Federal Income Tax on the interest received, however, at maturity, or time of sale, if there is a capital gain, taxes must be paid just as with any other capital gain. The interest is also tax-exempt from state taxes in the state where the bonds are issued but may not be tax-exempt in another state when the bonds are owned by a resident of the second state.

Municipal bonds may be general obligations of the state, backed by the power to tax residents to meet all payments or they may be revenue

¹From a study by Solomon Bros., New York, N. Y., as published in the New York Times, May 10, 1973.

²In this study tax-exempt bonds, municipal bonds and state and local government bonds are referred to as municipal bonds.

bonds with interest payments taken from the revenue generated by the facility built with the bond receipts. The bonds may be issued by relatively small communities with moderate income-producing resources, or they may be issued by the largest cities. Because of the financial disparity among the municipalities there is need for investors to know the relative security of each bond issue. Private rating systems have been established to meet this need.³ The grades are the same as those used to rate other types of bonds but the criteria are different. Sometimes the same bond issue may be rated differently by each rating house; the grading techniques are confidential and ratings are made for the benefit of individual clients. However, many other people are interested in how a municipal bond issue is rated, and since a difference of one grade level may mean millions of dollars difference in the amount that a municipality will eventually have to pay in interest, there is a great incentive for bond issuers to learn as much as possible about the rating systems. Accordingly, this is the area in municipal bonds which has been researched most intensely.

Characteristics of Municipal Bonds

Municipal bond issues contain bonds of different maturities (Appendix A). It is customary for short-term bonds to bear low coupon rates whereas bonds of longer maturity bear higher rates. The underwriters often have the prerogative of establishing the interest schedule although this may be restricted by some state laws which specify the maximum interest rates that can be paid. The purpose of the different maturities, which is in direct contrast with corporate bonds where bonds of the same issue normally

³There are two principal municipal bond rating services - Moody's Inc. and Standard & Poor's Co. They are both located in New York, New York.

have the same maturity date, is twofold: it enables investors to select the maturity that best fits their portfolio needs, thus avoiding having to sell and face marketability risk, and second, it allows the municipalities that issued the bonds to establish a retirement schedule tailored to their income accruals. Underwriters adjust the coupon rates so as to make the most unpopular maturities attractive to some buyers. Very few municipal bonds are issued containing a call feature.⁴

Rarely are municipal bond issues placed by private negotiations; practically all are required by law to be put up for public bid. Sometimes a community with a small bond issue will have all the bonds bought by the local banks at competitive yields. This is often a favored customer action for political expediency. In some instances states may buy tax-exempt bonds that have been issued by a municipality within the state.

The supply of municipal bonds has been found by Chalmers⁵ to be anticyclical. Unlike corporations and the U. S. Government which follow closely the business cycle in their demand for capital, there is a tendency for municipalities to postpone expensive projects when costs are rising and to initiate such projects when interest rates are stable. In times of inflation when other bonds carry high interest costs, the supply of new issues of municipals may taper off, thus tending to slow the rise in yield.

Municipal bonds are purchased by a relatively small sector of the public and the bondholders fall into distinct classes (Appendix B). With commercial banks and households providing 75% of the demand, their decisions

⁴The Blue List published by Standard & Poor's, Inc.

⁵Chalmers, J. A Model of State and Local Government Portfolios and Real Expenditure Behavior, 1952-1965, an unpublished dissertation, University of Michigan, 1969.

to buy or sell are heavily weighed by the market. If commercial banks are buying, yields are likely to decline. Because the municipal bond market is relatively a thin market, borrowers are wise to watch interest rates carefully and to adjust their use of funds to the investors demand for tax-exempt bonds. A unique characteristic of municipals which may be partially attributed to their segmented market is their volatility. The average yield to maturity changes more frequently than the yields on other bonds. Robinson⁶ discusses this fact. "The yields of long-term state and local government securities fluctuate through a wider range than any other important long-term interest rate. Their volatility apparently has been due to the fact that state and local government obligations are influenced by changes in the general level of interest rates and by the changing yield discount of the privilege of tax exemption."

One of the outstanding features of municipal bonds is their secureness; they stand next to U. S. Government bonds in financial strength. In a recent study Hempel⁷ found that there have been practically no delinquencies in investment grade municipal bonds since the 1929 Depression. Of those municipalities which defaulted on some interest payments during the Depression, most recovered within a few years and repaid all delinquencies. Some municipal bonds are even guaranteed by the Federal government, as for example, the Public Housing Authority Bonds.

⁶Robinson, R. Post-war Market for State and Local Government Securities, Princeton University Press, N. J., 1960, pp 15-17, 167.

⁷Hempel, G. H. Measures of Municipal Bond Quality. Unpublished dissertation, University of Michigan, 1971.

Boundary Areas and Past Studies of Municipal Bonds

The study of municipal bonds has moved forward on an uneven front. As already noted, an important problem was the secretiveness of the rating systems used by the bond rating houses in New York. There was concern not only because of the additional interest cost to the bond issuer caused by a lower rating, but also because many municipal bonds are not rated at all. It is important for both the municipality and the investor to know how the market will judge the issue. Likewise, in the inspection of bank portfolios (the largest purchasers of municipals) Federal and State Examiners have been confronted with groups of unrated municipal bonds. Since there are strict laws about the quality of assets which banks may hold, the ratings of the bonds becomes important.⁸

In contrast with determining the ratings and yields of municipal bonds there has been an investigation by the Joint Economic Committee of Congress⁹ into the purpose of municipal bonds, how well they accomplish this purpose and what it costs the U. S. Government in tax loss. In a study, Fortune,¹⁰ found that in 1968 the tax-exempt privilege afforded state and local governments a saving of \$1.2 billion and cost the U. S. Government \$1.8

⁸ Carleton, W. T. and Lerner, E. M. Statistical Credit Scoring of Municipal Bonds, Research Report for FDIC, 1969. Current study on the rating factors on Municipal Bonds is being conducted at the State University of New York, Albany.

⁹ Joint Economic Committee Hearing, Financing Municipal Facilities, 90th Congress 1st Session, 1967. At this hearing Mr. R. M. Goodman, Director of Finance of New York City defined the purpose of a bond as follows: "A bond is a money-making machine. It is supposed to pay interest at regular intervals and it is supposed to pay off at maturity, and in the process it is not supposed to dip severely in market value during the period that it is on the market, and hold its liquidity."

¹⁰ Fortune, P. "Tax-Exemption of State and Local Interest Payments: An Economic Analysis of Issues and Alternatives", New England Economic Review, May, 1973, Federal Reserve Bank of Boston, pp 3-31.

billion in given up tax receipts, thus providing a windfall income to high-tax investors of \$.6 billion. Fortune defined three problems caused by the tax-exemption on interest of state-local bonds: (1) the volatility of tax-exempt yields (the marketing problem), (2) the excess of cost to the U. S. Treasury over the interest savings of state - local governments, and (3) the impact on the distribution of after-tax income. A taxable municipal bond option has been suggested with the U. S. Government returning a portion of the interest cost as a subsidy if the municipality chooses to issue taxable bonds.

Still another area of advancement has been in seeking additional ways for state and local governments to reduce interest costs on municipal bond issues. Aside from better debt management in order to earn higher bond ratings, a few states have come forward with the idea of a municipal bond bank created by the state to handle bond issues for all the local communities and municipalities. If one school district, for example, needs \$.5 million, another \$2.5 million and still another \$10 million, the bond bank will add up the requirements and authorize one bond issue to cover all needs. When the money is received it is parceled out to the different municipalities according to agreement; each assumes his proportionate responsibility for interest and redemption payments. Because there has been one large bond issue instead of several small ones and because the large issue has the stronger guarantee of the state's general obligation, the bond rating will be higher, resulting in lower interest costs. So far Vermont, Texas and Maine have chosen this approach. It usually requires a change in the state constitution and the passage of special laws.

There have been other advances in the study of municipal bonds but these are mostly side effects; no other major areas are evident.

Several important questions remain unanswered, which if no solution is in sight, could benefit from as strong a foundation of municipal bond theory as is possible to construct. To say that present day dealers and investors need something to believe in is, at least, an understatement of the facts.

The Problem

Aside from the puzzling questions about the optimum coupon schedule for municipal bonds, the effects of increases and decreases in purchases by the different segments of the market, and whether too many categories (environment, pollution, industrial, etc.) are being crowded into the municipal tax-shelter, there is a much more fundamental question which is faced by every investor, bond issuer, or anyone who must deal with municipal bonds. That question is simply, "What are the determinants of the municipal bonds' yields"? This is the hidden question that is answered one way or another each time a decision to buy or sell a municipal bond is made. The decision-maker may rely on his experience or the experiences of others in the market; he may select his own secret financial variables to give him a clue or he may look at his favorite bond index and adjust for economic conditions.

It is precisely the purpose of this study to identify in so far as possible the underlying determinants of the municipal bond market's average yield. Economic and financial theory must be searched so that the major forces can be brought forward and used as the frame-work on which to build empirical models. Viable theory gives researchers something with which to work; its absence has resulted in a municipal bond trade in which there are few sound explanations for market trends.

Comments on the market by brokers and municipal bond dealers are published by the news media, daily; no two are alike and seldom are the comments helpful. It is true that each investor should make his own prediction of future market trends, he needs something more reliable than unsupported comments.

The Organization of This Study

In order to select those factors which are reliable representatives of the forces in the municipal bond market it is necessary to analyze thoroughly, both the technical and tactical operations of the market. This is done in Chapter II with particular emphasis given to the risk that underwriters must assume in bidding on municipal bond issues and the importance to them of a knowledge of the underlying market forces. Relationships are carefully examined: those between municipal bonds and other securities as well as those among the participants in the municipal bond market.

In Chapter II, economic and interest rate theory is analyzed in order that the applicable principles and constructs may be used to build a sound theoretical structure for empirical research. Before acceptable models can be written to depict the action of the municipal bond market, theoretical reasoning must suggest certain causes and effects. It is only by proceeding in this manner that the actual determinants of the market can be identified. Without a proven theoretical backup there is only conjecture and coincidence.

In Chapter IV the hypotheses are further refined and the methodology to be used is presented. Models are constructed and the sources of data are described. The Keynesian liquidity preference theory and the

term structure of interest rate theory are applied to municipal bonds. Other economic theories are also used.

Empirical results are presented in Chapter V of tests with the models that have been previously constructed. Statistical measures are explained and the results are organized for easy comparison. The tally of a private survey of 175 of the largest municipal bond dealers and brokerage firms are reported. Each firm was asked, based upon past experience, to specify the relative importance of certain economic factors in determining the average yield of the municipal bond market.

The study is concluded in Chapter VI. The previous empirical results are analyzed to determine how strong their support of the hypotheses. Where the affirmation is clear the importance and possibilities are discussed. If a hypothesis is in doubt, possible explanations are suggested and conclusions drawn. This study is compared with those of a similar nature made by other researchers. Finally, an over-view is presented and conclusions and recommendations made.

CHAPTER II

THE MUNICIPAL BOND MARKET

Since municipal bonds are sold over-the-counter and are not listed on either the New York or the American Securities Exchange, they suffer from a lack of familiarity and understanding by the public. Historically, only relatively wealthy individuals were able to benefit from the tax-exempt features, but within the past two decades as the economy has grown and the salaries of the middle class have climbed, more families arrived at the income level where the tax-exempt bonds become attractive. Today, with many wives working also, this is especially true. Several of the large bond houses¹ have attempted to educate the public to the advantages of owning municipal bonds by preparing Information Kits, holding free seminars, addressing investor clubs, etc., so that the market may be broadened. Some of the customer conveniences of other security markets are being adopted.

One of the attractions of common stock and corporate bonds is their liquidity. Specialists on the large exchanges maintain an orderly market; the investor can convert his security to cash by a single telephone call. Municipal bond houses are now giving their customers the same service. If the municipal bond was bought from a dealer he most likely carries the issue in his inventory and will offer an immediate quote to customers; if not, he is tied in through the National Association of Security Dealers' communication network so that he can get a bid quotation

¹ Among the bond firms that try to enlighten the public on municipal bonds are Lebenthal & Co., Eldredge & Co., Merrill, Lynch, Pierce, Fenner & Smith, Inc., Salomon Bros., and Goldman, Sachs & Co., all of New York, N. Y.

within minutes.

Besides the daily listings in the leading newspapers of the stock and bond quotations, there are also popular indexes with which the public is intimately familiar, such as the Dow-Jones Industrials, Standard & Poor's 500 stock and others, but the municipal bond indexes can not be found, they are available only in special trade papers. The most popular municipal bond index among brokers and dealers is the Bond Buyers Index, but this is printed in The Money Manager² or the Daily Bond Buyer, both of which are esoteric newspapers tailored to the needs of the municipal bond trade. The average investor who might be interested in municipal bonds will never see the Bond Buyers Index. The closest approach to a solution is the bid and asked sheets printed by the larger bond houses for those municipal bonds which they hold in their inventory. But to make matters even more complicated, the bids are quoted as yields-to-maturity instead of in dollars. The purchaser must pay the price necessary, in conjunction with coupon rate and maturity, to give the quoted yield-to-maturity.

Because of the many differences of municipal bonds from other securities and the separate universe in which the market operates, it is necessary to discuss in detail many important aspects before proceeding to identify the underlying forces of this market.

Yield

As already noted, the market for municipal bonds is quoted in yield-to-maturity. Normally there are two types of yields referred to by

²The Bond Buyer's Index is compiled from 20 municipal bonds whose average rating falls midway between the four top groups as classified by Moody's Investors Service. It appears in the Money Manager, a municipal bond trade paper published weekly by The Bond Buyer Co., New York, N. Y.

dealers and investors in municipal bonds. Current yield is simply the coupon payments on a bond for a year divided by the price of the bond; yield-to-maturity on the other hand is the rate of return that would be earned if the bond were held to maturity and all coupon payments plus the face value received. Brokers use the "Basis Book", a book of tables with precomputed values so that prices for bonds can be quickly converted to yields-to-maturity and vice versa. A formula has been derived that gives a very close approximation for yield-to-maturity:

$${}^3Y_{TM} = \frac{C_t + \frac{M - P_t}{n}}{\frac{M + P_t}{2}}$$

where YTM = yield-to-maturity

C_t = coupon payments during year, t

M = maturity or face value of bond

n = number of years remaining to maturity

P_t = price at beginning of year, t

Because the municipal bond market is quoted in terms of yield-to maturity, the investor needs to be sure that he understands all the steps in computing yield, else he may be misled into believing that he is receiving one yield when he is actually receiving another. Homer and Leibowitz⁴ make the point that the investor will achieve a fully compounded yield equal to the bond's stated yield-to maturity at the time of purchase only if he can reinvest all coupons at

³Letane, H. A. and Tuttle, D. L. Security Analysis and Portfolio Management, Ronald Press, New York, 1970, p. 35.

⁴Homer, S. and Leibowitz, M. L. Inside the Yield Book, Prentice-Hall N. J., 1972.

his purchase yield. Too often investors are careless about reinvesting coupon payments; it has been estimated that for a long-term bond, interest on interest is an important part of the compounded return, often as much as one-half. Therefore in choosing a maturity the investor must anticipate the future swings in yield level. The yield-to-maturity that he expects to obtain may fall short if he is unable to reinvest the coupon payments at an equal or higher rate of return. In the event that an investor expects a long period of low interest rates, he should consider the structural advantages of a discount bond over a par bond because that portion of his overall return represented by the discount is fixed, he then need worry only about reinvesting his coupon interest receipts at the current low interest rate in order to gain his original yield-to-maturity. This is in contrast with the problem he would face of reinvesting his high rate coupons in a weak market at the high rate necessary to achieve the yield-to-maturity at time of purchase. This assumes that the yields-to-maturity on both discount and premium municipal bonds were essentially equal at time of offer.

On the other hand, if an investor wishes to acquire long-term municipal bonds and expects future interest rates over a long period to be gradually rising, he should consider the structural advantages of a premium bond. A smaller portion of its overall return is fixed and a greater portion will come from interest on interest (coupon payments) but since interest rates will be rising it will be easy to invest the coupon payments at purchase rates or higher.

Although the municipal bond market is quoted as yield-to-maturity, the investor must actually deal in dollars when he buys or sells a bond. The conversion of yield into dollars often points out the high volatility

of bond prices for small changes in yields. It is commonly accepted that the volatility of high-grade bond prices, in response to a given yield change, depends entirely on maturity, but Homer and Leibowitz point out that this is only partly true; two other factors are important, the coupon rate and the general level of yields.⁵ With everything else being equal, for the same percentage increase in yield the volatility of the price of a bond increases:

(1) As maturity lengthens (the longer the maturity the greater the price volatility).

(2) As coupon rates decline (the lower the coupon rate the greater the price volatility).

(3) As yield rises (the higher the yield level from which a yield fluctuation starts, the greater the price volatility).

Sometimes these three determinants of price volatility counter each other and produce eccentric results.

The affects of maturity on volatility of price may be explained by remembering that yield is in part increased or decreased by the amortization of a discount or a premium over the years to maturity. Therefore with a constant coupon rate, the more years to maturity the larger the premium or discount when yield changes.

Likewise if the coupon rate declines and maturity and yield remain the same, the larger part of the total yield is provided by the lump sum payment of the discount. But this lump sum payment is not paid until the bond is redeemed and being so far in the future its present value is more volatile than that of the coupon payments.

⁵op. cit. 4, Homer and Leibowitz, p. 43.

If maturity and coupon rate remain constant but yields rise, the higher the level from which they start the more basic points it takes to equal the percent of yield change. Since the present value of the lump sum portion of the cash flow is proportional to the basis point yield change rather than the percentage change, there is more volatility in high yield areas rather than low yield areas.

Once an investor analyzes the many sides of yields he is better able to relate his opportunity for gain with the variations of the municipal bond market. There is always one reservation, however, his success can be no better than his judgement of the market.

Primary Market

The municipal bond market revolves around the competitive bidding of underwriters for new bonds issued by state and local governments. The market is both effective and efficient; effective because it enables state and municipalities to obtain the capital necessary to build the schools, water systems and other public works when they are needed, and efficient because the market is invariably cleared, demand always meets supply. There are some qualifications; for instance a local community may need such a small amount of capital that a bond issue is impractical, as a result the needs of several communities may be combined or if a small bond issue is floated it may be privately placed with a local bank. Occasionally a local government may be so remote, or the purpose for which the bonds were issued so risky, that investment bankers will not submit a bid but instead propose a best effort approach. They will accept the bonds at the price set and sell as many as they can on a commission basis, the remainder to be returned to the issuer. Normally the underwriter buys the

bonds outright and adjust the prices until they are all sold. Usually a new bond issue is sold out within a few days. Market efficiency has allowed the heavy growth in municipal bond offerings which provided the capital so badly needed by state and local government to meet the demands of a growing population. Between World War II and 1972, these capital needs increased ten-fold, from \$16 billion to \$162 billion.⁶

The mechanics of marketing vast sums of municipal bonds involves investment bankers who specialize in these issues and who form syndicates which bid against each other in open competition. Many municipal bond issues exceed \$100 million and for that reason no single investment banker will risk underwriting the entire amount. Instead a group of investment bankers will form a syndicate in order to spread the risk and to submit more competitive bids. Underwriting is welcomed by state and local governments because the underwriters act as middle-men in selling the bonds in much the same manner that wholesalers and retailers are the middle-men in selling a manufacturer's products. The syndicate insures the bond issuer against market risk; the bonds are delivered and the money is turned over in a lump sum to the state or local government. The distribution and marketing of the bonds is handled by professionals who, because of their insight into the market and their efficient sales techniques, are able to accept the marketing risk at a relatively small cost to the issuer.

When bids are submitted for a new offering of municipal bonds each bid will include the proceeds to the issuer, the coupon rate and the offering price. The offering price is that price at which the

⁶Morgan Guaranty Survey, published monthly by Morgan Guaranty Trust Co., New York, N. Y., Nov. '73, p. 5.

underwriter will reoffer the bonds to the public. The coupon rate is the interest rate that the issuer will be required to pay to the bondholder each year over the life of the bond. The proceeds to the issuer is the lump sum to be paid the bond issuer upon delivery of the bonds to the winning syndicate. The coupon rate and the proceeds are generally the basis for selecting the winner because the state or local government is primarily concerned about the quantity of funds it will receive and how much it will have to pay. The public, or the investors, are more concerned about the yield-to-maturity which is computed by using the offering price and the coupon rate. Finally, the underwriters are concerned about the difference between the offering price and the proceeds, or the spread, because this determines their profit and is the amount which the issuer paid in order to be relieved of the distribution and selling task.

At this point several people have made decisions about the municipal bond market. First, the voters of the municipality have decided that the need for the new facility should be met at this time, either because they believe that the municipal bond market is strong but is likely to weaken thereby reducing the proceeds to the issuer, or that the need for capital is so great that added cost can be justified. Next, the syndicate leaders have examined the municipal bond market and have decided upon a price that they believe will win the competition and leave sufficient spread for a satisfactory profit. Finally, the smaller investment bankers that became members of the syndicate have formed their own judgement about the market and after, perhaps, several rounds of voting have reached a compromise with the syndicate leaders.

There is often much maneuvering and negotiation within a syndicate because the final bid submitted must be acceptable to all the survivors. Sometimes the larger syndicate members will take over the bond allotment of some small members that won't go along with the recommended bid, but there is a limit to this and there may be several small adjustments before a final bid is submitted. A customary method of arriving at an offering price is to compare the new issue, feature by feature, with the most similar issues currently listed in the secondary market; it is fitted in among the other issues. Municipal bond indexes, such as the Bond Buyers Index, Dow Jones Municipals, etc., are checked for latest changes. An attempt is made to identify the underlying forces of the market and these are combined with a "feel for the market".⁷ Once the offering price is agreed upon, the syndicate manager works from there to arrive at the competitive bid. The decisions that the syndicate makes are fraught with risk.⁸

The criticality of the bidding process may be illustrated by considering the example where a syndicate wins a \$200 million municipal bond issue. In such large issues there are likely to be only two or three syndicates bidding because of the many members needed in each syndicate to

⁷Block, E. "Pricing a Corporate Bond Issue: A Look Behind the Scenes", Essays in Money and Credit, Federal Reserve Bank of New York, Dec. 1964, pp. 72-76.

⁸Block observed, "While the market for outstanding securities does provide some guidance to the pricing process, it is a rough guide at best. A new bond issue will be similar to, but rarely identical with, any security being traded in the secondary market. Pricing decisions on new issues are not made at the actual time of sale to the ultimate investor but must be made a short time before the bonds are released for trading, while the distribution itself may stretch over a number of days during which market rates may be in motion. The pricing of a new issue even under the best conditions thus takes place at the edge of the unknown".

spread the risk. The amount by which the winning bid exceeds the closest competitor is of grave concern, even fractions of a point difference in bids can amount to thousands of dollars in such a large issue. A syndicate desires to win the bidding competition by the barest margin, otherwise it is an easy matter to walk off and leave several thousand dollars "lying on the table". Each syndicate takes great care to keep its bid planning secret; in most cases syndicate members are not allowed to leave the room while final negotiations are going on. Because investment bankers are always regrouping as members of different syndicates during the year, there is a cross-fertilization which enables any one group to have a general awareness of how their competitors arrive at bids and this helps to keep the bids fairly close together, but not always. Even if there were an attempt at collusion there are no many parties and bond issues of such varied sizes and purposes that it would be almost impossible to hide wrongdoings.

Aside from bidding too low to win the competition there is the risk of setting an offering price that is too high or that may have been acceptable at the time of the bid but due to changes in the market is no longer tenable. Usually syndicate members are bound by agreement to stick with the offering price for a certain number of days or until the manager dissolves the syndicate. At that point prices may be adjusted to the demand in the secondary market. Because of the market risk, syndicate members try many tactics to insure that they will be able to sell their portions of the bond issue. Regular customers may be contacted ahead of time, the calendar for other new issues examined and large block orders may be sought; each underwriter tries to sell his portion of the issue as rapidly as possible. Such quick placements usually denote efficiency,

good syndicate management and profits. On the other hand, the likely result of overpricing is delayed sales, reduction in offering price and loss of profits.

The importance of good market judgement by investment bankers is evident; it determines whether they remain in business. Every bit of information whether it pertains to underlying forces that affect annual, quarterly, or daily market changes, or the theory that supports these variations, is valuable to underwriters. Theirs is the most critical need in the municipal bond chain.

The Secondary Market

Municipal bonds are sold over-the-counter; the National Association of Security Dealers is the self-governing body that regulates this market. The Securities and Exchange Commission has been content to remain on the side-lines as long as the dealers and brokers maintain high standards. This system has worked reasonably well while the market was in its formative stage and the professionals were in charge, but with the growth of the economy and higher salaries, more brokers have been attracted into the municipal bond field. A larger segment of the public now finds tax-exempt investments attractive (Appendix G). A few instances have occurred where unscrupulous bond brokers have cheated investors through misrepresentation of the quality of a municipal bond issue.⁹ Each time

⁹"To cope with a band of (municipal bond) dealers that had come to be known as the thieves of Memphis, Tennessee has created a Municipal Securities Board with sweeping power over bond dealers in the state. Arkansas, too, has toughened its regulation...."
Business Week, Sept. 2, 1972, p. 41.

this happens there is a call from members of Congress for the Federal Government to step in, but so far the municipal bond market has remained self-regulated.

After a syndicate has become the underwriter for a new issue of municipal bonds, it is customary for the members to allot a certain portion of their shares of the bonds to other dealers and brokers who then sell them to private investors, or other customers. This is the secondary market¹⁰ and it is quite important; it creates a continuous market in municipal bonds so that small lots can be readily bought and sold, it allows indexes to be computed which gage the market and it is a source of comparative values when underwriter syndicates are preparing bids on new issues. Individual investors wishing to purchase municipal bonds contact a municipal bond broker and state their preferences; he will check his own inventory and then turn to the secondary market where he has immediate access to those municipal bonds in the hands of dealers and advertised in the Blue List.¹¹ Since over 1400 municipalities¹² issue bonds with maturities ranging from 1 to 30 years or more, and with all the different ratings including none at all, the private investor has a wide choice. If he purchases one or two bonds or a small lot, he may be able to increase the yield slightly because large blocks of bonds demand

¹⁰It has been estimated that approximately \$40 billion of tax-exempt bonds are traded annually in the secondary market. Lebenthal & Co., New York, N. Y., 1972.

¹¹The Blue List is a trade paper published daily by Standard & Poor's, Inc., which lists those municipal bonds (including owner, purpose, coupon rate, maturity and yield) offered for sale by dealers and brokers. Although all of the municipal bonds in the secondary market may not be listed, it is the best price indicator and is used as such in the bond trade.

¹²Moody's Investment Service list more than 1400 municipalities in Moody's Municipals that issue bonds.

a slightly higher price (just the opposite from purchases of common stock). There is always the risk in bonds of losing part of the expected yield if the bonds are sold; for this reason many investors are careful to match the bond maturities against their financial plans. If it is necessary to sell, prices are on a bid-asked basis with about a 2 1/8 point spread (\$21.25 on a \$1,000 bond); the selling price will fall somewhere within the spread.

The municipal bond investor faces a somewhat different set of decisions than an investor in other marketable securities. Unlike the buyer of common stock, he need not worry about future income, it is fixed. Risk of default or bankruptcy is minimal if high grade bonds are chosen. But with tax-exempt bonds each investor must examine his income level and compare the advantages of additional tax-sheltered income over additional regular income. Perhaps the major decision, however, is when to buy or sell municipal bonds--timing. Whether the market is in a rising or declining trend makes a lot of difference. Since the bondholder can expect to realize his guaranteed yield only if he keeps the bond until maturity, he desires to buy when prices are low and yields are high. If he is fortunate enough to have bond prices rise after his purchase, he may decide to sell and realize a capital gain. In any event timing is critical. An investor might ask how he is to judge the market, if there are persistent forces that are responsible for the general trend in the municipal bond market and if a knowledge of them would provide a stronger basis for timing decisions. These are the questions that are to be examined in this study.

Municipal Bond Funds

If an investor desires tax-exempt income but wishes to retain financial flexibility and at the same time avoid the intricacies of the municipal bond market, he may buy shares in a municipal bond fund.¹³ Other advantages are: relative stability of capital with very low risk of default, broadly diversified portfolio carefully selected and supervised which provides higher yields with less risk than could otherwise be obtained by an individual investor, and personal convenience that requires the owner only to clip coupons and leaves the decision making and the administration to the fund manager. To insure marketability so that shares or units of ownership can be readily redeemed, the bond house that established the fund usually maintains a market for the units with the intent of bidding higher than the net asset value. Trustees may also redeem units at a price based upon the value of the bonds in the fund on the day on which the unit is tendered for redemption.

The first successful municipal bond fund was formed in 1961; by 1967 four others had been started although each was slightly different from the other. Since that time there has been a gradual increase in the number, however, the financial crises in the brokerage firms during the past few years and the rapid inflation has slowed the anticipated growth. Of the different types of municipal bond funds, probably the simplest is the Mutual Investment Trust Fund (MITF). A number of units of ownership (for example, 10,000 at \$1,000 each) may be offered for sale and the

¹³ Information on municipal bond funds relies heavily on the report, "Tax-Exempt Bond Mutual Funds, 1963-1966" by Pinezich, P. V., as printed in Current Issues on the Frontiers of Financial Analysis edited by Barnes, L. and published by Hofstra University, 1970, pp. 121-148.

returns used to purchase blocks of municipal bonds. Certain restrictions may be applied such as not more than 10% of the fund is to be invested in any single bond issue, the portfolio should contain widely diversified bonds from different states and the bond ratings should be of investment grade (top four grades). The bonds may be selected with maturities to match a fund termination date, or for the best yield opportunity, with the goal of never allowing the total fund to fall below some minimum level, for example \$4.5 million; otherwise the relative percent of fixed expenses would be too large. Management fees usually appear as sale charges; the offering price for a unit may be based on the current price of the underlying bonds plus a sales charge of approximately 4 ½%. Whatever the sale charge, a portion is returned to the dealer as a commission charge and the fund manager retains the rest to cover handling plus a modest return. There is also a slight charge by the trustee and the evaluator receives a small fee for each determination of the aggregate value of each issue of bonds. These are usually paid by deductions from the interest account.

Although the individual investor buys units in a municipal bond fund so that he can have highly trained professionals select the bonds and judge the market, he can not escape responsibility completely. He must pay a sales charge for the service, he must decide when to buy into the fund and he must choose the type of municipal bond fund that best meets his needs. In addition to the Mutual Investment Trust Fund where the sales charge is determined by the price of the bonds, there are tax-exempt funds with fixed sales charges and the amount that can be invested is in steps of \$100, once an original investment of \$1,000 has been made.¹⁴

¹⁴This is the pattern of the Nuveen Tax-Exempt Fund as sponsored by the John Nuveen Co., New York, N. Y.

An investor with \$4,500 would be able to invest the entire amount instead of just \$4,000 as in the case where \$1,000 is the minimum purchase. Still slightly different is the tax-exempt Income Fund; their primary objective is to obtain the highest possible yields in order to maximize tax-exempt income. Some risk is involved as most of the municipal bonds purchased are unrated. Sizeable blocks of revenue bonds are usually included; these are bonds issued by state or municipalities to build plants and facilities in order to attract new industry into the area. The resources for interest payments on these bonds are often the rents to be paid by the occupants. Even though unrated, their quality is considered good in light of the record over the years since they have been introduced. Some of the most popular revenue bonds are those secured by automobile and truck highway tolls, gasoline taxes and cigarette taxes, or those issued by some large port authority such as New York or San Francisco. The $\frac{1}{2}$ to 1% increase in coupon rates makes them attractive candidates for the tax-exempt income funds.

Municipal bond funds are sold over-the-counter; both bond dealers and fund managers are members of the National Association of Security Dealers which in its self-regulating capacity administers the Security and Exchange Commission's Statement of Policy governing the standards for sales literature. Municipal bond funds are required to file within three days after publication all sales literature including all newspaper, radio or television advertising. Besides complying with NASD regulations, municipal bond funds must adhere to the standards set by the Securities Exchange Act of 1934 and the 1940 Investment Company Act.

The sponsors of municipal bond funds are faced with risks somewhat similar to those that face underwriters. If the bond prices drop during their accumulation and before they can be placed in the hands of the trustee, the sponsor must absorb the loss. Indeed, one of the incentives for sponsoring a fund is the inventory of municipal bonds already acquired. Another period of risk for the sponsor occurs during the distribution of the units of ownership. Bound by the prospectus he can not sell units at a price differing from that specified by the public offering price formula. The trustee determines the unit offering price using current market bids on the underlying bonds plus a sales charge.

Discount Bonds

As the municipal bond market changes, prices that are offered for various issues of municipals vary so as to earn a yield-to-maturity competitive with that of other bonds of like risk. If market yields rise, prices will drop--a \$1,000 four percent bond may be offered at \$900 so as to boost the yield-to-maturity to the market average. A bond reduced in price below par because of a low coupon rate so that its yield-to-maturity increases is called a discount bond. This does not mean that the bond is being sold at a discount because it is no longer valuable; it will still pay the same interest dividends and the same redemption amount as specified on the day the bond was issued, it means only that as a result of a general rise in interest rates the price of the bond must fall so that a new buyer can obtain the going rate of yield-to-maturity.

Discount bonds are attractive to some investors because they are able to benefit from the capital gain. If discount bonds are bought at a low enough price there may be a considerable capital gain when the bond

matures. It is possible to choose discount bonds with maturities that match one's retirement plans so that the investor benefits in two ways. First, he receives the tax-exempt income during his years of highest earnings and later when he retires and falls into a lower tax bracket, he receives the capital gain at bond maturity.

Premium bonds occur when the coupon rate is higher than the going market average yield-to-maturity. Purchasers are then willing to pay above par (a premium) for the bonds because of the high interest dividends. For an investor thinking of retirement the situation is exactly the reverse of the discount bonds--he receives high yearly dividends but no capital gains.

Summary

This examination of the various phases of the municipal bond market has emphasized the importance of future market trends. All participants are concerned and their profits or losses depend upon their judgement of the future. The case of the bond issuer, the municipality, is relatively straight-forward; if public officials believe that the trend in interest rates is up and will go even higher, the bond issue is likely to be expedited; to delay will mean extra costs. If the composite facts upon which the future market trend is judged are faulty and interest rates go down when they are expected to go up, the possibilities of loss are even greater.

The investment bankers who underwrite the municipal bond issues have the most urgent need for information about market determinants. Their decisions are based both on short-term changes and long-term trends. If they recognize which are the dominant forces in the market they can

consider them when making bid proposals. Underwriters must cover as many eventualities as possible, therefore they adopt bidding procedures which include cross-checks among syndicate members, market sampling and price forecasting. To misjudge the market is to court financial ruin.

The individual municipal bond investor, the final participant, is also either the victim or the beneficiary of future market trends. It was shown that even though he tried to avoid investment decisions by buying shares in tax-exempt bond funds where he received the benefit of professional money managers and bond analysts, he still could not escape the timing element. If he bought in at the beginning of a rising market trend his returns were greater; if he misjudged the market his returns suffered. Likewise in selecting discount or premium municipal bonds he must compare the present opportunity with the future.

Having documented the overall importance of municipal bond market trends, the goal now is to identify the market determinants. An investigation of the economic theory underlying the bond market and a review of the theoretical structure of interest rates is in order.

CHAPTER III

THEORETICAL STRUCTURE

Introduction

The yields on municipal bonds are more volatile than the yields on other bonds. This can be attributed in part to the market participants.¹ In 1971, of the \$154 billion of state and local debt outstanding the largest holders were commercial banks², \$78 billion; households, \$37 billion; insurance companies, \$21.4 billion and corporations, \$11.9 billion. Commercial banks not only held 50% of the outstanding debt, but during the decade of the 60's they acquired 70% of the new issues. Obviously, the commercial banks and private households together holding three-fourths of the municipal bonds have dominated the market and have supplied a large portion of the demand. The commercial banks buy high grade municipals as a way to invest excess liquidity and produce income which is tax-exempt. The nature of banking is such that it is both an instrument of, and a respondent to, U. S. Government monetary policy. Since banks are primarily in the business of making loans, and from this source earn their major profits, they are sensitive to the needs of their customers. As monetary policy changes customer demand, banks vary their own investments in order to maintain a proper level of liquidity.

¹Staats, W. F. "Commercial Banks and the Municipal Bond Market", Business Review, Federal Reserve Bank of Philadelphia, Feb. 1967, p. 5. "Because of the way banks change their investments and the way dealers manage their inventories, yields on municipal bonds tend to fluctuate more widely than those of other securities."

²Appendix B.

Private households exhibit a different demand pattern. Because of income tax consideration the private investor is motivated to put his money where the net return after taxes is highest, considering the level of risk he is willing to accept. Municipal bonds offer special advantages to such an investor in the form of subsidized taxes. As his income level increases he finds that tax-free returns from municipal bonds are equivalent to higher and higher taxable income. Unlike the commercial bank which must maintain a certain liquidity level in order to serve customers, the individual investor has no such requirement; he can change his investment according to the best financial opportunity.

The supply of municipal bonds may be offered by two sectors of the market, the primary where it is somewhat inelastic and the secondary where it is quite elastic. As Chalmers³ has shown, although the decisions by the municipalities to issue bonds is sensitive to interest rate levels to some degree, there are other pressures involved such as the necessity to win voters' approval for the bond issue, the urgency of the need and the alternative financing options available. The supply of new issues could hardly be described as determined by impulse decisions. In the secondary market the supply of issues offered for sale changes more rapidly, bolstered by the action of the commercial banks. If banks are selling, the secondary market inventory is likely to increase, and yields rise. Some bondholders who had been willing to sell at a higher price will withdraw their bonds. Conversely, if banks are buying, prices will

³Chalmers, J. A Model of State and Local Government Portfolio and Real Expenditure Behavior, 1952-1965. Unpublished dissertation, University of Michigan, 1969.

⁴Capital value risk is defined as the risk of losing a portion of the capital invested when the bond is sold.

rise and more bondholders will be tempted to sell. Other owners of municipals such as insurance companies and corporations are more likely to buy and hold because they seek a steady return and an avoidance of capital value risk.⁴ Likewise many private portfolios, once they acquire tax-exempt bonds, have a tendency to hold them until maturity in order to insure full yield.

If demand and supply for municipal bonds are used in determining the price, then the powerful positions of commercial banks and households in the market is likely to make the relationship demand biased, i.e. supply will adjust to demand.

Background Theory

To understand the behavior of the municipal bond market better and to determine whether its actions over the past two decades have conformed to the principal interest rate theories, some macro-economic background is helpful. If an LM-IS diagram is drawn (Appendix C) the LM schedule suggests that several rates of interest (monetary rates) are consistent with monetary equilibrium whereas the IS curve suggests that several rates (real rates) are consistent with product-market equilibrium. Only at the intersection of the two curves would the interest rate indicate full equilibrium for both the supply and demand for money and the supply and demand for product.

⁴Capital value risk is defined as the risk of losing a portion of the capital invested when the bond is sold.

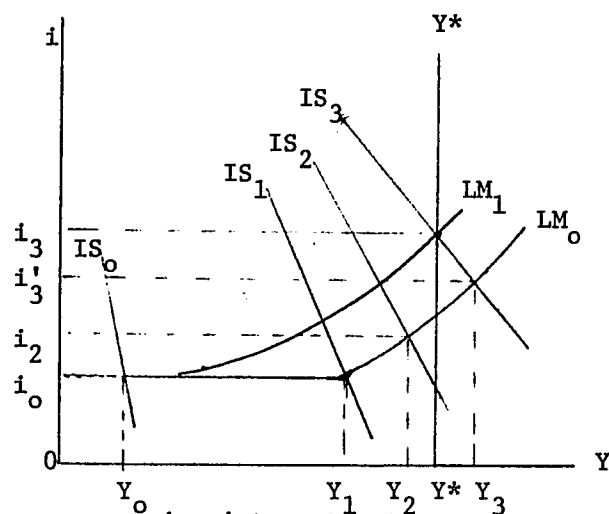


Figure 1

i = interest rate
 Y = income
 I = investment
 S = savings
 L = speculative demand for money
 M = money supply
 Y^* = income with full employment of resources

Referring to the above diagram⁵ the natural rate of interest as defined by Wicksell⁶ occurs at that point where the IS-LM curves intersect and there is full-employment. If the intersection is IS_0 and LM_0 , this is to the left of Y^* at a point of less than full-employment; the supply of output can adjust and the intersection remains a point of general equilibrium. The existence of unemployed resources implies that there is no need for the public to release more resources, only that idle ones be put to use. The interest rate need not change.

⁵This diagram and the related discussion are mainly based upon Macro-Economics by Dernburg, T. F. and McDougall, D. M. McGraw-Hill, New York, 1960.

⁶Wicksell, K. Interest and Prices. Reprints of Economic Classics, Augustus M. Kelley, New York, 1965.

If the IS schedule shifts to IS_1 for some reason the level of income will rise to Y_1 . Figure 1 depicts this case of the liquidity trap in which the equilibrium rate of interest is the rate at which the demand for money becomes infinitely elastic; the interest rate remains the same.

At IS_2 the level of income again rises but this time the rise in income is accompanied by a rise in interest rate to i_2 . The liquidity trap has been escaped; in this region the equilibrium interest rate will vary depending upon both the LM curve and the IS curve (the interest rate is determined by the combined action of the product and money markets and can be changed either by monetary factors or real factors).

Finally, if the IS schedule shifts to IS_3 so that the intersection with LM_0 is to the right of the full-employment level of income at interest rate i'_3 , it is impossible for the supply output to adjust to demand because the resources are fully employed. The LM schedule will have to shift and a new equilibrium point established. Stability will occur at interest rate i_3 where monetary equilibrium is equivalent to real product equilibrium and there is full employment of production resources.

The IS-LM curve above depicts graphically the different equilibrium points at which the rate of interest may be established (assuming wage-price rigidities in the downward direction). As the IS curve shifts, the LM function may have no effect on an interest rate (i_0 , liquidity trap), or it may form a combined equilibria (i_2), or if beyond full-employment the LM function may shift (LM_1) reaching equilibrium with the IS function at the natural interest rate, (i_3).

According to the equilibrium theory, the interest rate may depend on both monetary and real factors, therefore it seems only logical that modern theories of interest rates are divided into two categories: real

theories and monetary theories.⁷ Real theories are based on the equilibrium between investment and savings. As investments result in the production of real goods and bring returns to the investor, he is persuaded to borrow more or less capital from the saver depending upon the level of the interest rate, and the opportunity for future profits. The equilibrium between the marginal rate of return on investment and the cost of capital determines the real rate or product rate of interest.

The Real Theory of Interest Rates

The real theories of interest make up the classic theory and go back as far as Turgot, Ricardo, Marx and J. B. Say. Bohm-Bawerk has reviewed the many differentiations and concluded that it is the "Causation" or "why" of interest that is unclear; he accepts the "how" or technical action of equilibrium between the demand and supply of income and savings.⁸ Samuelson has in turn reviewed Bohm-Bawerk's summary of the real interest theories and concluded that the many versions based upon time periods, average versus spot values, extra productiveness and different refinements of the definitions of supply and demand do very little to change or improve the classic theory of interest which depends on the demand and supply for real goods (savings and investments).

Irving Fisher⁹ is credited with the best exposition of the modern real theory of interest. He refers to the rate of interest as the bridge

⁷ Samuelson, P. A. "Modern Theories of Interest Rates", as published in Money Financial Institutions and the Economy by Crutchfield, Henning and Pigott, Prentice-Hall, New Jersey, 1965.

⁸ op. cit. 5, Samuelson.

⁹ Fisher, I. The Theory of Interest. Reprint of Economic Classics, Augustus M. Kelley, New York, 1961.

or link between income and capital and defines the rate of interest as the percent of premium paid on money at one date in terms of money to be in hand one year later. Fisher points out the real problem of determining interest rate as correctly identifying the forces of supply and demand. He uses three approximations in arriving at six principles for determining interest rates. In his first approximation he assumes each person's income stream is foreknown and unchangeable except by loans; in his second, income becomes modifiable by loans and other means and in his third approximation risk and uncertainty are introduced. The result is a set of six principles which may be said to determine the rate of interest.

1. Principles of impatience which includes the time preference of the individual and the principle of maximum desirability.
2. Principle of investment opportunity which refers to the range of choices that are available to the individual and to the principle of maximum present value of returns.
3. Finally, the principles of the market: the market must be cleared and debts must be paid.

Having identified the forces which act on the supply and demand of income and capital and that bring about an equilibrium and determine interest rates, Fisher suggests that these rates are subject to both nominal and real variations.¹⁰ Moreover, the rate of inflation will increase the

¹⁰ We have seen that, theoretically, the rate of interest should be subject to both a nominal and real variation, the nominal variation being that connected with the changes in the standard of value, and the real variation being that connected with other and deeper economic causes.

As to the nominal variation in the rate of interest, we found that, theoretically, an appreciation of 1% of the standard of value in which the rate of interest is expressed, compared with some other standard, will reduce the rate of interest in the former standard, compared with the latter, by about 1%... p. 493-4, op. cit. Fisher.⁹

rates of interests by just the amount of inflation, however, the adjustment will be distributed over a period of years and will be indirect.¹¹

Fisher's additions to the theory of real interest were a major advancement for the classical theory of economics, but there were other outstanding economists which contributed to the advancement, also. Marshall¹² was one of the most distinguished, and his work is important to this study of municipal bonds because of its thorough examination of price as associated with supply and demand. Marshall has been called a "supply and demand economist".¹³ It was his lot to give "demand" at least some of the recognition it deserved in setting price. At that time classists held that "supply" was the more important factor, that the supply cost was the major ingredient in determining price; demand was taken for granted. Marshall was responsible for a better understanding of the demand-supply relationship and how it affected price. Although he placed less emphasis on interest rates, by his clear analysis of the pricing mechanism he laid a strong foundation for explaining the price of any commodity, for example, securities. He stressed utility, value and time; in his own words, "We may conclude that as a general rule the shorter the period which we are considering, the greater must be the share of our attention which is given to the influence of demand on value; and the longer the period the more important will be the influence of cost of

¹¹"In so far as there exists any adjustments of the money rate of interest to the changes in the purchasing power of money, it is for the most part (1) lagged and (2) indirect. The lag, distributed, has been shown to extend over several years." op. cit. 10, Fisher p. 494.

¹²Marshall, A. Principles of Economics, MacMillan & Co., London, 5th ed. 1907.

¹³Davenport, H. J. The Economics of Alfred Marshall, Cornell University Press, 1935, p. 15.

production on value."¹⁴ Undoubtly, this statement refers to the pricing of commodities, but only a slight transition is needed to apply it to securities. Marshall's notion of market equilibrium in a stationary and in a changing society¹⁵ is just one of the principles which may be applied in determining the price (yield) of municipal bonds.

The Monetary Theory of Interest Rates

In contrast with the real interest theories, their dependence on income and savings and their after-thought method of treating uncertainty, the monetary theories rely on the demand and supply of money and emphasize the role of uncertainty. John Maynard Keynes was the principal expositor of monetary interest theory (Appendix D). Quoting from his writings¹⁶, "In any given state of expectation there is in the minds of the public a certain potentiality towards holding cash beyond what is required by the transaction motive or precautionary motive, which will realize itself in actual cash-holdings in a degree which depends on the terms on which the monetary authority is willing to create cash." His liquidity equation:

¹⁴Marshall is referring to the time necessary to produce an item which may determine labor costs and when added to material cost would determine supply costs. Securities, on the other hand, have a small supply cost.

¹⁵"When demand and supply are in stable equilibrium if any accident should move the scale of production from its equilibrium position, there will be instantly brought into play forces tending to push it back to that position, just as if a stone hanging by a string is displaced from its equilibrium position the force of gravity will at once tend to bring it back to its equilibrium position." op. cit. 13, Marshall, p. 346.

¹⁶Keynes, J. M. The General Theory of Employment, Interest and Money, Harcourt, Bruce and World, New York, 1964, p. 205.

$$M = M_1 + M_2 = L_1(Y) + L_2(r) \quad (1)$$

where M = total amount of liquidity, or money supply.

M_1 = the amount of cash held to satisfy the transaction and precautionary motives.

M_2 = the amount of cash held to satisfy the speculative notice.

Y = income

r = interest rate

L = liquidity function

shows how the uncertainty of the future course of the rate of interest is related to the demand for cash. The division of M into M_1 and M_2 will depend on the responses of investment to a change in the rate of interest, and of income to an increase in investment. As the interest rate, r , varies, the demand for liquidity, L_2 , also changes. Keynes states that uncertainty is the sole, intelligent explanation for this.¹⁷ In the above equation the demand for liquidity also is a function of income. The relationship between r and M is such that a change in either will lead to a new equilibrium partly by changing M_2 and partly by changing Y and therefore M_1 .

It is a simplification of the Liquidity Preference theory to define the interest rate as that premium which equates the demand for liquidity with the supply, however, this theory has been tested many times in its simplified form with many replications.¹⁸ As shown in equation (1),

¹⁷op. cit. 16, Keynes, p. 201.

¹⁸"There is no need for a further test of the qualitative relationship: if one found opposite results at this stage, suspicion would be cast on his empirical procedure rather than on the theory". Okun, A. M. "Monetary Policy, Debt Management and Interest Rates: A Quantitative Appraisal" published in the book Stabilization Policies by Brown, E. C. Prentice-Hall, New Jersey, 1963, p. 333.

a change in the interest rate works a change in the speculative demand for liquidity in an indirect way. Using this theory it should be possible to explain the movements of the average yield to maturity of municipal bonds and identify these factors which act as determinants.

Term Structure of Interest Rates

In addition to theories which explain the level of interest rates there are also theories which explain the relationship between interest rates. The more acceptable of these deal with the maturity structure of interest rates. They offer the basis for answer to such questions as:

Do short-term interest rates move in a predictable pattern about long-term interest rates?

Can observations of one be useful in making predictions about the other?

It is known that asset preferences of lenders and investors are influenced by many factors--their wealth, expectation about future markets, current prices of goods and services and many others. These have been studied by the theorists and, following the leadership of Hicks¹⁹, they have hypothesized that the interest rate on a long-term debt tends to equal the average of short-term rates expected over the duration of the long-term debt. If this is true, the system of interest rates for various debt maturities can be reduced to the short rate (current) combined with

¹⁹Hicks, J. R. Value and Capital, 2nd ed., Oxford University Press, N. Y., 1946. "If we decide upon some minimum period of time, loans for less than which time we shall be prepared to disregard, every loan of every duration can be reduced to a standard pattern--a loan for a minimum period, combined with a given number of renewals for subsequent periods of the same length, contracted forward. The rate of interest for loans of two weeks is compounded out of the 'spot' rate of interest for loans of one week and the 'forward' rate of interest for one week of loans to be executed in the second week". pp 145-6.

a series of relevant forward short rates. This belief that the term structure of interest rates depends on expectation of future interest rates has been called the expectation theory and Lutz²⁰ is its most articulate spokesman. Abstracting from costs of investments and using institutional rigidities he is able to explain any pattern of interest rates. However, Lutz has been criticized by Culbertson²¹ who disagrees with the basic foundation of the expectation theory and states that interest rate expectation is important mainly as a factor determining very short-run movements in long-term rates and ordinarily of little importance in determining average rate movements over considerable periods of time. He subscribes to the older view that interest rates generally move up and down together because of overlapping among debt markets and the role of arbitrage of specialists.

More recently Malkiel²² has supported the expectation theory on the grounds that it more nearly conforms to the actual practices of both investors and traders. He asserts that the yield-maturity relationship is more clearly perceived when implicit recognition is given to bond prices (rather than to interest rates). Expectation of price changes play an important part in market decisions and these expectations are

²⁰ Lutz, F. A. "The structure of Interest Rates", Quarterly Journal of Economics, Vol. LV (Nov. 1940), pp. 36-63).

²¹ Culbertson, J. M. "The Term Structure of Interest Rates", Quarterly Journal of Economics, Vol. LXXI (Nov., 1957), pp. 485-517.

Culbertson's theory is stated in this passage - "Rates on short-term and long-term U. S. Government securities, which are tied to rates on related private debt, characteristically move simultaneously in the same direction in the short-term (over periods of weeks or months) with short-term rates changing over the wider range. The general coincidence of movement in rates reflects basically the simultaneous impact in various credit markets of changes in general credit conditions resulting from changes in business conditions and monetary policy and substitutability between short-term and long-term debt on the part of both borrowers and lenders".

and should be continuously up-dated with new information.

Finally, Roll²³ has examined the pure expectational hypothesis of Lutz and Meiselman²⁴ and concludes that since liquidity premium is considered to be zero, or is the result of mathematical expectation alone without influence by uncertainty, that the expected return from holding any default free bond for one period is the current short-term rate and is completely independent of the maturity of the bond. The pure expectational hypothesis assumes that investors are indifferent to risk associated with maturity, therefore if default risk is equal among bonds, the expectational returns must be equal over any holding period. In contrast with this view Roll introduces the Market Segmentation hypothesis with its basic premise that securities of different maturities are imperfect substitutes; the liquidity premiums for different maturities are not zero. He then considers two variants, one where future payments streams depend upon calendar time and the other where future payments streams are independent of calendar time. He then writes an expectational operator for each of these conditions and after arriving at a testable equation concludes that the segmentation hypothesis is a more accurate description of the relationship among interest rates.

Malkiel has observed that interest rate structure theory remains in an uncomfortable state of confusion. An empirical test with municipal bonds may reinforce certain hypotheses.

²²Malkiel, B. G. "Expectation, Bond Prices and the Term Structure of Interest Rates", Quarterly Journal of Economics, Vol. LXXV, May, 1962, pp. 197-218.

²³Roll, R. The Behavior of Interest Rates, Basic Books, New York, 1970.

²⁴Meiselman, D. The Term Structure of Interest Rates, Prentice-Hall, New Jersey, 1970.

Recent Studies of Bond Yields

Feldstein and Eckstein have performed a study²⁵ of the variability of long-term interest rates using the average yield of Moody's Aaa grade corporate bonds as the dependent variable. Their analysis is a synthesis of Keynes' Liquidity Preference theory and Fisher's Principles model. No demand function is written, instead the liquidity preference function is regarded as defining the bond interest rate at which investors are content to hold the available supply of money. Their first equation is a linear, multiple regression having two independent variables, the real per capita monetary base (money supply plus reserves/GNP Price Deflator and resident population) and per capita real, private GNP. The coefficient of determination is noted by the investigators and as additional independent variables are added in subsequent equations results are compared. For the second trial, Feldstein and Eckstein allow for a more general dynamic response by using the change in per capita monetary base from the preceding quarter as a third independent variable. Instead of implying that the interest rate responds completely within one quarter to the change in liquidity, this reflects the change over the most recent two quarters; however, the coefficient of determination increased only slightly indicating that the shorter run effect is greater. Since the first two equations used only real values, inflation was considered in equation three in the form of an expectation model which included the distributed lag of past inflation rates. This is a technique introduced by Irving Fisher to describe anticipated inflation which Hicks and others have

²⁵ Feldstein, M. and Eckstein, O. "The Fundamental Determinants of Interest Rates", Review of Economics and Statistics, Nov., 1970, pp. 363-375.

considered so important to bond rates. As might be expected, this brought spectacular results boosting the coefficient of determination to .982. Finally, a fourth independent variable was selected, the interest bearing debt of the Federal government. It is believed that this is a relatively close substitute for corporate bonds in most portfolios. The results imply that changes in the outstanding public debt can have an important impact on corporate bond rates, which is as expected. (A 10% increase in real per capita privately owned Federal government debt will raise interest rate on corporate bonds by 27.8 basis points).²⁶

In another study on the variability of bond rates, Okun²⁷ investigated long-term U. S. Government bonds. He applied the simple Keynesian model to modern monetary policy. He accepted the major importance of quarterly changes in money supply and he followed the basic doctrine of the supply and demand for liquidity being the main determinants of interest rates. He analyzed the demand for U. S. Government bonds and identified key independent variables. These were selected, together with the supply of money, and a linear, multiple regression equation was tested. It showed the relationship between the dependent variable, long-term average yields on U. S. Government bonds, and the independent variables, money supply, long-term Federal debt, intermediate Federal debt, Maturity and Income. Since nominal values were used throughout, inflation was not considered as a separate variable. Three different definitions of money

²⁶op. cit. 25, Feldstein and Eckstein, p. 387.

²⁷ibid. 18, Okun, pp. 331-380.

supply were used: M_1 the conventional measure; M/R where M is the volume of demand debt and R is the required reserve ratio, i.e., maximum potential money; and $\frac{M-C}{R} + C$ which is potential demand deposits plus actual currency. Both of the hypothetical money variables were more successful in explaining interest rates than was the actual volume of money. In addition, Okun found that Wealth²⁸ which he defined as National Private Wealth and which differs from National Wealth by including all Government liabilities and excluding all assets of the Government, had negligible effect on long-term U. S. Government bonds' interest rates. He originally used it as an over-all constraint. As a result of empirical tests he concluded that the long-term U. S. Government bond interest rates were determined principally by the balance sheet of the Federal monetary authorities, the legal reserve ratio and the level of Income. Moreover, Okun constructed a matrix of the interest rates of all types of private assets showing their correlation with each other and concluding that by explaining the variations of the yields on U. S. Government bonds he had explained the major portions of the variations of the yields on private assets. He termed the yields on Government bonds as "pivotal yields".

In the area of the term structure of interest rates, Meiselman performed an operational test of the expectation hypothesis.²⁹ He derives the forward rate on a one year loan during the period, $t + 1$

$${}_{t+1}1_t = \frac{(1 + {}_tR_{2t})^2}{(1 + {}_tR_{1t})} - 1 \quad (2)$$

${}_tR_{1t}$ and ${}_tR_{2t}$ are the rates of interest on payments to be made at the end of years, $t, t + 1 \dots$

²⁸This has been referred to as Patinkin wealth by J. Tobin. See "Asset Holdings and Spending Decisions", American Economic Review, Vol. XLII, May, 1952, pp. 110-120.

²⁹op cit. 24, Meiselman, pp. 18-25.

$t + 1$ r_{1t} , the forward rate on a one-year loan during $t + 1$, is derived from the structure existing at the beginning of the period, t . In testing the hypothesis it becomes the rate on the delivery of one-year loan funds expected at the beginning of period, t , to prevail at the beginning of the period, $t + 1$.

A critical point in the expectation hypothesis is the effect of errors in the estimate of future short-term rates. Meiselman studied the errors and hypothesized that forward short-term rates change on the basis of errors made in forecasting the current short-term rate. Because long-term rates are an average of current and forward short-term rates he also hypothesizes that unanticipated changes in the long-term rates are based on errors made in forecasting short-term rates. After conducting tests over the 54 year period, 1901-1954, he concludes that:

1. The future's market in loans reacts quickly to forecasting errors.
2. Expectations are revised only on the basis of forecasting errors made within the same year that the revision takes place. Previous errors have little, if any, effect on expectations.

Still another investigation of interest rates has been made by Roll.³⁰ He has studied their behavior and developed an econometric model to explain the movements of short-term interest rates of 90-day U. S. Government bills. His dynamic equation for interest rates in an efficient market is:

³⁰ibid., 23.

$$E_{t-1} (r_{jt} - L_{jt} : B_{t-1}) = r_{j+1, t-1} - L_{j+1, t-1} \quad (3)$$

where r_{jt} is the one-period forward rate for j periods hence observed in period t and L_{jt} is the j -period liquidity premium observed in period t .

E_{t-1} is the estimated value at $t-1$

But the above equation can not be tested unless all variables in the sequence are observable. Liquidity premium can not be obtained directly so Roll estimates it from other (observable) variables specified by term structure hypotheses. First, he examines the pure expectation hypothesis and finds this of little help because it asserts that the L 's are identically zero for all j and t . Next, the market segmentation hypothesis, based on the premise that securities of different maturities are imperfect substitutes, is considered. Some of the L 's are non-zero. In order to make the proper assumptions and draw the correct implications he examines two variants, one that is time dependent and the other stationary. He chooses these because maturities of payment streams of many assets and liabilities depend on calendar time while streams from other assets and liabilities are independent of calendar time. After much rearranging and substitution, Roll arrives at a testable equation. He uses this in an empirical test as he considers whether the interest rates on U. S. Government bills follow any kind of a distribution as they change over time.

Hypotheses

Such a broad review of the interest rate theories and empirical tests which have sought to identify cause and effect among the movements of the various security yields, underscores the truth that everything in finance is more or less related to everything else. There is a family of

interest rates and although they generally move together over cyclical or secular trends there are individual differences. It is the examination of the individual security movements and the determining of the variables which explain them that is the current state of the art in security market theory. What is sought are the prime or principal factors which influence these variations. It may be argued that the major factors have already been identified and that they are the same for the entire family of securities. On the other hand, either different factors or different weights must be present, else the explanation for the variations among interest rates is incomplete.

Theoretically, by using stocks or flows it should be possible to select any type of security and show how its interest rate varies in accordance with the supply and demand of that security. Moreover, it should also be possible to test its conformance to the monetary interest rate theory and finally, its interaction with other maturities should be explainable by term structure theory of interest rates.

In this particular study the type of security selected is the municipal bond. The first hypothesis tests the application of the stock or flow methodology and its effectiveness in identifying the determinants of the market yields.

Hypothesis I: The variations in the average yield to maturity on long-term municipal bonds are determined by five independent variables, (1) the Prime Rate, (2) Dividend Yield on common stock, (3) Net Acquisition of Financial Assets by commercial banks, (4) New Issues of municipals and (5) Income Tax Rate.

The five independent variables measure flow and are derived from theoretical reasoning and the empirical research of others.

The second hypothesis applies the liquidity preference theory to municipal bonds. Extensive work has been done testing its application to U. S. Government bonds' and to corporate bonds' interest rates but not to municipal bonds! While the application of this theory can be expected, the degree of success in explaining the municipal bond yield variations is in question.

Hypothesis II: The variations in the average yield to maturity on long-term municipal bonds may also be determined by the Money Supply, Income or the demand for liquidity, and the Marketable Debt of the three sectors of the bond market---corporate, government and municipal.

The liquidity preference theory has been extended to include changes in the marketable debt of the three sectors of the bond market as independent variables following the practice of Feldstein and Eckstein³¹ in developing their "portfolio balance model" during their study of corporate bonds and of Okun³² in his use of the market equilibrium theory while investigating government bond interest rate behavior.

Yield variations of the municipal bond market can be investigated using still another approach--the term structure of interest rates. Meiselman's test³³ of this theory as expressed by the expectation hypothesis during which he used corporate bonds may be extended to municipal bonds.

³¹ibid., 25.

³²ibid., 18.

Hypothesis III: The municipal bond market maturity structure is such that the variations in the average yield to maturity on long-term bonds are a reflection of the errors between actual and expected short-term municipal bond yields.

The purpose of this study and the goal of the three hypotheses is a better understanding of the variations of municipal bond yields and the identification of the prime forces behind them. Because most financial variables are related there is real uncertainty about the relative importance of each. Different types of securities vary in their responses to economic factors. This research proposes to identify those independent variables which are persistent in explaining the movements in the municipal bond market.

³³ibid., 24.

CHAPTER IV

METHODOLOGY, MODELS AND DESCRIPTION OF TEST DATA

Once hypotheses have been stated they must stand or fall depending upon the results of empirical tests. The methodology used calls for the application of theoretical reasoning to the economic areas already discussed and drawing there-from the principles and the constructs necessary to form the test models. These mathematical models must use relationships among variables to describe specific economic actions. The more accurate the descriptive function, the more powerful the model. In this study the demand function for municipal bonds is required in one test. A review of the basic elements of a demand function is therefore in order.

The demand for any asset can be expressed in general as a function of Income, Wealth, its own yield and the yield of other assets.

$$D = f (Y, W, r_a, r_o) \quad (4)$$

where D = demand for the asset.
 Y = income, defined as the Gross Private Product.
 W = wealth
 r_a = yield or return on a particular asset.
 r_o = yield on other assets.

This is the logical proposition that Wealth serves as an overall constraint on demand; Income denotes the transaction needs, and yields of other assets indicate the competitive rates. All have an effect on the demand for a specific asset.

If the demand function desired is that for municipal bonds, the different terms that make up a general demand function must be refined to capture the particular forces that affect the municipal bond market.

Considering the fact that two classes of buyers, commercial banks and private households, so thoroughly dominate the market it may be said that the demand of municipals is really the demand of commercial banks and of private households for municipals. First, with reference to commercial banks, Marcus¹ found that they use excess funds to buy high grade municipal bonds when the demand for loans is weak. If the amount of bank loans is low and the amount of savings deposits is high, banks look for other sources of income. Since 1961, municipal bonds have become increasingly their choice, therefore some measure of the demand for bank loans or of the excess cash-on-hand should be a good indicator of the commercial banks' demand for municipals.

As for individual households' private portfolios, Markowitz's² theory on efficiency is the best guide. Individuals will buy municipals when the tax-free income is equivalent to a return that exceeds the returns from other investments of similar risk. Their demand for municipals will be directly influenced by this condition. Many high-tax-bracket individuals invest in common stock and since that market is the most volatile it is quite likely that the common stock side of the portfolio will generate the conditions for an investment change. This warning may come in the form of return on equity, or dividend yield, or a change in income-tax provisions. Since individual households are more inclined to buy and hold

¹Marcus, R. G. Commercial Bank Activity in the Municipal Bond Market. Unpublished dissertation, University of Kentucky, 1969.

²Markowitz, H. "Portfolio Selection", Journal of Finance, March 1952, pp. 77-91.

municipals than to trade³, it is more logical to consider those factors which lead to greater purchases of municipals rather than negative factors which might cause them to sell municipals.

Returning to the general equation for demand (4) for any asset, Income, which usually denotes the demand for liquidity should be interpreted, more specifically, as Gross Private Product, (GNP less U. S. Government payroll) the private transaction demand for liquidity. A Wealth proxy must be selected which will show the general level of economic activity and especially, activity in the security market. The purpose is to circumscribe that portion of national wealth which has the major effect on the demand for municipal bonds, and yet is large enough to be somewhat visible as it responds to the movements of leading indicators. The Federal Reserve's Flow of Funds Tables list the amounts spent by all sectors of the economy in acquisition of financial assets. Since wealth and expenditures are related, the investment in financial assets by the different sectors should be considered as a possible proxy for wealth.

Aside from the methodology followed in writing a demand function, there are also techniques for selecting test data. The data must be relevant, unbiased and accurate. There are two options: either the data are taken from a cross-section of the population at a particular point in time, or they are a series of values over a period of time. For example,

³Lebenthal & Co., the large municipal bond house in New York, N. Y. made this comment: "Because Municipal Bonds are not traded on a central exchange, because most individuals do not sell their bonds, and because few Municipal Bonds are quoted in the daily papers, the individual may get the idea that his bonds are cloaked in secrecy. The evidence is to the contrary...."

Municipal Bonds and the Individual Investor, Lebenthal & Co., Inc., New York, N. Y., 1972, p. 11.

a time series would be the monthly yield average on long-term municipal bonds over a ten-year period whereas cross-section data would be the prices of 150 designated issues of stock on a particular day. The data in this study are of the time series type because the hypotheses refer to relationships which exist over long time periods. But the time series data offer certain obstacles: just suppose that corporate debt was selected as an independent variable, over a period of 10 years it would be found that each year the amount of debt increases. The same pattern is noted in GNP, Money Supply and others. If independent variables of this type are to be useful, a way must be found to avoid serial correlation. An acceptable method is to use the change in values, or the first differences. Sometimes seasonal adjustment will realign a typical data into a more useful form. Adjusting techniques may appear to reduce the date effectiveness as in the case of first differences where coefficients of determinations may be lowered as a result. It is important to remember that a lower R^2 with an effective independent variable is much preferred over a high R^2 , denoting coincidence. The statistical problems of autocorrelation and multi-collinearity can be avoided by using unrelated basic measures which are supported by sound economic theory.

The methodology used to construct the various models in this research consisted of first studying the classical and Keynesian economic theories as expressed by Wicksell, Marshall, Fisher, Keynes, etc., and previously discussed in Chapter III. The real interest rate theories, the monetary theories and the term structure theories were carefully examined to determine which applied to municipal bonds. Models were then constructed provided it was possible to obtain satisfactory empirical data. In most instances the applicable theory suggested the economic and market

forces that had to be expressed. The simplest relationships were sought so that either simple or multiple linear regression equations could be used. The variables that best captured the specific forces were selected, however some independent variables played a more important part than others in explaining the variance of the dependent variable. The simple form of the models undoubtedly resulted in sacrificing closeness of fit, but the aim of this study is to identify the persistent determinants of yield changes of municipal bonds and not the fitful and short-lived determinants. Marshall⁴ expresses the importance of this approach: "The actual value at any time, the market value as it is often called, is often more influenced by passing events and by causes whose action is fitful and short-lived, than by those which are working more persistently all the time. But in long periods these fitful and irregular causes in large measure efface one another's influence; so that in the long run persistent causes dominate value completely".

Model I

The first model to be tested can not be classified as built either on the real interest theory expounded by Fisher or the monetary theory of Keynes. Instead it is an original model based on Marshallian economics. According to Marshall⁵, the first step in economic reasoning is the following:

"....to examine the general relations of demand and supply;
especially those which are connected with the adjustment of

⁴op. cit. 12, Chapter III, Marshall, p. 350.

⁵Marshall, A. Principles of Economics, MacMillan & Co., London, 1907, 8th ed., p. 323.

price by which they are maintained in equilibrium."

"....it sets out the theoretical backbone of our knowledge of the causes which govern value (prices)".

This model borrows from classic economic theory to test the interest rates of municipal bonds by explaining the variations in their demand and supply.

$$R_m = f(D_m : S_m) \quad (5a)$$

or $R_m = f(S_m : D_m) \quad (5b)$

where R_m = yield to maturity of long-term municipals
 D_m = demand for municipal bonds
 S_m = supply of municipals

The demand function for municipals must include the demand of the principal purchasers of municipals: commercial banks and private households.

As explained by Ludtke⁶, municipal bonds are not the first choice of investments by commercial banks. Their main source of profit is from short-term bank loans and their chartered purpose is to provide liquidity to the public. It is only as money become plentiful and interest rates decline that a crossover point is reached where municipal bonds can produce added profits. Consequently the commercial banks' demand for municipals is based on their customers' demand for money which is in turn directly reflected in the Prime Rate. Since the banks set the Prime Rate, it is an excellent indicator of their investment demand position.

⁶Ludtke, J. B. The American Financial System, Allyn & Bacon, Boston, 1961, p. 517.

The demand of private households for municipals, the other large sector of the market, runs counter to that of commercial banks.⁷ When money is tight and banks are not buying municipals, prices appear low in comparison with other securities so household private portfolios are adjusted in accordance with rational investor decisions. Low performing securities are replaced with others of the same or lesser amounts of risk which are more profitable. Since common stocks are the most volatile segment of the securities market and hence greatly influence a portfolio's performance, they are closely watched. Return on equity and dividend yield are the most obvious measures. As the portfolio manager attempts to improve efficiency he shifts from common stock to bonds and in the case of the wealthier households (larger portfolios) municipal bonds become more attractive. Either the dividend/price yield or the return on equity should prove to be a good indicator of the demand for municipals by households.

In the process of gaging the demand for municipal bonds by the two largest buyers, commercial banks and private households, the principal competing securities have been identified and independent variables

⁷ op. cit. 6, Ludtke aptly sums up the vagaries of the municipal market: "In 1954 and 1958 the banks supplied more than 40% of total annual flows, but in 1956 the banks supplied only 6% of total annual flows. It will be recalled that 1954 and 1958 were recession years and that 1956 and 1957 were years of economic boom. It will also be recalled that banks reduced their holdings of Federal obligations by \$9.7 billion during 1955 and 1956. Obviously, the demand for business loans has priority over state and local obligations, as well as over Federal obligations, but to a lesser degree. The banks did not liquidate state and local obligations, instead they merely stopped acquiring such obligations. Commercial banks enter the market in periods of easy money and withdraw from the market in periods of tight money. The reverse is true for individuals."

selected which explain their activity. It now remains, in accordance with the general equation for a demand function (4) to capture the wealth effect, that is the effect of wealth in so far as it increased or decreases the demand for municipals by commercial banks and private households.

As the nation's wealth increases it is reflected in the Flow of Funds accounts published by the Federal Reserve Board. The added flow of funds through the different sectors of the economy are evident from the growth in the net acquisition of financial assets. It is possible then to measure some aspects of the wealth effect by observing the changes in the net acquisition of financial assets by both the commercial banks and the private households, however, in order to establish the real trend it is necessary to note the increase of financial assets purchased when referenced to a changing base, such as Income. The greater this increase, the greater the demand for municipals by the two sectors.

Having indicated the important elements of demand for municipals it is now possible to define that function:

$$D_m = f(\text{Prime Rate, Dividend/Price yield on common stock, Net Acquisition of Financial Assets/Y})$$

There are two other factors which, theoretically, have a strong influence on municipal bond yields and must be considered before a model describing the behavior of the municipal bond market can be formed. The first of these is the supply of New Issues which is important because it is the portion of supply which is viable and which is weighed against demand to determine price. The municipal bonds in the secondary market

more or less follow the prices which the New Issues have set.⁸ Although there are no records available of the total number of municipal bonds sold each week because of the informal, over-the-counter market, nevertheless bond traders are in instant contact with customers and market events through extensive communication networks.

The second important factor affecting municipal bonds is the income tax rate. Since the single, most attractive feature of municipals is their exemption from Federal Income Taxes, it appears logical that as new tax laws change the rate schedule on taxable income the municipal bond market will be affected.

When these factors are considered together with the demand function for municipals already discussed, it becomes possible to form a model which can test Hypothesis I, already stated. Model I may be written in an operational form:

$$R_m = a_0 + a_1PR + a_2D/P + a_3NAFA/Y + a_4NI + a_5T \quad (6)$$

where R_m = yield to maturity on long-term municipal bonds.
 PR = prime rate as set by commercial banks.
 D/P = dividend/price yield on common stock.
 $NAFA/Y$ = net acquisition of financial assets by commercial banks per unit of Income.
 NI = new issues of municipal bonds.
 T = income tax rate level.
 $a_1, a_2 \dots$ = regression coefficients.
 a_0 = constant.

A linear, multiple regression is selected because the variable factors do not necessarily depend upon each other and because other researchers

⁸ Informal discussion with brokers and traders confirm that most municipal bonds advertised in the Blue List, a trade paper published by Standard & Poor's, Inc., having asking prices geared to the comparable New Issues' prices. Also see H. Wallich's "Overshoot Theory" on bond prices as discussed by Okun, op. cit. 9, pp. 350-351.

have found a linear form more effective with similar parameters.⁹

Model II

The monetary theory of interest rates has been chosen by Feldstein and Eckstein for empirical tests to identify the determinants of long-term corporate bond yields and by Okun to identify the determinants of long-term U. S. Government bond yields. A simplified version of the Keynesian liquidity preference theory was the test vehicle in each case. Model II uses the Okun approach¹⁰ in empirical tests over a different time period to measure the effectiveness of certain independent variables in explaining the variations of long-term municipal bond yields. No tests of the application of the liquidity preference theory to the yields of municipal bonds have been reported to date.

Okun's equation: $r = a_0 + a_1 \text{Money} + a_2 S + a_3 I + a_4 L + a_5 T + a_6 Y + a_7 W$

where r = long-term interest rate on U.S. Government bonds.
 S, I, L = short-term, intermediate and long-term Government debt.
 T = maturity on debt.
 Y = gross private product (GNP less compensation to Government employees).
 W = net private wealth, differs from national wealth by including all Government liabilities and excluding all Government assets.
Money = money supply
 $a_0, a_1, a_2 \dots$ = regression coefficients

⁹Hastie, K. L. The Determinants of Municipal Bond Yields, unpublished dissertation, Cornell University, 1970.

Okun, A. M. "Monetary Policy, Debt Management and Interest Rates: A Quantitative Appraisal" as published in Stabilization Policies, Brown, E. C. Prentice-Hall, N. J., 1963.

Marcus, R. G. Commercial Bank Activity in the Municipal Bond Market. Unpublished dissertation, University of Kentucky, 1969.

¹⁰ibid. 9, Okun, P. 343.

Okun tests three different money supplies: M_1 , M/R and $\frac{M - C}{R} + C$

where M_1 = currency in circulation and demand deposits
 M = demand debt
 R = required reserve ratio of national banks
 C = currency

In similar tests Feldstein and Eckstein used the Monetary Base as defined by the Federal Reserve Bank of St. Louis, for money supply.

The liquidity preference theory has been the basis for practically all empirical tests on interest rates where the investigator wishes to look behind the intercorrelated structure of the rates. Model II applies this theory to municipal bonds. It follows the suggestion of Okun and combines the market equilibrium theory with the liquidity preference theory. Outstanding debt is recognized as influencing the cost of new debt.

Model II may be written:

$$R_m = a_0 + a_1 \text{Money} + a_2 Y + a_3 \text{Debt} \quad (7)$$

where R_m = average yield to maturity on long-term municipal bonds

Money = money supply, to be tested in the three forms used by Okun.

Y = Income, Gross National Product less Government payrolls.

Debt = Outstanding marketable debt of the three principal borrowing sectors: corporation, the U. S. Government and municipalities.¹¹

$a_0, a_1, \dots$ = intercept and regression coefficients.

¹¹ All maturities of the Federal debt are combined also by Feldstein and Eckstein, op. cit. 25 chap. III in this study.

Model III

Several recent studies¹² of interest rates have emphasized the term structure relations between bond rates and short-term interest rates. Model III makes use of the work by Meiselman and the error-learning model that he developed based on the expectation theory. To the hypothesis that long-term interest rates are the average of the relevant short-term rates he has added the substantive hypothesis that unanticipated changes in the long-term rate are based on errors made in forecasting short-term rates.

Meiselman's model:

$${}_t + 1r_{1t} = \frac{(1 + {}_tR_{2t})^2}{(1 + {}_tR_{1t})} - 1$$

$$\Delta_t + nR_{jt} = k(E_t)$$

where ${}_t + 1r_{1t}$ = a forward interest rate on a one year loan beginning at $t + 1$, based on market rates at time, t .

$\Delta_t + nR_{jt}$ = change in the actual long-term (j years) interest rate from one period to another.

E_t = error between actual short-term interest rate and anticipated short-term rate.

Model III will use Moody's intermediate municipal bond yields (10 year maturity) as the short term rate and the yield on 20-year municipals as

¹²For example see Modigliani, F. and Sutch, R. "Innovations in Interest Rate Policy", American Economic Review, May, 1966: DeLeeuw, F. and Gramlich, E., "The Federal Reserve - MIT Model", Federal Reserve Bulletin, Jan., 1968: Meiselman, D. The Term Structure of Interest Rates, Prentice-Hall, N. J., 1970, and Telser, L. G. "A Critique of Some Recent Empirical Research on the Explanation of the Term Structure of Interest Rates", Journal of Political Economy, August, 1967. Roll, R., op. cit. we in chap. III has also done outstanding work on term structure.

the long-term rate. The questions to be answered are these: Can the yield on 20-year municipals be considered an average of the current 10-year rate and the forward 10-year rate? Are the changes in the 20-year yields the result of the unanticipated error in the forward 10-year rate?

Model III;

$${}_t + 1r_{10t} = \frac{(1 + {}_t R_{20t})^2}{(1 + {}_t R_{10t})} - 1 \quad (8a)$$

$$\Delta {}_t R_{20t} = a + bE_t \quad (8b)$$

where E_t = Unanticipated error between the forward 10-year rate as predicted and as actually occurred one 10-year period later.

$$E_t = {}_t R_{10t} - {}_t r_{10t} - 1$$

${}_t R_{10t}$ = actual market rate of interest at beginning of period t on a 10-year municipal bond, commencing at period, t . Each period, 10-years long.

${}_t r_{10t-1}$ = forward rate on 10-year municipal bond, commencing at period, t , implied by market rate at time, $t - 1$.

The indexes of intermediate and long-term municipal bonds are used in Model III because they are most readily available to the public. Whereas Meiselman used one and two-year corporate bonds to compute forward rates this study will extend the maturities to 10 and 20 years. Period 1 will be 10 years in length and period 2 will be the second 10 years in a 20 year span. Forward, spot rates on 10 year municipal bonds will be subtracted from actual rates on 10 year bonds to determine the error, E_t . This error will then be compared with changes in the average yield rate on long-term municipal bonds.

The methodology leading up to this will be in gradual steps. First, Meiselman's error-learning model¹³ will be tested exactly as he tested it, except that one and two year municipal bonds will be used to determine the error, E_t , instead of corporate bonds and the change in long-term yields will be of municipal bonds, also. Data on yields of municipal bonds of these maturities are available from Salomon Bros.¹⁴ For purposes of clarity and understanding, Meiselman's comments on his theory are quoted:

"According to the expectation hypothesis expected rates are equal to the forward rates given by the market. Thus for purposes of testing the expectation hypothesis ${}_{t+1}r_t$ becomes the rate on the delivery of one-year loan funds expected at the beginning of period, t , to prevail at the beginning of the period, $t+1$.

Similarly, at the beginning of the year, t , one can look at the market rate prevailing one year earlier. From these rates one can derive the one-year rate that had been expected to prevail at the beginning of year, t . The expected rate can then be compared with the actual market rate on one-year loans at the beginning of year, t . If actual rates are higher than had been anticipated, then the market may systematically revise upwards expectations of what short-term rates in the future are likely to be.

Because a long-term rate is an average of current and forward short-term rates, we also have the substantive hypothesis than unanticipated changes in long-term rates are also based on errors made in forecasting short-term rates."¹⁵

Once replication has been achieved, the next step is to vary the frequency of observation. Instead of comparing actual and expected short-term yield rates at the beginning of each year, they will be compared at the beginning of each month. The final step is to vary the bonds used in

¹³Meiselman, D. The Term Structure of Interest Rates, Prentice-Hall, N. J., 1970, p. 21.

¹⁴Salomon Bros., 1 New York Plaza, New York, N. Y.

¹⁵op. cit. 13 Meiselman, pp. 19-20.

computing the short-term forecasting errors from those with maturities of 1 and 2 years to those of 10 and 20 years. Meiselman places no limits on the period of time over which interest rates may be averaged in determining the forecasting error or on the frequency of observations.

Summary

The three Models which have been developed were designed to test the hypotheses earlier stated. Hypothesis I lists five independent variables which represent the underlying or persistent forces that determine the average yield to maturity on long-term municipal bonds. They are the Prime Rate, Dividend Yield on common stock, Net Acquisition of Financial Assets by commercial banks per unit of Income, New Issues of municipal bonds and the Income Tax rate. Model I simply incorporates them into an equation of the form suggested by the economic relationship. Empirical data are then collected. Both the types of data and the sources are later discussed in detail.

Hypothesis II takes the broader view that the average yield on municipal bonds is determined by monetary forces--money supply, liquidity demand and debt. The testing model resembles that used by Okun to explain U. S. Government interest rates, as already discussed. It was designed to determine the significance of the three variables. Because the variables encompass the entire economy whereas municipal bonds are only a sector thereof, the empirical data must be adjusted.

Hypothesis III suggests that the term structure of interest rate theory applies to municipal bonds; Model III tests this assumption by attempting to confirm the proposition that long-term municipal bonds' average yield correlates highly with the predicted error in short-term

municipal bond yields. This test draws upon private data collected by Salomon Bros. and the technique used by Meiselman to determine forward interest rates.

Because the empirical test data are so important both in form and fact and are critical to the proof of the hypotheses, each variable in each model is now described in detail and the data source listed.

Description of Test Data

Model I

$$R_m = a_0 + a_1PR + a_2D/P + a_3NAFA/Y + a_4NI + a_5T \quad (6)$$

where R_m = average yield to maturity on long-term municipal bonds.

PR = prime rate set by bankers.

D/P = dividend-price yield on common stock

NAFA/Y = net acquisition of financial assets by commercial banks over Income, ratio.

T = income tax rate

$a_0, a_1, \dots$ = regression coefficients

The operational form of Model I stated above has been derived by the application of Marshallian economic principles of supply, demand and price (yield) to the area of municipal bonds. It will be shown by empirical tests using stocks and flows that yields to maturity on long-term municipal bonds are determined by the forces of supply and demand as represented by the key independent variables listed.

The test variables and empirical data may be further described as follows:

R_m = yield to maturity on long-term (over 10 years) municipal bonds according to the index by Standard & Poor's Corp. This index is computed from the yields on a selected group of high grade municipal bonds and is practically identical with a similar index published by Moody's Inc.

PR = prime rate as set by commercial banks on loans to their most credit-worthy customers and published in the Federal Reserve Bulletin. The rationale behind selecting the prime rate as an independent variable lies in its direct measurement of the strength of the demand for bank loans as reported by the banks, themselves; it is therefore an indicator of the main thrust of their investments. Marcus¹⁶ has shown that municipal bonds and bank loans are the strongest competitors for the commercial banks' investment dollars.

D/P = the dividend-price yield on common stock is published in the Federal Reserve Bulletin on a quarterly basis. The divident of an average share of common stock is divided by the average price. The purpose of choosing this independent variable is to capture the demand of the private investors--households and private portfolios--for municipal bonds. Since stocks and bonds are alternated in portfolios according to the economic conditions and their return on investment, lower dividend yields may mean a shift into bonds. The prices of the three classes of bonds,

¹⁶Marcus, R. G. Commercial Bank Activity in Municipal Bond Markets, 1947-1967, unpublished dissertation, University of Kentucky, 1969.

municipal, corporate and government, tend to move together and the different bonds are close substitutes. For the wealthy individual municipals will be more profitable and will be favored if dividends decline below a certain yield.

NAFA/Y = net acquisition of financial assets by commercial banks/Income ratio. This is a flow measurement. Net acquisition of financial assets is published in the Flow of Funds report of the Federal Reserve Board for all major sectors of the economy. Source of data is Federal Reserve Bulletin. Y is Gross Private Product, determined by subtracting from the seasonally adjusted GNP the salaries of the U. S. Government civilian employees and of the Armed Forces. The source is the Survey of Current Business published by the U. S. Department of Commerce. What is sought by this variable is a wealth constraint which applies to the most active and the dominant purchaser of municipal bonds, the commercial banks. As the nation's wealth increases, the flow of funds quickens, the net acquisition of financial assets expands and spreads through the banking system. The real growth rate of the acquisition of financial assets may be measured by referencing to income.

NI = New Issues of municipal bonds, also published in the Federal Reserve Bulletin. They are reported monthly in millions of dollars and are a flow measurement. The total New Issues for each quarter is used. From an ex-post viewpoint, New Issues of municipals are a proxy for the overall demand for municipals since the New Issues always sold one way or

another, either by the underwriting syndicate or by the individual members after the syndicate is disbanded. Interviews with members of Standard & Poor's, Inc., publishers of the Blue List, confirm that the prices of the New Issues of municipals determine the prices of other municipal issues in the secondary market.

T = income tax rate schedule or percent of income in excess of a base amount that must be paid as taxes. Data are the same for all quarters of a year and are recorded for the year in which they cause a change in the tax payment. For example, if a schedule change caused increased taxes in 1960 or 1959 income, it is counted as effective in 1960. Sources of data are tax-rate schedules as published by the Internal Revenue Service and the period covered by the observations is 1957-1972. The rate changes at income levels above \$40,000 annual income for joint husband-wife head of household option were used.

All empirical data for Model I test are listed in Appendix H. Quarterly observations are made except that when monthly values are reported as in the cases of R_m and Y, the last month of the quarter is selected as the representative value for the quarter. The period covered by this test is 1957 Qtr. 1 to 1971 Qtr. 3, and was chosen because of a change in the method of computing the net acquisition of financial assets by the Federal Reserve in 1957.

Model II

$$R_m = a_0 + a_1 \text{Money} + a_2 \text{Debt} + a_3 Y \quad (7)$$

where R_m = yield to maturity on long-term investment grade municipal bonds.

Money = money supply

Debt = the amount of marketable debt both long and short-term issued by the U. S. Government, private corporations and state and local governments.

Y = Income or Gross Private Product.

$a_0, a_1 \dots$ = regression coefficients.

The Model II operational equation is used in an empirical test to determine if the liquidity preference theory as stated by Keynes¹⁷ and modified by Okun¹⁸ to include the effect of the general equilibrium of financial markets (interest rates are affected by debt) can be successfully applied to explain the variations in the municipal bond interest rates just as it has been to explain U. S. Government bond rates¹⁹ and corporate bond rates.²⁰

The test variables and empirical data may be further described as follows:

R_m = yield to maturity on long-term municipal bonds as reported by Standard & Poor's, Inc.

Money = Money Supply, it is tested in three forms: M_1 as normally reported, total demand deposits in banks plus currency in circulation, the actual stock of money. The second form M/R , where M

¹⁷ Keynes, J. M. The General Theory of Employment, Interest and Money, Harcourt, Bruce and World, New York, 1964, p. 205.

¹⁸ Okun, A. M. "Monetary Policy, Debt Management and Interest Rates: A Quantitative Appraisal", published in Stabilization Policies by Brown, E. C., Prentice-Hall, New Jersey, 1963, p. 333.

¹⁹ ibid., 3.

²⁰ Feldstein, M. and Eckstein, O. "The Fundamental Determinants of Interest Rates", Review of Economics and Statistics, Nov., 1970, pp. 363-375.

is Federal Demand Debt, equal to the sum of Member Bank Reserves, Other Deposits and Currency Outside Government is reported in the Federal Reserve Bulletin. R is the required reserve ratio set by the Federal Reserve Board for member banks. M/R has been called the maximum possible money supply if all demand debt were utilized to back demand of the private sector and there were no currency or excess reserves. The third form is $(M - C)/R + C$, where M and R are as already defined and C is currency outside Government. $(M - C)/R$ then becomes the potential demand deposits if currency is excluded. Potential money under this definition is potential demand deposit plus currency outside Government, $(M - C)/R + C$. These different forms of Money Supply have been further defined by Okun and used by him to explain the variations of the yields on U. S. Government bonds.

Y = Gross Private Product or the GNP less salaries paid to Federal Government employees and members of the Armed Forces. It reflects private transactions demand for liquidity. Source is Federal Reserve Bulletin.

Debt = amount of marketable debt outstanding: because of data limitations the changes in debt of Corporations (ΔC), U. S. Government $\Delta(S+I+L)$ and state and local governments (ΔM) are used. These refer to both short and long-term debt in the form of marketable securities, bonds, notes and bills. For corporations ΔC is the Net Change in Outstanding Corporate Securities (bonds and notes). For state and local governments, ΔM is the net change in municipal bonds outstanding and is represented by a proxy, New Issues of municipal bonds, because data on the amount of municipals retired

each quarter is not available. Source for the amount of New Issues is the Federal Reserve Bulletin. For the U. S. Government, $\Delta(S+I+L)$ is the change in short-term debt (securities maturing within one year) plus the changes in intermediate debt (1-5 years) plus the change in long-term debt (5 years or more). Source is the Federal Reserve Bulletin. The use of the changes in stocks of Government, corporate and municipal bonds instead of the stocks themselves is necessary because of the many different maturities and the call options that are exercised. Records of the many quarterly transactions are not available, however the use of quarterly changes in stocks captures the same effects as well as reduces the possibility of autocorrelation.

All empirical data are quarterly observations and the time period covered is 1952 Q1 to 1972 Q2. Where monthly data is reported, the last month of the quarter is selected to represent the quarter (Appendix H).

Description of Test Data - Model III

The general form of both Meiselman's equations and Model III may be written:

$$r_n = \frac{(1 + R_n)^n}{(1 + R_{n-1})^{n-1}} - 1 \quad (9a)$$

$$\Delta_{t+n} R_{jt} = k(E_t) \quad (9b)$$

r_n is the forward rate for a municipal bond of n maturity. Two forward rates are used in this test, r_1 and r_{10} . R_n is the actual interest rate for a municipal bond of n maturity. Five actual rates are used; R_1 , R_2 , R_{10} , R_{20} and R_{30} . Three of these, R_1 , R_2 and R_{30} , are actual average

yields to maturity on one, two and thirty year municipal bonds compiled by Salomon Bros. R_{10} is the actual average yield to maturity on ten-year state bonds as reported in Moody's Manual, and R_{20} is the actual average yield to maturity on municipal bonds with maturities of 20 years or over, also reported by Moody's. All bonds used to compute the indexes for ten-year and twenty-year municipals are of investment grade (first four ratings by Moody's). The municipal bonds used to form the one, two and thirty-year bond indexes are of premium grade - AAA or Aaa.

R_{jt} indicates the actual, average yield rate on municipal bonds of j maturity at time, t . Maturity is always in years and t is the present time.

$\Delta_{t+n} R_{jt}$ refers to the change in value of R_j between time, t , and $t+n$ where in this case n is the number, 1, 2, 3 etc.

E_t designates the error between the expected or forward rate, and the rate that actually exists when certain municipal bond averages are considered.

The sequence of the test is first to replicate Meiselman's error-learning theory using municipal bond rates in equations (9a) and (9b), then to test Model III using equations (8a) and (8b). Whereas Meiselman found that the error between the actual rate and the expected (forward) rate on one-year corporate bonds correlated with the changes in yield to maturity on long-term corporate bonds, this test will determine if there is a correlation between the ten-year municipal bond actual-expected rate error and the changes in the average yield on long-term municipal bonds.

All data pertaining to these tests are listed in Appendix H. Observations are both monthly and yearly and extend from 1952-1973, depending upon the particular equation to which they apply.

CHAPTER V
EMPIRICAL RESULTS

The operational form of Model I has been stated:

$$R_m = a_0 + a_1 PR + a_2 D/P + a_3 NAFA/Y + a_4 NI + a_5 T \quad (6)$$

R_m is the average yield to maturity on long-term municipal bonds as reported by Standard & Poor's, Inc. and is the dependent variable. In the multiple regression it is regressed with five independent variables which have been determined by theoretical reasoning to be the most important in influencing the behavior of the municipal bond market. As already stated:

PR is the prime rate of interest charged by commercial banks on loans to their most credit worthy customers.

D/P is the dividend yield, determined by dividing the dividend of an average share of common stock by its price.

NAFA/Y is the net acquisition of financial assets by commercial banks divided by National Income.

NI is the amount of new issues of municipal bonds issued during the quarter.

T is the income tax rate schedule.

These independent variables have been described and their sources indicated; only one raises doubts. T, the income tax rate that a married, joint-return taxpayer must pay on taxable income in excess of \$40,000, has changed only three times since 1957 and a surtax was levied in 1968 which counteracted the effect of the rate schedule change during the succeeding

three years. Therefore Model I was tested first without T and later with it. In this empirical test, 59 observations were made on a quarterly basis between 1957-1 and 1971-3. Table I gives the results of the multiple regression with T omitted. In equation (11) the "t" values are listed below each regression coefficient. All of the independent variables are significant at the .05 level in explaining the variance of the municipal bonds' average yield to maturity. The coefficient of determination is .83 indicating that portion of the variance which has been explained. The standard error of estimate is .44 and the Durbin-Watson statistic is .81, indicating that the important systemic elements have been identified.

If the regression coefficients are cast in the same units of measurements, the Model takes the form of equation (12). It is immediately apparent that the Prime Rate is the most important independent variable because it has the largest Beta coefficient. For every one percent change in Prime Rate the average yield on municipal bonds will change .7 percent, other things being the same. A priori reasoning anticipated the strength of this relationship because the prime rate is an accurate measure of the demand for bank loans and therefore an indicator of the banks' investment activity in municipal bonds. Moreover, the prime rate is highly visible, always before the public and always current. As the demand for loans increases, the banks raise the prime rate as a means of spreading their funds among their customers. They reduce the purchase of municipals and may even lighten their portfolios if the demand for loans continues high. With the commercial banks no longer buying, the yields on municipals rise reflecting the need to meet the competition from other securities. The regression coefficient in equation (2) is therefore positive, confirming this.

TABLE 1

$$R_m = a_0 + a_1 PR + a_2 D/P + a_3 NAFA/Y + a_4 NI \quad (10)$$

$$R_m = -.7193 + .5985PR + .3045D/P - 6.3298NAFA/Y + .0003NI \quad (11)$$

(10.57)*	(1.94)	(-1.97)	(4.51)
(.0564)**	(.1562)	(3.2126)	(.0000)

$$R_m = -.7193 + .7139PR + .1181D/P - .1327NAFA/Y + .3565NI \quad (12)$$

$$R^2 = .83$$

* t value

$$SEE = .4395$$

** standard error of coefficient

$$D W S = .8163$$

The second most important independent variable is the total amount of New Issues of municipals for the quarter. There is no other type of bond where such intensive competition exists in establishing the price. Practically all new issues are let through public bids to the winning syndicate of underwriters. Bidders are put in the impossible position of having to gaze into the future and judge what the market will be for the bonds two or three days hence. Under such harsh competitive conditions the amount of the new issues offered would naturally be quite important in establishing the price (yield). An active financing quarter for state and local governments will mean the offering of extra issues of municipal bonds and *ceteris paribus*, prices will drop and yields rise as denoted by the positive regression coefficient of New Issues in equation (11).

The third independent variable is the Net Acquisition of Financial Assets by commercial banks divided by National Income. This is a proxy measure of the relative investment activity of commercial banks during all phases of the business cycle. Since commercial banks are the largest investors in municipals, it would be expected that as their rate of investment intensifies their purchases of municipals will increase. The result is the decline in yield and, hence, a negative regression coefficient.

The last independent variable of Model I is the dividend yield on common stock. This is only one of the possible parameters that might be selected by households or private portfolio managers to measure the return on their investments in common stock. The return on equity--dividend plus capital gains--is another. Equation (13) shows the results of substituting Return on Equity for Dividend/Price in the original Model.

$$R_m = .3846 + \frac{.7182PR}{(9.92)} + \frac{.0046\text{Return on Equity}}{(.07)} - \frac{.1518NAFA/Y}{(2.19)} + \frac{.3231NI}{(4.01)}$$

$$R^2 = .8168 \quad (13)$$

$$SEE = .4547$$

$$DWS = .7641$$

There is a decrease in the coefficient of determination; not as much of the variance of the dependent variable is explained. The substituted independent variable, Return on Equity, has a regression coefficient with a low t value indicating that it is not significant. The standard error of estimate increases and the Durbin-Watson statistic decreases suggesting a loss of important systemic elements. Therefore, instead of Return on Equity the independent variable, Dividend/Price, is preferred. Equation (11) shows that its regression coefficient is significant at the .05 level and the standard error of estimate is somewhat reduced. A comparison of Equation (11) with Equation (13) suggests that households and portfolio managers find the dividend yield a more convenient way to judge the returns on their investments in common stocks. If stock yields are high they are less likely to sell stock and buy bonds (municipals, for the wealthy investor). This will necessitate a rise in bond yields to attract buyers. This type of action is reflected in the positive regression coefficient for Dividend/Price in Equation (11).

Finally, Model I was tested with T, the income tax rate schedule, as the fifth independent variable. The results are indicated in equation (14).

$$R_m = -5.0273 + \frac{.7103PR}{(10.87)*} + \frac{.0003NI}{(5.57)} + \frac{.1974D/P}{(1.31)} + \frac{4.8217NAFA/Y}{(-1.57)} + \frac{.0728T}{(2.90)} \quad (14)$$

$$R^2 = .85$$

$$SEE = .4081$$

$$DWS = 1.06$$

* denotes t value

Although it may appear at first glance that the tax variable improves the closeness of fit of the multiple regression equation, the variable in fact must be rejected because the results do not support theory. If T had succeeded in portraying the true effect of changes in income tax rate, an increase in rate would cause an increase in the purchase of municipal bonds by private household and, ceteris paribus, a decrease in yield. The fact that the positive regression coefficient, .0728, indicates exactly the opposite shows that variable T does not accurately capture the effect of change in income tax rates on the municipal bond market. The presence of an irrelevant variable unbalances the multiple regression equation (6) so T was dropped and Model I is based on four independent variables.

Empirical Test - Model II

In this model the Keynesian Liquidity Preference theory as modified by Okun¹ to include the effects of market equilibrium is tested in the area of municipal bonds.

$$R_m = a_0 + a_1 \text{Money} + a_2 \text{Debt} + a_3 Y \quad (7)$$

where Money is the money supply and may be defined three ways: M_1 , the actual stock of money (demand deposits plus currency); M/R , the maximum potential money supply with M representing the volume of demand debt and R the required reserve ratio; $(M-C)/R + C$ is a somewhat smaller potential money supply, currency is considered an exogenous variable and is first subtracted from the potential demand debt and then added back to the money supply.

¹Okun, A. M. "Monetary Policy, Debt Management and Interest Rates: A Quantitative Appraisal", published in Stabilization Policies by Brown, E. C., Prentice-Hall, New Jersey, pp. 330-380.

Debt is defined as the change in the total marketable debt per quarter for Corporations, ΔC , the U. S. Federal Government, $\Delta(S+I+L)$, and state and local governments, ΔM .

Y is Income or Gross Private Product (GNP less salaries of Government Employees and members of the Armed Forces).

The operational equation listed above tests the degree of conformance of R_m , the average yield to maturity of long-term municipal bonds, to the modified liquidity preference theory. Empirical results of the tests are listed in Tables II and III. Table II shows the regression coefficients of the independent variables with their standard errors enclosed in parenthesis below. Table III has the beta coefficients of the independent variables with the F numbers in parenthesis.

In Table II the results from the use of each type of money supply can be seen. M_1 , as shown in Equation (15) is the least successful. The tests for significance indicated by the F numbers in Equation (18) Table III, show that when a regression line is fitted to the data, some of the independent variables are not significant, including M_1 , itself. Furthermore the regression coefficient of M_1 is positive when, according to the liquidity preference theory it is expected to be negative. Okun² in his study of U. S. Government interest rates found similar results. If M/R , Equations (16) and (19) and $(M-C)/R + C$, Equations (17) and (20) are used as alternate money supplies, the results are much better. The regression coefficients have the expected negative sign and they are significant at the .01 level.

²op. cit. 1, p. 347.

TABLE II

Model II Equations Explaining Municipal Bond Yields with Regression Coefficients, 1952-1 to 1972-2

	Dependent Variable	Type of Money Variable	Coefficients					Constant	SEE	R ²
			Money	Y	$\Delta(S+I+L)$	ΔC	ΔM			
(15)	R _m	M ₁	.00951 (.01283)*	.00282 (.00186)	.00001 (.00002)	.00012 (.00009)	-.00029 (.00034)	.45350	.58162	.7664
(16)	R _m	$\frac{M}{R}$	-.01122 (.00645)	.00945 (.00313)	.00002 (.00001)	.00012 (.00008)	-.04618 (.00033)	2.54509	.57243	.77372
(17)	R _m	$\frac{M-C}{R} + C$	-.03399 (.01510)	.01014 (.00275)	.00002 (.00001)	.00018 (.00008)	-.00027 (.00033)	3.80879	.56518	.77942

*Standard error of the coefficient

R² = Coefficient of Determination

SEE = Standard error of estimate

TABLE III

Model II Alternate Equations Explaining Municipal Bond Yields with Beta Coefficients, 1952-1 to 1972-2

		Coefficients								
	Dependent Variable	Type of Money Variable	Money	Y	$\Delta(S+I+L)$	ΔC	ΔM	Constant	SEE	R^2
	(18) R_m	M_1	.2461* (.549)**	.48385 (2.297)	.03262 (.299)	.16910 (2.042)	-.04832 (.738)	.45350	.58162	.76640
	(19) R_m	$\frac{M}{R}$	-.89310 (3.026)	1.61898 (9.085)	.07177 (1.600)	.16657 (2.184)	-.04618 (.703)	2.54509	.57243	.77372
06	(20) R_m	$\frac{M-C}{R} + C$	-1.08612 (5.068)	1.73746 (13.569)	.08965 (2.436)	.25097 (4.932)	-.04464 (.674)	3.80879	.56518	.77942

*Beta coefficients

**F Numbers

DF 81

The second independent variable, Y, reflects the private demand for liquidity excluding the U. S. Government's payroll need. In Equations (16) and (17) the standard error of the regression coefficient of Y is reduced when $(M-C)/R + C$ is substituted for M/C as the independent money variable. In both Equations the regression coefficient is highly significant and has the expected sign.³ Y is seasonally adjusted.

The independent variables selected to represent Debt are included in this test model because of the general equilibrium view of financial markets. The goal is to capture the market effect of the three types of bonded debt. In order to lessen the secular trend, quarterly changes in marketable debt are used. The change in Federal debt (short-term plus intermediate plus long-term securities) when used as an independent variable has a regression coefficient and a small standard error which remains constant in both Equations (16) and (17). The significance level improves from the .05 level to the .01 level as the Money variable is changed. The sign of the coefficient is positive as expected. (As debt increases and there is demand for more capital, *ceteris paribus*, entrepreneurs can expect to pay higher interest rates). The change in corporate debt, as an independent variable behaves in a similar manner to the change in Government debt. The regression coefficient has a small standard error and the significance improves as maximum money supply, M/R , is somewhat refined to $(M-C)/R + C$. The similarity in the behavior of the two independent variables, ΔC and $\Delta(S+I+L)$ is quite logical since all bonds tend

³ Okun has stated the liquidity preference theory in a simplified form: "The interest rate should be positively related to the level of income and negatively related to the supply of money", *op. cit.* 1, p. 333.

to be substitutes for each other and the market rates generally move together. However, it is important to note that the actual determinants of yield-changes of the different classes of bonds are either different, or act different, as manifested by the yield spreads and variability. The independent variable, ΔC , has a regression coefficient and a small standard error that remains constant in both Equations (16) and (17); the regression coefficient is significant at the .01 level in both instances.

The last independent variable, the change in municipal bonds outstanding, can not be determined because there is no record available of the quarterly sales and retirements. Instead, the change in New Issues was taken as a proxy because of their dominance of the municipal market.⁴ Apparently this ignores too many factors because the results in equations (16) and (17) were not improved. The regression coefficients are not significant and the negative sign is illogical. When recognition is given to the many different maturity dates which make up a single municipal bond issue it becomes evident that the amount of state and local debt is changing constantly. ΔNI , then is not a proper independent variable; a better measure of the actual change of debt is needed.

When the independent variables are compared according to their beta coefficients, (equations (19) and (20)) Income and Money Supply are the most important. This is to be expected since they are the principal elements of the liquidity preference theory and have been shown many times to be the determinants of interest rates. It is in capturing the effect of the equilibrium of financial markets that the independent variables

⁴Standard & Poor's, Inc., publishers of the "Blue List" report that the prices of municipal bonds in the secondary market generally follow those established by New Issues.

become more difficult to select. Changes in debt for corporations and for the U. S. Government are effective but no significant proxy variable was found to represent the changes in state and local government debt. (Although, in theory, changes in all sectors of debt affect the interest rates, Okun and others⁵ have shown that satisfactory results can be achieved by choosing the larger sectors.)

In summarizing the results of this test, when equations (15), (16) and (17) are examined, equation (15) can be set aside as not really descriptive of the yields on long-term municipal bonds. Equations (16) and (17), however, are quite effective in explaining the variance. The coefficient of determination of equation (16) is .7737, which increases to .7794 for equation (17) while the standard error of estimate decreases from .572 to .565. The lack of an acceptable independent variable to represent the change in state and local debt is evident. When this is considered together with the necessity for using first differences of the other debt variables in order to remove trend, the resulting R^2 is quite acceptable and corresponds to a much higher value than is possible if direct measurement of debt stock could be made and then adjusted for secular trend.

Tables IV and V show the results if ΔM , change in state and local debt, is deleted for want of an acceptable explanatory variable. There are few changes, the R^2_{15} remain approximately the same and the coefficients adjust slightly in significance.

⁵Feldstein, M. and Eckstein, O. "The Fundamental Determinants of Interest Rates", Review of Economics and Statistics, Nov. 1970, pp. 363-375.

TABLE IV

Alternate Equations Explaining Municipal Bond Yields with ΔM (change in municipal debt)
deleted 1952-1 to 1972-2

		Type of Money Variable	Coefficients						R^2
Dependent Variable			Money	Y	$\Delta(S+I+L)$	ΔC	Constant	SEE	
(21)	R_m	$\frac{M}{R}$	-.01110 (.00644)*	.00942 (.00313)	.00002 (.00001)	.00011 (.00008)	2.52099	.57133	.77163
(22)	R_m	$\frac{M-C}{R} + C$	-.03393 (.01507)	.01016 (.00275)	.00002 (.00001)	.00018 (.00008)	3.79491	.56398	.77746

*Standard error of the coefficient

R^2 = Coefficient of Determination

SEE = Standard error of Estimate

TABLE V

Alternate Equations Explaining Municipal Bond Yields with ΔM (change in municipal debt)
deleted 1952-1 to 1972-2

	Dependent Variable	Type of Money Variable	Coefficients					SEE	R^2
			Money	Y	(S+I+L)	C	Constant		
(23)	R_m	$\frac{M}{R}$	-.88341* (2.974)**	1.61424) (9.068)	.07449) (1.736)	.15755 (1.980)	2.52099	.57133	.77163
(24)	R_m	$\frac{M-C}{R} + C$	-1.08412 (5.071)	1.74057 (13.676)	.09245 (2.611)	.24186 (4.645)	3.79491	.56398	.77746

*Beta Coefficient

**F Number

DF 81

Empirical Test - Model III

According to plan, step one of the Model III test is to replicate the results which Meiselman achieved with his error-learning model except that municipal bonds are used instead of corporate bonds. Recalling Meiselman's models:

$${}_{t+1}r_{1t} = \frac{(1 + {}_tR_{2t})^2}{(1 + {}_tR_{1t})} - 1 \quad (9a)$$

$$\Delta {}_{t+n}R_{jt} = k(E_t) \quad (9b)$$

${}_{t+1}r_{1t}$ is the forward rate on a one-year municipal bond at time, $t+1$. It is computed by using actual rates on one and two-year bonds, R_{1t} , and R_{2t} . E_t is the error between actual and expected one-year rates. An important point in this test is the period of time between observations. Data listed in Appendix H show that observations were made at the beginning of each year, for example January 1960, January 1961..., etc. Yearly observations were used because they were used by Meiselman, however this limited the number to fourteen since the records only went back to 1959.

The result of regressing the change in the average yield to maturity of long-term municipal bonds with the error between actual and expected short-term municipal bond rates is shown in Table VI, equation (25). The simple correlation is .694 or .70 which compares favorably with .82 that Meiselman found using corporate bonds with 54 observations (1900-1954). With municipal bond data extending over more years, it appears probable that the correlation would increase. The standard error of estimate is .369.

TABLE VI

Regression Equations Showing Relationship of Municipal Bonds Expected-Actual
Rate Errors and Changes in Yields on Long-Term Municipal Bonds. $\Delta R_{tnt} = a + bE_t$

	Dependent Variable	Error E_t	Index Variable	Coefficients				
			Coef.	Constant	SEE	R	R_2	F
(25)	ΔR_{t30t}	$tR_{1t} - t^r(t-1)$	.475 (.142)*	.229	.369	.694	.483	11.2
(26)	ΔR_{t30t}	$tR_{1t} - t^r(t-1)$	.635 (.058)	.189	.165	.712	.506	121.1
(27)	ΔR_{t20t}	$tR_{10t} - t^{r10}(t-1)$	.048 (.025)	.010	.175	.176	.031	3.7

*Standard error

Having achieved reasonable success in replicating the error-learning model test using municipal bonds, the way was cleared to proceed to the second step of the Model III investigation. Instead of choosing only January 1 as the day to compare changes in long-term yields with actual-expected errors in short-term rates, February 1, March 1, etc., were also selected. Each month the change in long-term municipal bonds' average yield was paired with the error between the actual and expected rates for the present year beginning on that date.⁶ This is an extension of Meiselman's suggestion which he could not have performed because the data were not available at that time. The results are shown in equation (26) of Table VI. There were 120 monthly observations (1962-1972). The simple correlation between the changes in the average yields on long-term municipal bonds and the actual-expected short-term yield errors increased to .712. Both the coefficient of determination and the F number also increased, indicating a stronger relationship.

The final step and the test of Model III, equations (8a) and (8b) uses the monthly observation criteria but the maturity of the short-term municipal bonds has been pushed to the edge of the intermediate range--from bonds of one-year maturity to bonds of ten-year maturity. Beginning in January, 1962 and each month thereafter for 120 months, the error between the actual and expected rates on ten-year municipal bonds was computed. The errors were then regressed with the change in the average

⁶"It is important to note that observations have been taken once a year only. It may well be that using semi-annual, quarterly, or monthly observations to test the model will lead to modification of these statements and also yield more precise information on the adaptive mechanism upon which the model rests". op. cit. 13, Chap. IV, Meiselman, p. 30.

yield to maturity on long-term (20 years) municipal bonds. The results are shown in equation (27) of Table VI. In this case the simple correlation drops to .176 and the F number is only 3.71, indicating that the results are not significant at the .05 or higher level.

Sample Survey

The empirical results of the different models have been stated and the principle determinants of yield variations in the municipal bond market identified. In order to compare these results which were derived from theoretical reasoning with current practices in use by dealers and underwriters, an opinion survey was conducted. A questionnaire (Appendix E) was sent to 157 of the largest municipal bond dealers and underwriters (most located in New York City but some in other large cities, also). There were 80 responses with 75 usable forms returned. Of the fourteen factors listed in the questionnaire and chosen as the most probable ones that are considered in judging the market, no effort was made to avoid duplicating parameters, for example, the Consumer Price Index and the Implicit GNP Price Deflator both of which are a measure of inflation. Rather, the main effort consisted of selecting the factors and indexes most readily available to the dealers in order to try and determine what they rely on either consciously or unconsciously in forming an opinion about the market. Instead of using economic theory as a basis for selecting the factors, current trade publications and newspapers were the source. Financial writers and analysts attribute market actions to a myraid of reasons; it was from the factors used to back-up their explanations that the questionnaire was formed.

Long-term U. S. Government bonds' average yield to maturity was selected as one factor because it serves as a departure point in many discussions of the bond market. Having no risk of default, the yield is often referred to as the "pure interest rate". Because the U. S. Government is believed by some to control or manipulate both short and long-term interest rates as a result of the Accord between the Federal Reserve Board and the U. S. Treasury, the behavior of U. S. Government bonds is closely watched. Also the Prime Rate and the Federal Funds Rate (interest rate charged by banks on overnight loan of reserve funds), the most popular indexes of short-term interest rates, were included as possibly significant to some municipal bond specialists. Frequent references are made to changes in short-term interest rates when long-term rates are discussed. The Prime Rate is a favorite bench mark for measuring and forecasting other interest rates. Another factor which makes the financial headlines is inflation; the reactions of underwriters and bond dealers range from grave concern to mortal fear, therefore the two most popular measures of inflation, Consumers Price Index and Implicit GNP Price Deflator, were included in the questionnaire.

With the shift in recent years from Keynesian economics to Monetarism as put forth by the University of Chicago school of economists and the recognition that the control of money supply is the primary tool used by the present Administration to fine-tune the economy, it follows quite naturally that this factor will influence some municipal bond dealers. The change in money supply was included as a factor but no attempt was made to further refine it.

Many of the measures of supply and demand for municipal bonds that are readily available to traders were listed; for instance, one of the principal trade papers (The Money Manager) publishes the 30-day Visible Supply--a look ahead for the next 30 days at the amount of new issues of

municipals scheduled to be offered. Also, it publishes a Placement Ratio which indicates the percent of the new issues offered during the past week that have been successfully sold. A third index is the total municipal bonds offered for sale in the secondary market by brokers and dealers and advertised in the Blue List⁸ and usually referred to as municipal bonds in the hands of dealers. The demand for municipal bonds by commercial banks is a monthly statistic not quite so accessible as the others, but available from the Federal Reserve Bulletin.

Measures of general economic growth were the last factors included in the questionnaire; they are GNP growth rate, increase in Personal Income and Bank Free Reserves.

There is a direct contrast between the method used in forming this questionnaire and that used in designing models to test hypotheses; the goals are quite different. All that is desired from the survey is a consolidation of the most popular yield determinants of the municipal bond market so that they may be compared with the actual determinants proven earlier in tests of the hypotheses. In the last part of the questionnaire, participants were asked to suggest other factors that they found to be useful in forming opinions about the municipal bond market. Four listed the amount of cash held by Fire and Casualty Insurance Companies and two emphasized commercial bank loans as quite important.

Table VII gives the results of the survey; the different factors are listed followed by the preference order. The first number indicates

⁸The Blue List is published daily by Standard & Poor's, Inc., New York, N. Y. and The Money Manager is published weekly by The Bond Buyer, Inc., New York, New York.

the priority and the number in parenthesis indicates the plurality. For example, 2 (4) opposite Prime Rate indicates that out of the 75 observations four individuals believed that Prime Rate was the second most important factor in determining variations of the municipal bond market. Appendix F includes profile plots of the preferences for each factor considered. Some profiles such as the one for Change in Money Supply, show an orderly consensus of importance just as others, such as Personal Income Growth, show similar agreement on lack of importance. Some factors elicit only mixed reactions.

Table VIII depicts the overall order of importance of the factors if the total of the preferences for the first five positions is summed. For example, the Supply of Municipal Bonds in the hands of dealers was considered to be among the five most important factors by 59 out of a sample of 75 of the largest municipal bond dealers; in contrast only 2 thought Personal Income Growth was among the five most important in determining changes in the municipal bond market.

TABLE VII

Long-Term U.S. Gov. Bonds Yields	1(6)	2(3)	3(3)	4(5)	5(5)	6(10)	7(6)	8(12)		
	9(6)	10(5)	11(0)	12(2)	13(2)	14(1)				
Prime Rate	1(8)	2(4)	3(1)	4(7)	5(9)	6(8)	7(6)	8(5)	9(9)	10(3)
	11(5)	12(1)	13(0)	14(0)						
Federal Funds Rate	1(1)	2(1)	3(3)	4(2)	5(5)	6(7)	7(12)	8(10)	9(7)	
	10(9)	11(5)	12(2)	13(2)	14(0)					
Consumer Price Index	1(1)	2(4)	3(2)	4(2)	5(5)	6(1)	7(1)	8(11)	9(5)	
	10(4)	11(9)	12(8)	13(10)	14(2)					
Implicit GNP Price Deflator	1(3)	2(2)	3(0)	4(0)	5(0)	6(3)	7(3)	8(11)	9(3)	
	10(4)	11(3)	12(10)	13(6)	14(22)					
Change in Money Supply	1(15)	2(7)	3(6)	4(5)	5(7)	6(6)	7(7)	8(7)	9(5)	
	10(5)	11(2)	12(0)	13(2)	14(0)					
Commercial Bank Ownership of Municipals	1(12)	2(8)	3(6)	4(7)	5(8)	6(12)	7(4)			
	8(3)	9(2)	10(5)	11(1)	12(2)	13(0)	14(1)			
Supply of Municipals in the Hands of Dealers	1(21)	2(12)	3(12)	4(10)	5(4)					
	6(1)	7(3)	8(2)	9(2)	10(3)	11(1)	12(0)	13(0)	14(0)	
Placement Ratio as Reported by the <u>Bond Buyer</u>	1(0)	2(3)	3(6)	4(17)	5(12)					
	6(2)	7(4)	8(5)	9(6)	10(5)	11(3)	12(1)	13(2)	14(2)	
30 Day Visible Supply as Reported in the <u>Bond Buyer</u>	1(1)	2(18)	3(21)	4(6)	5(7)					
	6(4)	7(5)	8(2)	9(2)	10(2)	11(3)	12(0)	13(0)	14(0)	

TABLE VII(continued)

Amount of New Issues of Municipals	7(2)	8(1)	9(8)	1(3) 10(1)	2(8)	3(13)	4(5)	5(5)	6(8)
Personal Income Growth	8(0)	9(1)	1(0) 10(3)	2(2) 11(9)	3(0) 12(9)	4(0) 13(23)	5(0) 14(12)	6(1)	7(2)
GNP Growth Rate	8(1)	9(5)	1(2) 10(3)	2(0) 11(8)	3(1) 12(13)	4(0) 13(11)	5(1) 14(16)	6(0)	7(2)
Change in Bank Free Reserves	8(7)	9(4)	1(3) 10(10)	2(2) 11(8)	3(1) 12(4)	4(7) 13(1)	5(6) 14(2)	6(5)	7(10)

TABLE VIII

Supply of Municipals in the Hands of Dealers	59
30 Day Visible Supply as Reported by the <u>Bond Buyer</u>	53
Change in Money Supply	40
Commercial Bank Ownership of Municipals	38
Placement Ratio as Reported by the <u>Bond Buyer</u>	38
Account of New Issues of Municipals	34
Prime Rate	29
Long-Term U. S. Gov. Bond Yields	22
Change in Bank Free Reserves	19
Consumer Price Index	14
Federal Funds Rate	12
Implicit GNP Price Deflator	5
GNP Growth Rate	4
Personal Income Growth	2

CHAPTER VI

RESULTS AND CONCLUSIONS

This study sought to describe and explain the yield variations in the municipal bond market. Approaches were made from four directions. First was the attempt to single out stock and flow variables so that the demand and supply for municipal bonds might be distinguished from the demand and supply for other securities. Next, the relationships of interest rates in general to money (monetary interest rates) were examined and compared with similar relationships of municipal bond rates in order to determine how closely the latter responded to the widely accepted Keynesian liquidity preference theory. The third approach, almost universal among economic model builders, involves the term structure of interest rates. If economists are willing to accept long-term interest rates represented by equations whose principal parameters are short-term rates, why not use the same technique with long-term municipal bonds? Finally, the largest municipal bond houses were surveyed and asked to select from a list of the most frequently used explanatory variables the ones that they had found to be most significant in determining yield variations in the municipal bond market.

Among the early results was the confirmation that almost all of the financial variables are interrelated and that an effective independent variable may be available only as an intervening variable chosen to represent a particular economic or market characteristic that is unique.

A modus operandi that had to be accepted before further progress could be made was the necessity of a two-stage effort in forming market decisions. In the first stage the decision-maker should look at the foundation or structural facts basic to the decision, those factors which have a persistent effect and can be relied upon to control the market in the long-run; in the second stage he must consider tactical conditions or those conditions of the moment which influence the market. Research in this study was concentrated on the first stage. No instances were noted where a systematic attempt has been made to combine the two phases of financial decision making or where the importance of the separation has been recognized. There is a tendency to discuss either one phase or the other; trade papers and financial writers usually describe the market in terms of indexes and daily economic and political events whereas theorists seek to identify the underlying forces.

Finally, results showed that it is possible to describe the underlying forces which affected the municipal bond market over the past two decades, however, these results are explanatory, not predictive. They suggest that a theoretical model of the municipal bond market can be built which will account for 83% of the variance and serve as an excellent vantage point from which to observe daily occurrences and plan market strategy.

Hypothesis I

The first hypothesis confronted squarely the problem of identifying sufficient stock or flow variables to verify the main theoretical forces of the market. A solution was possible only because municipal bonds differ enough from other bonds to be unique. The large amount outstanding and the

distinct marketing system made it possible to obtain unbiased data in certain key areas, but not in all areas. The data involved such large numbers, frequent revisions and long periods of time that only strong, persistent market forces could be explained.

Empirical tests of Model I verified that four of the five independent variables hypothesized to represent major forces in the municipal bond market actually did during the period investigated, 1957-1972. Results showed that Prime Rate, Dividend Yields on common stock, amount of New Issues of municipals, and Net Acquisition of Financial Assets by commercial banks were significant in explaining the variance of the municipal bond market average. The income tax rate schedule was not significant, undoubtedly because of its infrequent changes and because so many other factors in the economy exert over-riding forces. Tax laws are passed by the U. S. Congress and often produce strange results. For example, as the economy expands and the Federal Reserve Board fights inflation by allowing high interest rates (through their control of the money supply) Congress may become alarmed at increased unemployment and reduce the tax rate on one hand and levy a surtax on the other. The end result of such competing forces made it impossible to capture the true effect of the income tax changes.

Prime Rate proved to be the most important variable in determining the municipal bond market movements. Marucs' work¹ on the activity of commercial banks in the municipal bond market and the importance of bank loan demand was verified in general; identical tests were not made, how-

¹op. cit. 1, Chap. IV, Marcus dissertation. He found an inverse relationship between the demand for bank loans by the public and the demand for municipal bonds by commercial banks.

ever the bank loan - municipal bond investment relationship conformed with Marcus' findings. An explanation for this importance of Prime Rate as an explanatory variable lies in the simple, direct relationship between bank loans and investments. Federal and state laws restrict the types of investments of commercial banks and charters define their relatively straightforward mission.

The significance of Dividend Yield of common stock substantiates the claim that private investors do not always behave rationally as recommended by Markowitz, but often find dividends more important than a decrease on equity. This may be explained by the class of investor. Many who acquire common stock are willing to accept the vagaries of the stock market as long as their dividends remain steady or increase, but let a decrease or omission of dividends occur and they turn to other securities such as bonds. A recent example of this was the wave of discontent when the large New York utility firm, Consolidated-Edison, Inc., omitted dividends for the first time in 25 years. The price of the stock took a severe drop (\$18 to \$8) as investors who had built retirement incomes around this high-yielding stock became bitterly disappointed and sold their holdings. This confirmation of the significance of dividends also reinforces the often discussed reluctance of management to cut them, but instead to start off small and gradually increase dividends as the years go by.

The importance of the New Issues of municipal bonds in determining the market is unique only because it represents a portion of the supply of municipals. For example, during 1972 roughly \$350 million of New Issues were sold during an average week whereas there were \$750 million

total issues advertised in the Blue List² for sale in the secondary market. Although there are at least twice as many bonds offered in the secondary market as there are new issues bid for by underwriters in the primary market, tests show that it is the smaller market that controls the prices. This high-lights the extreme competitiveness of the municipal bond market and the critical importance of the syndicate bid in establishing the market price. It also confirms the practice of bond traders of following the bid prices and adjusting the prices on their secondary holdings at just a trifle above or below depending upon the size of their inventory.

The fourth independent variable, Net Acquisition of Financial Assets by commercial banks, captures the wealth effect by relating the investment activity of the largest purchaser of municipal bonds to the national income. As the national economy increases, the question may be asked if the commercial banks decrease their investments in financial assets relatively, so that they can finance the economic growth. This variable is a theoretical construct designed to capture a maximum of the nation's wealth effect on the municipal bond market. Wealth is of such vast scope that only a sector of it can be examined in an objective test such as this.

Hypothesis I was confirmed by empirical tests using the four designated independent variables; 83% of the variance in the municipal bonds' average market yield was explained in terms of underlying and persistent economic forces. This leaves approximately 17% of the variance unexplained and sets an outside limit of the effects of day-to-day events and the market psychology of traders and investors.

² Estimate averages are taken from Municipal Finance Statistics, Vol. 11, p. 21, '72, published by the Bond Buyer, Inc., New York, N. Y. and The Blue List, a trade paper published by Standard & Poor's, Inc., New York, N. Y.

Hypothesis II

Okun's study of U. S. Government bonds has already been discussed and analyzed. It was his statement that by identifying the determinants of Government bond yields he had thereby explained a large portion of the municipal bond yield variations, that suggested the statement of Hypothesis II. Okun found a .93 correlation between the two rates. Hypothesis II extracts the determinants identified by Okun, reorients them to municipal bonds and examines their relationship with the yields to maturity of municipals. Empirical tests showed a much more complex relationship between these determinants and the yields on municipal bonds. For example after the Government bond yield determinants had been converted to municipal bond data, the amount of the variance of municipal bond yields that could be explained was 78%. This compares with an explanation of 93% of the U. S. Government bond yield variance. The liquidity preference theory upon which this hypothesis is based attributes interest rates to the demand and supply of money. Empirical results from the test of Model II indicated that this is also true with municipal bond's interest rates. Money supply and demand for liquidity are the most important explanatory variables accounting for over 70% of the variance. Hypothesis II infers that a portion of the remaining variance can be explained by the total marketable debt of corporations, the U. S. Government and state and local governments. Empirical results showed that this was true for the twenty years, 1952-1972, to a modest degree. Explained variance increased to 78% even though first differences in the value of debt outstanding had to be used instead of totals. Restrictions on the availability of data necessitated the use of changes in marketable debt for corporations and the U. S. Government. For state and local governments, however, not even

the quarterly changes were available. These data limitations lowered test coefficients.

Although the amount of New Issues was used as a proxy for municipal bond supply in Model I when the municipal bond market was being considered separately, it does not represent the total debt of state and local governments on a national economy scale and can not be used for such a purpose in Model II. This real problem undoubtedly lowered the coefficient of determination in the Model II tests, however the over-all results confirmed the application of the liquidity preference theory to municipal bonds. They also demonstrated that the introduction of a market effect as suggested by Okun tailored the liquidity preference theory and improved its capability to explain municipal bond interest rates.

Empirical results confirmed Okun's statement that he had explained the major portion of the variance of municipal bond yields by his work with U. S. Government bonds, however an important caveat should be added-- the major portion but not necessarily the most important portion. Other test results disclose that the remainder of the variance is quite difficult to explain because of the limitation of data, the thinness of the municipal bond market and other unsteady relationships. Based on the results achieved, however, money supply, demand for liquidity and marketable debt are significant determinants of the variations in the municipal bond market. Hypothesis II has thus been confirmed and the monetary interest rate theory applies to municipal bonds. Further efforts to narrow the unexplained variance should use the micro- instead of the macro- approach, or examine factors which more closely affect municipal bonds rather than the entire economy. That is the principal difference between the empirical tests of Hypothesis I and Hypothesis II. Although both have been verified,

Hypothesis I is more effective as shown by the respective coefficients of determination. This is to be expected because of the possibility of a more direct relationship when the field of study is better focused.

Hypothesis III

The term structure of interest rates is perhaps the most controversial of all the interest rate theories. Hypothesis III is based on the proposition that the expectation theory, which has been earlier explained, and its verification by Meiselman's error-learning model are among the most significant advances in the study of term structure of interest rates. The yields on long-term municipal bonds were hypothesized to respond just as the yields on other long-term bonds to the error in the expected-actual short-term rates. Test results proved that this was true between 1959 and 1973 when data observations were made yearly, although the proof is not as rigorous as would have been possible if the data had extended beyond the fourteen year period. To refine further the relationship of the yields on long-term municipals with the unanticipated error in short-term municipals, the annual yield rates were observed more frequently, monthly instead of yearly. The results improved slightly with the simple correlation between yield and error increasing from .70 to .712 Equation (26). Although Meiselman did not perform tests based on data from monthly observations, he suggested that such a test might show an even stronger yield-error relationship. Empirical results confirmed this to a moderate degree. The F number increased from 11.2 to 121.1 and the coefficient of determination from .483 to .506. However, it is evident from this study that unanticipated errors of short-term municipal bond yields explain about the same percentage of the variance in long-term municipal bond yields

regardless of whether comparisons are made monthly or yearly. Aware that other possibilities might exist, Model III was designed to test the feasibility of using intermediate term municipal bonds as a source of the expected-actual rate error and correlating it with the change in average yield on long-term municipals. The results were disappointing, no relationship existed. Upon further examination it appears that the intermediate bonds span too much time for investors to have any knowledge of the error between the expected and actual rates or for the error to be pertinent to the current market. Meiselman's statement that errors made in other years are sunk and forgotten proved to be true.

The most useful term structure relationship is that of long-term municipal bond yields and the error between the actual and expected rates on one-year maturity municipal bonds, observations made on an annual basis. Secular trends can be spotted and can become an important element in the financial decisions by bond dealers and investors.

Survey Results

The Opinion Survey discussed in Chapter V showed that some bond houses delve into the theory underlying the bond market more than others, that all are acutely aware of the daily occurrences in the market and that they believe some forces have more effect on the market than others. According to the poll conducted, the two most influential factors pertained to supply: the supply of municipal bonds in the hands of dealers and the 30-day visible supply of new issues of municipals. Third in importance was money supply and fourth was commercial bank ownership of municipal bonds. From this priority the general viewpoint of the dealers and brokers becomes more apparent; the supply of municipals is seen as

more critical than the demand, and the supply of new issues scheduled for sale during the next 30 days is more significant than the sale of new issues during the past week. The total supply of municipal bonds in the hands of dealers is the most important of all. Combined, these factors represent the present supply and best estimate of the future supply. The supply of money is important because it represents the amount of money in circulation or readily available. Only after the supply of municipals and the supply of money does the demand for municipals become the dominant factor. This demand is best represented by municipal bonds owned by commercial banks. In summary, as the present and foreseeable future supply of municipals varies and the liquidity increases or decreases, the investors and dealers will be motivated either to buy or sell. The market is seen as thin and sensitive not only to present but also future supply, buyers are more likely to be in the market if money is available, and daily conditions have priority.

The actual picture as portrayed by empirical tests for the period, 1957-1972, is somewhat different. Demand for municipals was more critical than the supply in determining the persistent forces in the municipal bond market. The supply of municipals in the hands of dealers as reported by the Blue List was found to be incomplete--not all such holdings are listed. The 30-day visible supply of new issues as published by the Bond Buyer Co. undergoes so many changes during the actual 30-day period that it is generally unreliable. Only the new issues of municipal bonds actually sold counted with the market. Although the principal demand for municipals comes from two classes of customers, commercial and households, there is more of a tendency for them to counter each other rather than act in unison.

The financial conditions which induce commercial banks to buy municipals may have an opposite affect on households and vice versa, nevertheless the quick reaction of commercial banks to interest rate changes Equation (12), causes fluctuations in their purchases of municipal bonds. As a result, the overall demand for municipals is somewhat volatile and must be captured by using several variables. Results of Model I tests suggest that the bidding by syndicates of underwriters kept the state and local governments so aware of interest rates that some concessions were made to demand. For example, if yields on municipal bonds were high there was a tendency to postpone new issues or seek alternative sources of finance. This confirms the finding by Chalmers³ that expenditures by state and local governments tend to be countercyclical.

Although the results of the Survey and Model I research were alike only in their agreement that the forces of supply and demand underly the municipal bond market, there is some justification for the different choices of explanatory variables. It is possible that the municipal bond dealers are extremely sensitive to the thinness of the market, that having experienced several occasions as syndicate members when bond prices had to be reduced resulting in personal losses, they see the market through supply biased eyes oriented towards future events. Although test results from the period, 1957-1972, exposed the error of this view, the dangers of a thin market for municipal bonds continues to grow. Industrial bonds, Public Housing Authority, Pollution Abatement and other special purpose bonds are crowding under the tax-exempt umbrella. Even if the spectre of the thin market continues to emphasize the supply side of the equation,

³op. cit. 4, Chap. I, Chalmers dissertation.

the decision makers need a more accurate measure of the municipal bonds being offered for sale.

Conclusions

As a result of the analysis of the empirical test conducted in this study, the following conclusions are drawn:

(1) The persistent forces which determine the variations in the municipal bond market are best represented by the independent variables: Prime Rate, New Issues of municipals, Dividend Yield on common stock and the Net Acquisition of Financial Assets by commercial banks.

(2) The monetary interest rate theory applies to municipal bonds; Money Supply, Income and Marketable Debt (corporate and U. S. Government) are the principal determinants of municipal bonds' average yields.

(3) The expectation theory of the term structure of interest rates applies to long-term municipal bonds and the change in yields can be explained by the error between the actual and expected yields on one-year municipal bonds. This finding suggests the use of the term structure relationship to indicate cyclical or secular changes in municipal bond yields.

(4) The average municipal bond dealer considers the supply of municipal bonds more critical than the demand in determining the market behavior, i.e., there is a greater possibility of a sudden increase in supply without a similar increase in demand than of a sudden loss of demand without a similar decrease in supply.

(5) In the past the demand for municipal bonds has been more critical than the supply. The changes in demand by commercial banks and private households accounted for over twice the variance in municipal bond rates that was accounted for by supply, Equation (12).

This study has examined the municipal bond market and identified those independent variables which, when related according to the theory specified, are the determinants of the persistent changes. It has confirmed the application of the liquidity preference theory and the term structure of interest rate theory to municipal bonds and specified conditions of their maximum effectiveness. In a private survey the current opinions of the largest municipal bond houses have been collected and their preferences compared with empirical findings.

Finally, this study confirms that most variations in the municipal bond market can be supported by economic theory and that the probability sector of decision making in that market can be greatly reduced.

APPENDIX A

NEW ISSUE

SAMPLE MATURITY AND INTEREST RATE SCHEDULE

In the opinion of Bond Counsel, interest on the 1972 Series A Bonds is exempt under the existing statute and court decisions from Federal income taxes, and under the provisions of the Act, the 1972 Series A Bonds and the interest thereon and the income therefrom are exempt from taxation by the State of Vermont, except for transfer, inheritance and estate taxes.

\$63,500,000

VERMONT MUNICIPAL BOND BANK

1972 Series A Bonds

Dated: March 1, 1972

Due: December 1, as shown below

Coupon bonds in the denomination of \$5,000, registrable as to principal only, and fully registered bonds in denominations of \$5,000 or any authorized multiple thereof. Coupon and registered bonds are interchangeable. Principal and interest (first coupon payable June 1, 1972 and each December 1 and June 1 thereafter) payable at the corporate trust offices of the Trustee, Bankers Trust Company, New York, New York, or, at the option of the holder at The First National Bank of Boston, Boston, Massachusetts, or at The First National Bank of Chicago, Chicago, Illinois, or at Chittenden Trust Company, Burlington, Vermont.

<u>Maturity</u>	<u>Principal Amount</u>	<u>Interest Rate</u>	<u>Yield or Price</u>	<u>Maturity</u>	<u>Principal Amount</u>	<u>Interest Rate</u>	<u>Yield or Price</u>
1972	\$3,300,000	4 $\frac{1}{4}$ %	2.50%	1982	\$3,265,000	4.30%	100%
1973	3,160,000	4 $\frac{1}{4}$	2.80	1983	3,285,000	4.45	100
1974	3,350,000	4 $\frac{1}{4}$	3.10	1984	3,295,000	4.60	100
1975	3,310,000	4 $\frac{1}{2}$	3.30	1985	3,335,000	4.70	100
1976	3,330,000	4 $\frac{1}{2}$	3.50	1986	3,365,000	4.80	100
1977	3,350,000	4 $\frac{3}{4}$	3.70	1987	3,670,000	4.90	100
1978	3,320,000	4 $\frac{3}{4}$	3.90	1988	3,095,000	5	100
1979	3,320,000	4 $\frac{3}{4}$	4.00	1989	2,925,000	5.10	100
1980	3,335,000	4 $\frac{3}{4}$	4.10	1990	2,490,000	5.20	100
1981	3,305,000	4.20	100	1991	1,695,000	5.20	100

(Accrued interest from March 1, 1972 to be added)

The 1972 Series A Bonds maturing on and after December 1, 1981, shall be redeemable, as a whole or in part, beginning on December 1, 1980 as more fully described in the Official Statement.

These 1972 Series A Bonds are offered when, as and if issued and received by the Underwriters, subject to prior sale, to withdrawal or modification of the offer without notice, and to the approval of legality by Messrs. Hawkins, Delafield & Wood, New York, New York, Bond Counsel to the Vermont Municipal Bond Bank. Certain legal matters will be passed on for the Underwriters by their Counsel, Messrs. Mudge Rose Guthrie & Alexander, New York, New York. It is expected that such Bonds in definitive form will be available for delivery in New York, New York on or about March 14, 1972.

Goldman, Sachs & Co.

DATED: February 17, 1972

Statements herein, while not guaranteed, are based upon information which the Underwriters believe to be reliable.

APPENDIX B

HOLDERS OF STATE AND LOCAL GOVERNMENT DEBT June 30, 1961-1972

(Billions of dollars)

	1972	1971	1970	1969	1968	1967
Total State and Local Government						
Debt Outstanding:	\$170.3	\$154.0	\$139.0	\$129.3	\$118.8	\$110.2
Long-Term	153.5	138.8	126.8	119.3	110.4	103.2
Short-Term	16.8	15.2	12.2	10.1	8.4	7.0
Held By - Households	50.7	46.1	47.3	41.6	38.9	37.8
Corporate Business	3.7	2.7	3.1	3.3	3.7	3.3
State & Local Government						
General Fund	1.9	2.1	2.3	2.3	2.1	2.1
Commercial Banks	87.1	78.4	63.3	60.4	53.0	47.1
Mutual Savings Banks	0.6	0.3	0.2	0.2	0.2	0.2
Life Insurance Companies	3.4	3.4	3.2	3.2	3.2	3.0
Other Insurance Companies	20.3	18.5	17.0	15.7	14.6	13.4
State & Local Government						
Retirement Funds	1.8	2.0	2.2	2.4	2.4	2.4
Brokers and Dealers	0.8	0.5	0.4	0.3	0.7	0.6

(Information furnished by the Federal Reserve Board.)

Because of rounding, detail may not add to totals.

Reprinted from the Bond Buyer's Municipal Finance Statistics, Vol. 11, April 1973.

APPENDIX B. (continued)

(Billions of dollars)

	1966	1965	1964	1963	1962	1961
Total State and Local Government						
Debt Outstanding:	\$104.1	\$96.9	\$89.9	\$85.0	\$79.2	\$73.2
Long Term	98.1	91.5	85.3	80.8	75.5	69.8
Short Term	6.1	5.3	4.7	4.3	3.7	3.4
Held By - Households	37.3	33.9	33.1	31.9	31.4	31.6
Corporate Business	5.3	5.3	4.3	3.8	3.0	2.7
State & Local Government						
General Fund	2.1	2.2	2.2	2.4	2.7	2.8
Commercial Banks	40.8	36.7	31.5	28.0	23.4	18.2
Mutual Savings Banks	0.3	0.4	0.4	0.5	0.6	0.7
Life Insurance Companies	3.2	3.7	3.8	4.0	4.0	3.7
Other Insurance Companies	12.0	11.1	10.8	10.3	9.5	8.5
State & Local Government						
Retirement Funds	2.5	2.7	3.1	3.6	4.1	4.4
Brokers and Dealers	0.6	0.8	0.6	0.6	0.5	0.5

(Information furnished by the Federal Reserve Board.)

Because of rounding, detail may not add to totals.

Reprinted from the Bond Buyer's Municipal Finance Statistics, Vol. 11, April 1973.

APPENDIX C
THE IS - LM FUNCTION

For simplification purposes let it be assumed that the government does not exist and that there is no foreign trade, then equilibrium of the market for final goods (product market) requires equality between intended savings and investments.

* $S = Y - C(Y)$ is the savings function

where Y = income

$C(Y)$ = portion of income consumed.

$I = I(i)$ is the investment demand schedule

where $I(i)$ = investment demand at a particular interest rate.

Then product market equilibrium condition is

$$I(i) = Y - C(Y)$$

For any arbitrary rate of interest there is some level (or levels) of income which will make intended investment equal savings. This relationship between the rate of interest and the level of income is referred to as the "IS function". (See graph).

Let it also be assumed that there is a real speculative demand for money dependent on the rate of interest and a real transaction and precautionary demand dependent on the level of real income, then equilibrium in the money market may be written:

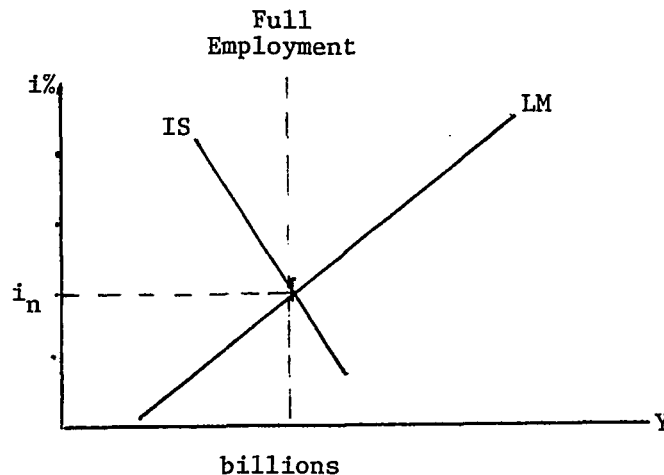
*The model used here is that of J. R. Hicks, "Mr. Keynes and the Classics: A Suggested Interpretation", Econometrica, New Series, No. 5, 147-159 1937.

$$m_s = kY + L(i)$$

where m_s = supply of real money balances

$L(i)$ = speculative demand at interest rate level (i) .

Given the supply of real money balances there will be some level (or levels) of real income which is (are) associated with a particular rate of interest. This relationship is called the "LM function".



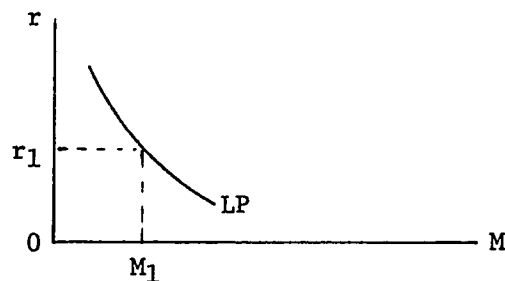
As shown on the graph, the LM schedule depicts those rates of interest which are consistent with monetary equilibrium, the IS schedule depicts rates of interest which are consistent with product market equilibrium; there is only one rate of interest and one level of income that is consistent with both. If this intersection of the LM - IS curves comes at the level of full-employment income the resulting interest rate has been called the natural rate of interest.

Traditionally, it has been taken for granted that the interest rate is determined by real factors and that influences from the monetary market were short-run disturbances, but when it is recognized that full-

employment is a rare phenomenon in an economic society, the true effect of monetary values on the equilibrium interest rate then become evident. As Keynes has said, there is nothing natural about the natural rate of interest.

APPENDIX D
LIQUIDITY PREFERENCE FUNCTION

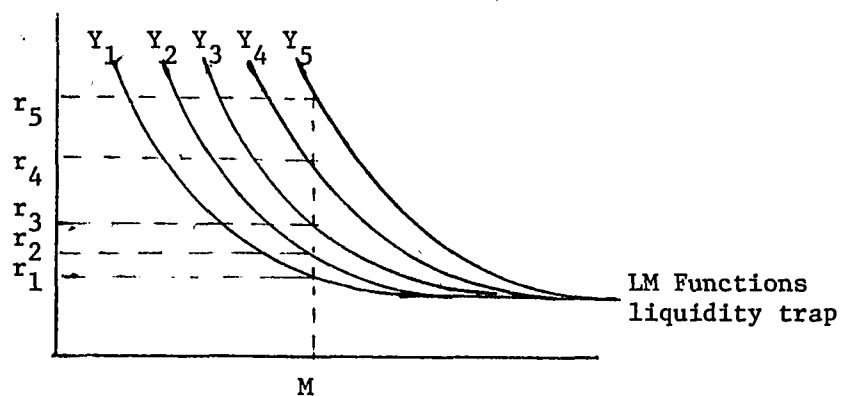
Starting with the assumption that people want money not just to spend but to hold as cash balances because of future uncertainties, Keynes has reasoned that the interest rate is in effect the opportunity cost of liquidity or the price that must be paid to persuade people to forego holding money and to invest, instead. A liquidity preference schedule may be plotted.



where r = rate of interest
 LP = liquidity preference function
 M = money supply

For any money supply, M_1 , the liquidity preference function will determine the interest rate, r_1 .

It should be pointed out that of the three components of liquidity preference only the speculative motive for holding cash balances is interest elastic. The transaction and precautionary motives are income elastic, instead. However, if transaction demands (L_t) and speculative demands (L_s) are combined for several different levels of income and plotted the liquidity functions are similar.



where $Y_{1,2,3}$ = Income levels

It can be seen that an increase in income induces an upwards shift in liquidity preference functions. With a constant money supply this upwards shift will cause an increase in the rate of interest. Also, the L function tends to become more elastic at lower levels of interest rates, approaching perfect elasticity at some very low interest rate.

APPENDIX E
QUESTIONNAIRE

From your experience and observations which of the factors listed below have the strongest relationship (either positive or negative) with the changes in long term municipal bonds' yields to maturity?

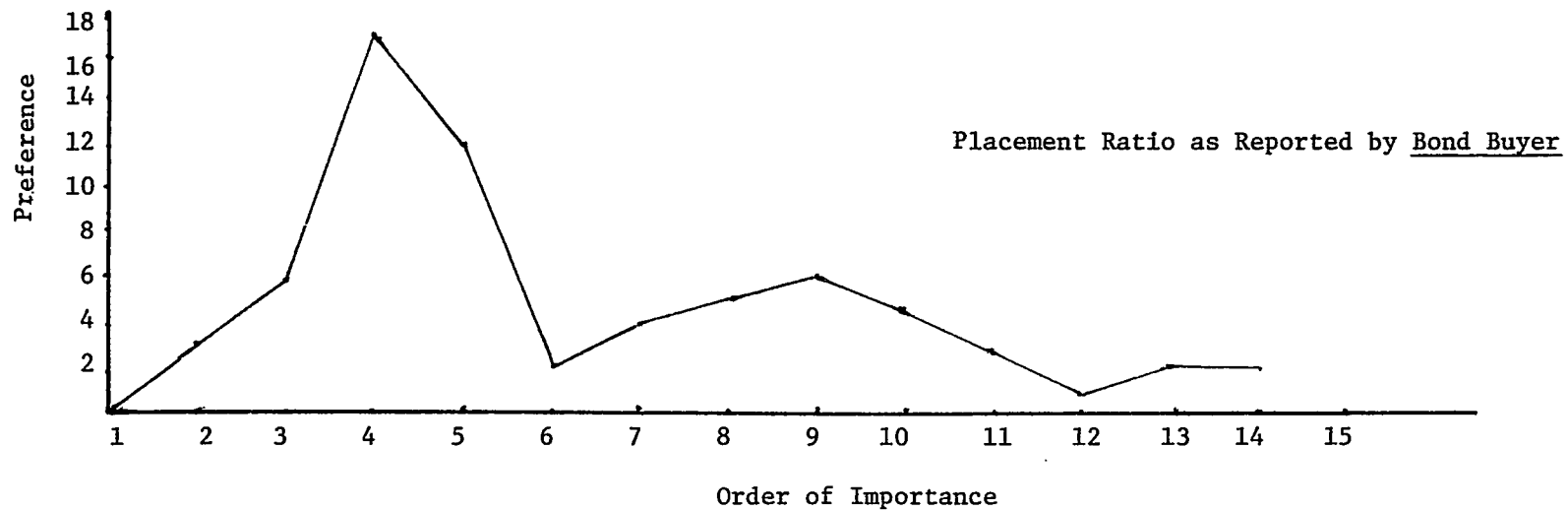
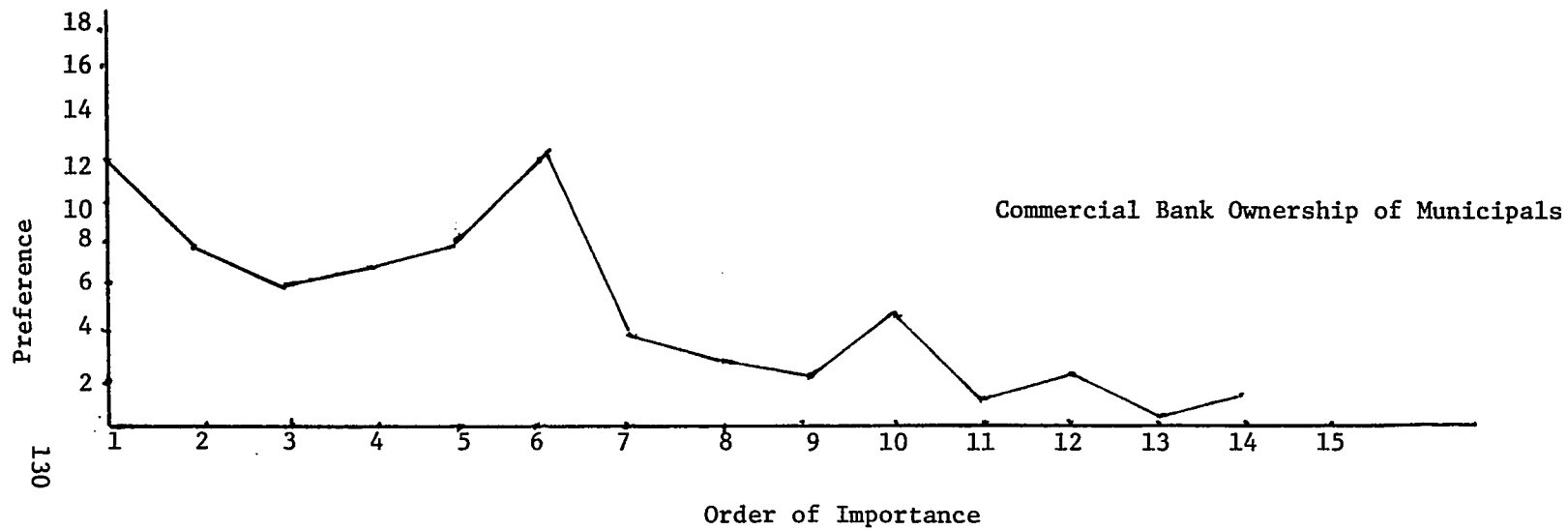
Please number in order of strength -- 1 strongest relationship, 2 next strongest, etc.

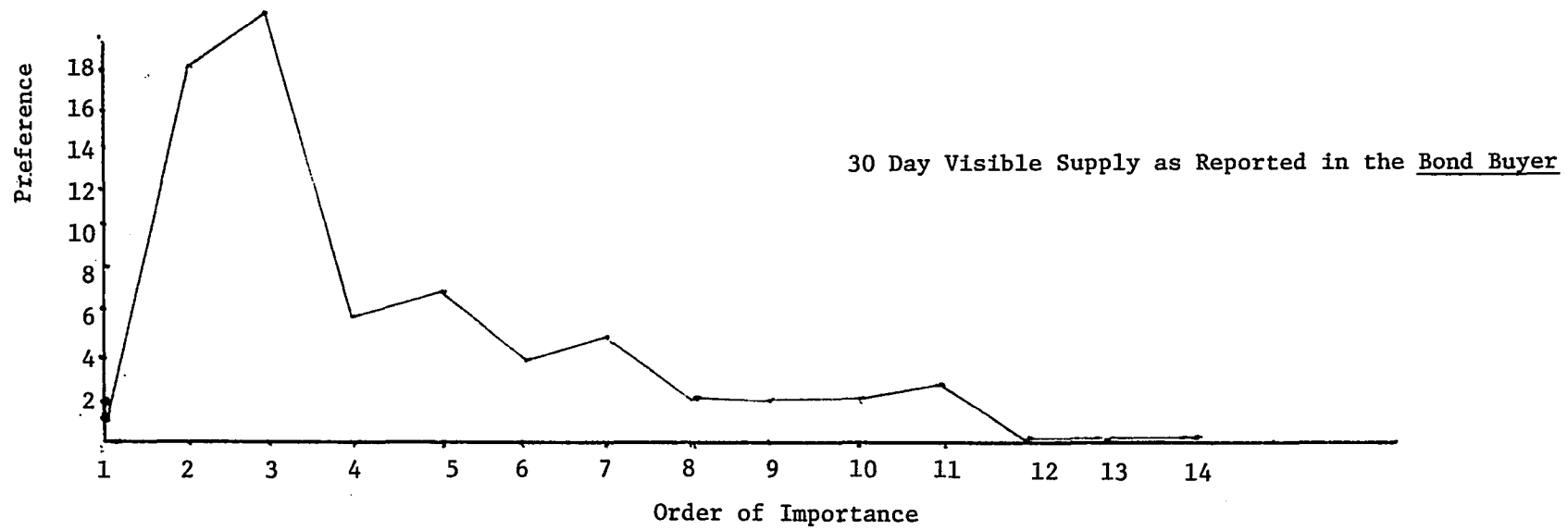
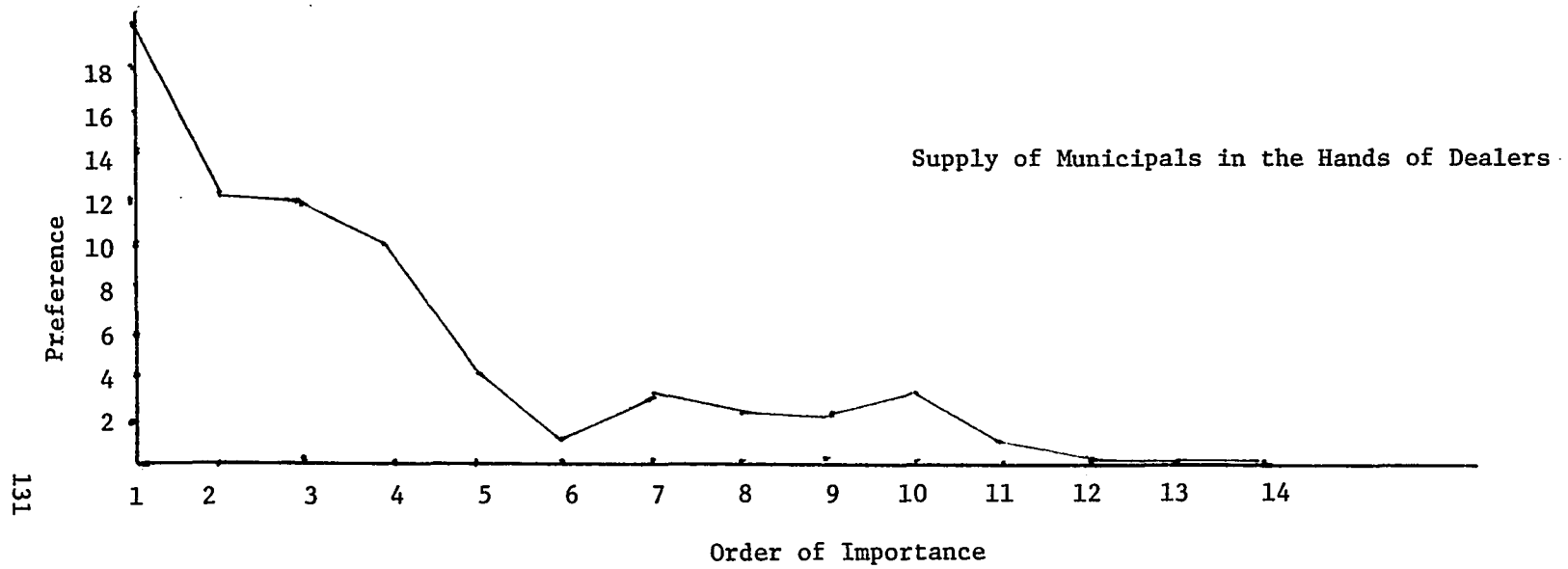
- ___ Long term U. S. Gov. Bonds' yields
- ___ Prime rate
- ___ Federal Fund rate
- ___ Consumer Price Index
- ___ Implicit GNP Price Deflator
- ___ Change in Money Supply
- ___ Commercial Bank ownership of municipals
- ___ Supply of municipals in the hands of dealers
- ___ Placement ratio as reported by the Bond Buyer
- ___ 30 day visible supply as reported by the Bond Buyer
- ___ Number of new issues of municipals
- ___ Personal Income growth
- ___ GNP growth rate
- ___ Change in Free Bank Reserves

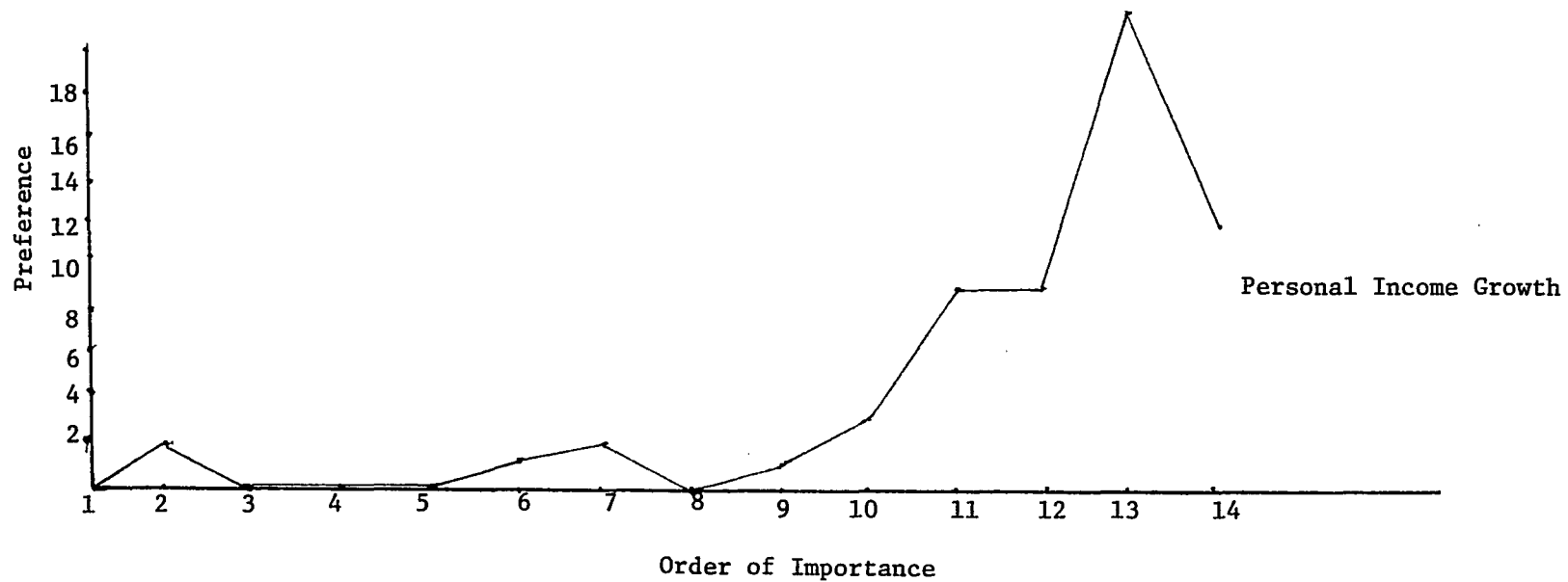
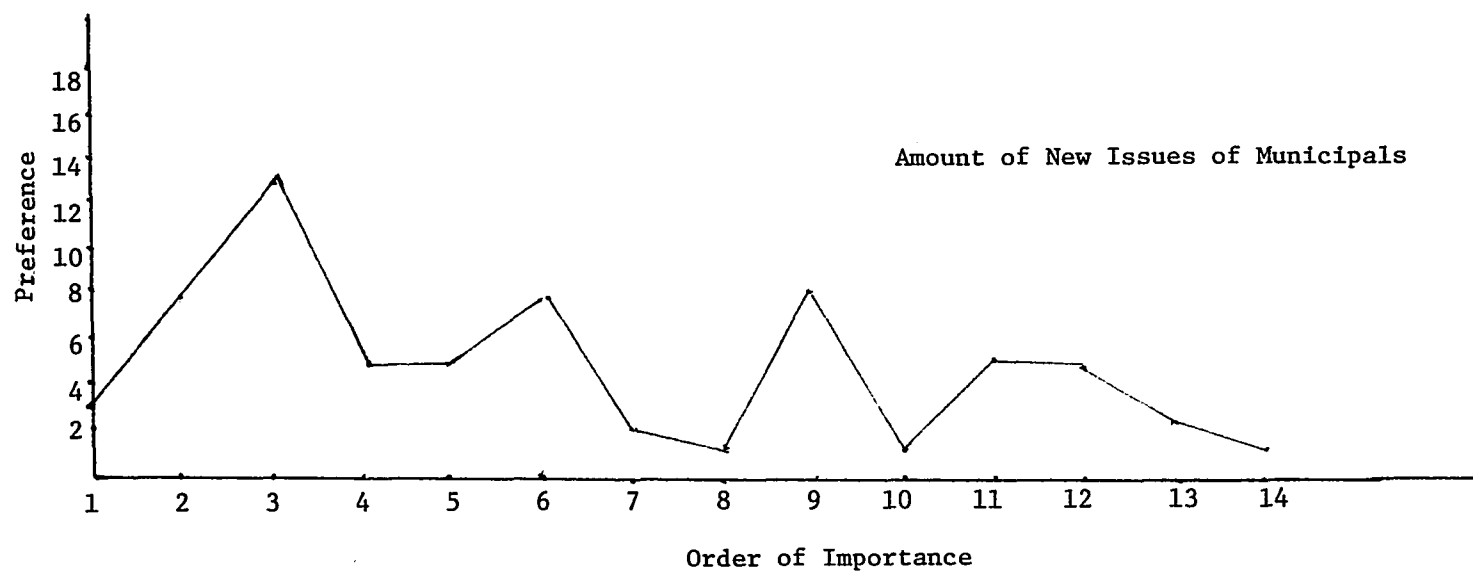
OTHER

COMMENTS

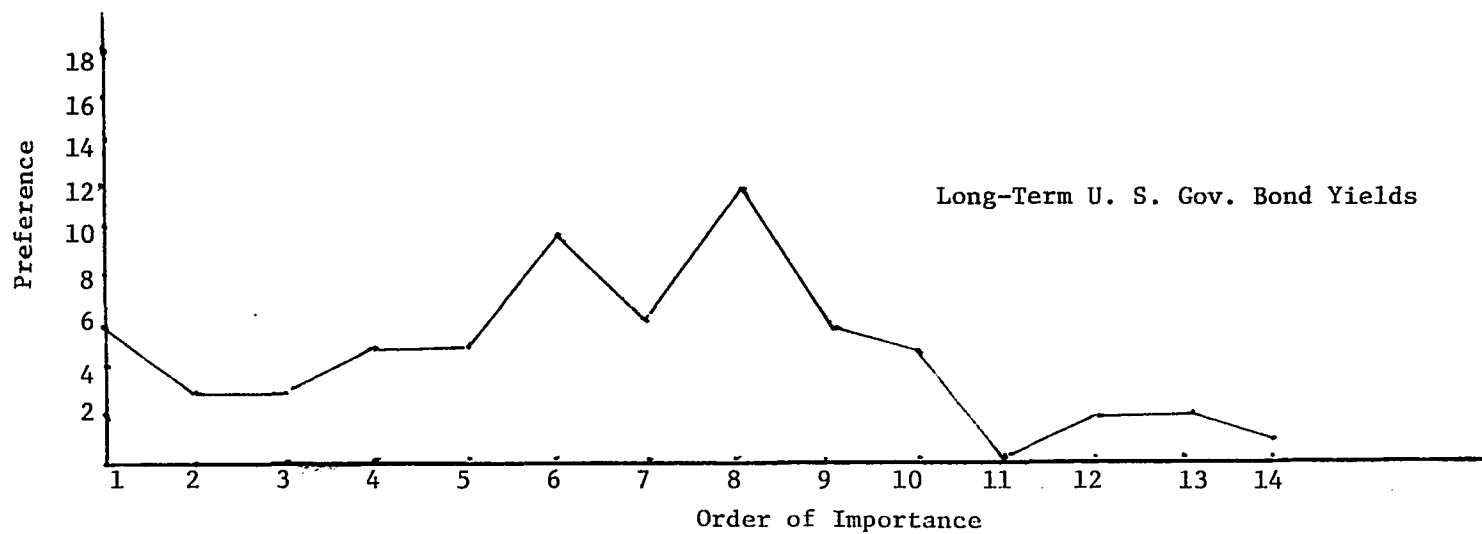
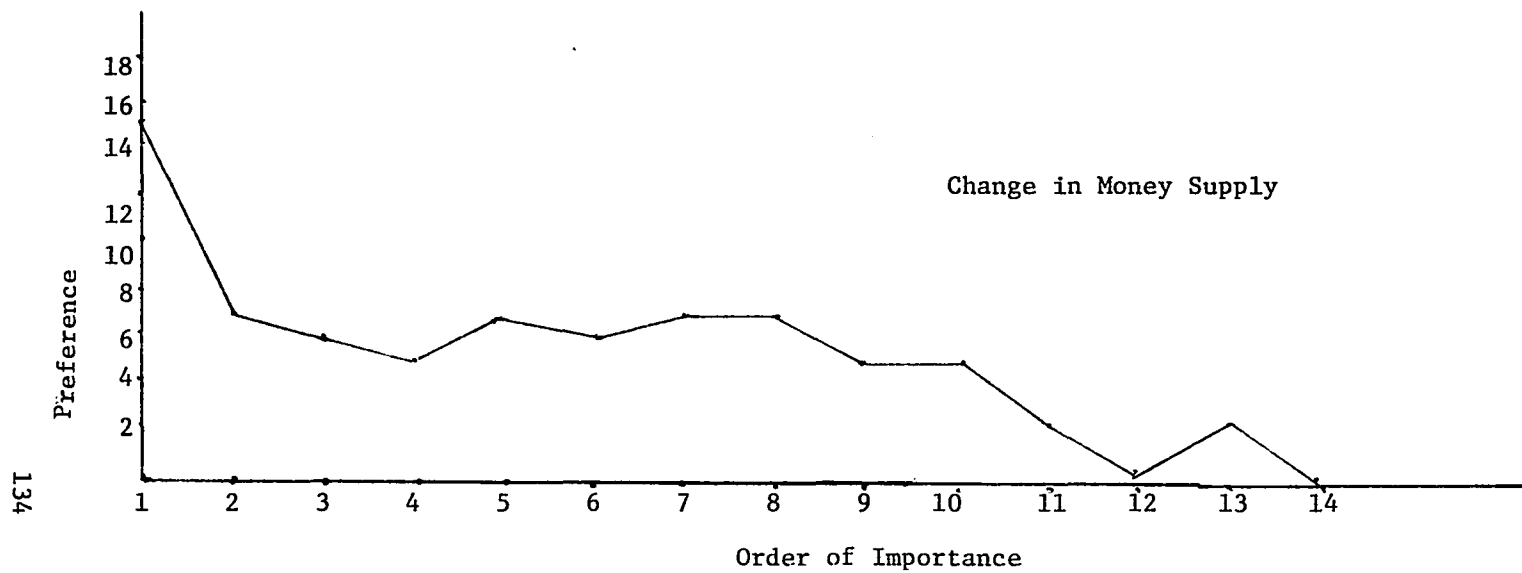
A P P E N D I X F

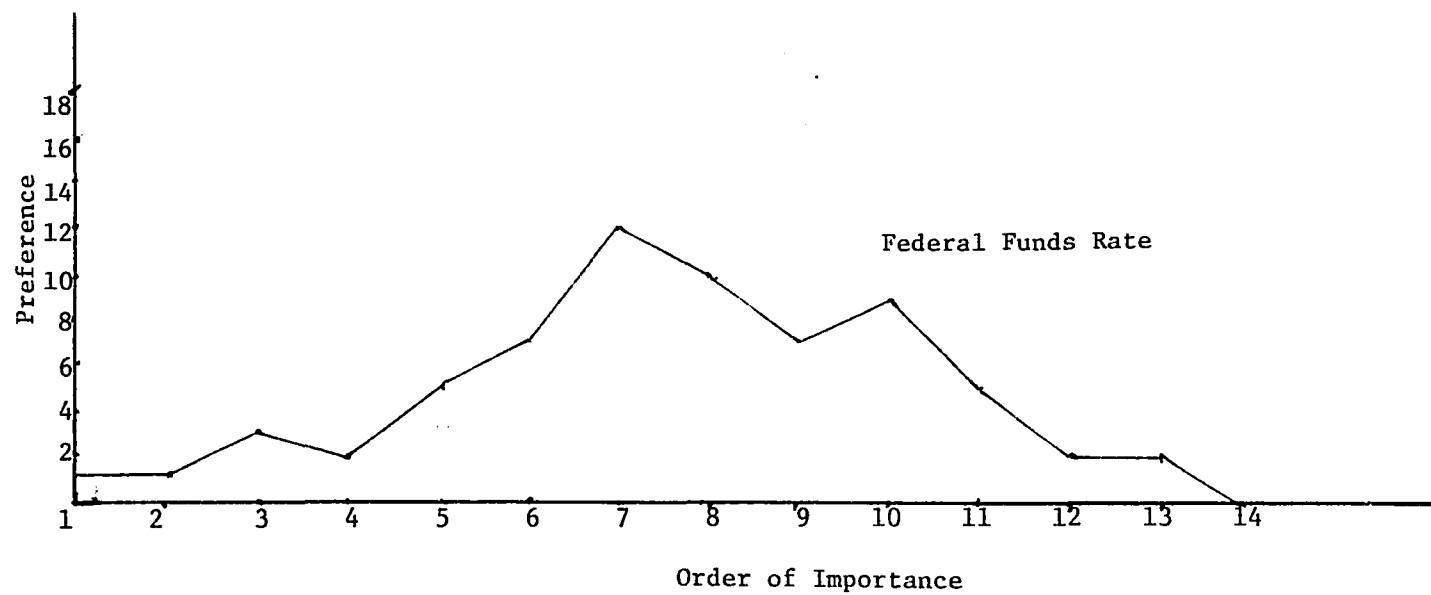
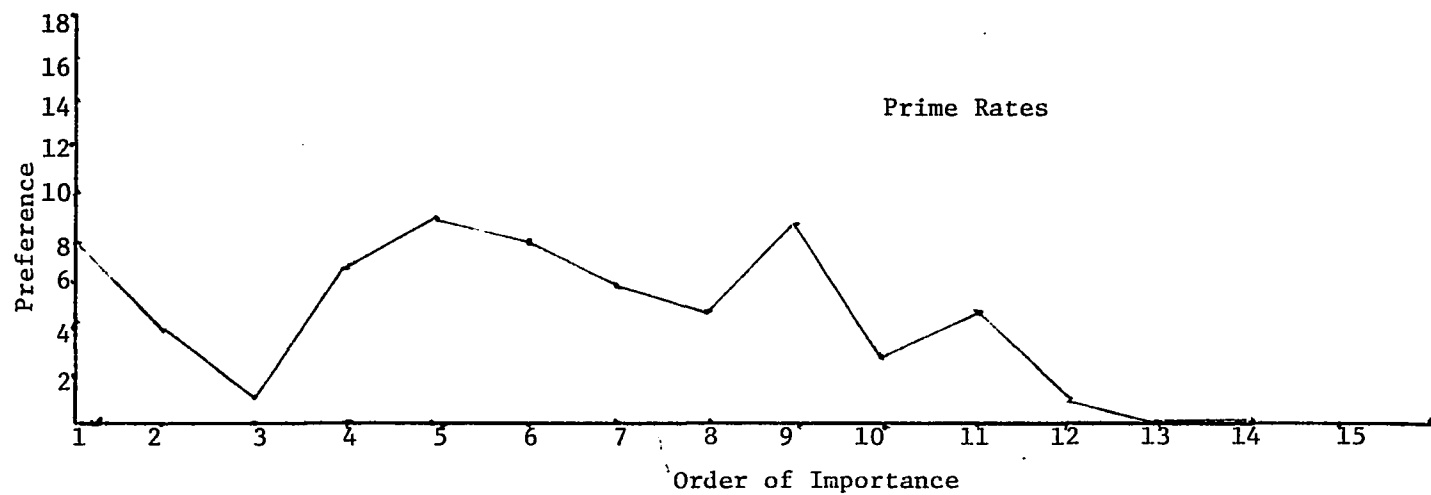


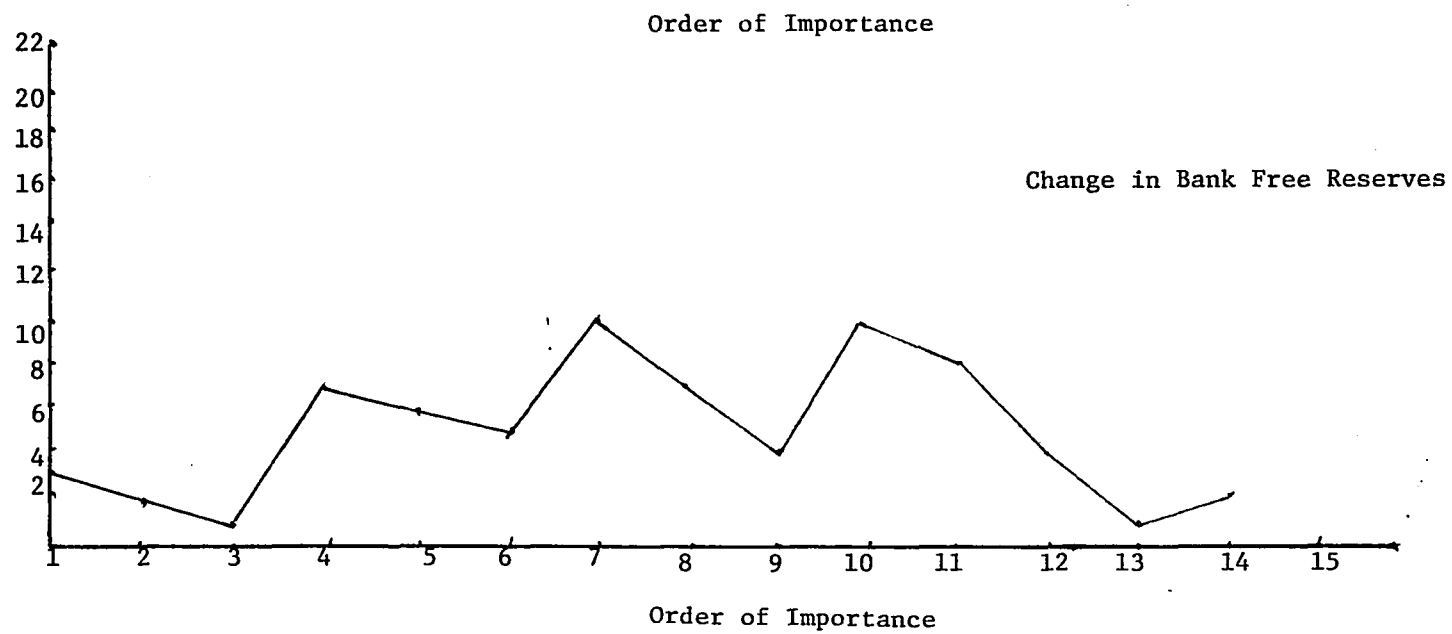
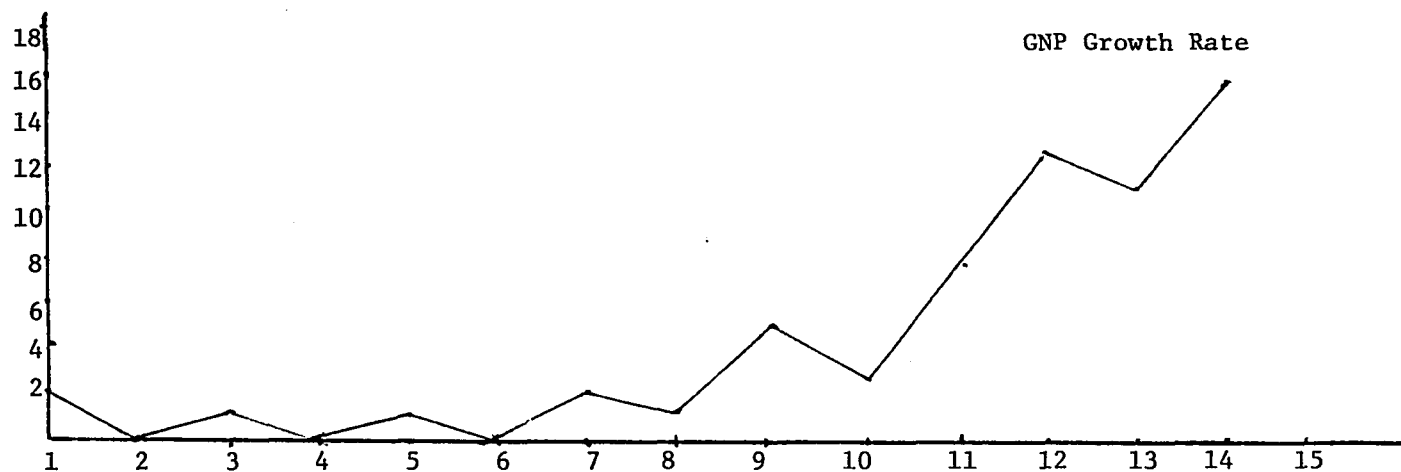












APPENDIX G

COMPARATIVE INVESTMENT RETURNS

Personal Income Tax Brackets (Joint Return)

AND YOU INVEST IN -

If Your Annual Taxable Income Is	Your Federal Tax Bracket Is	Your N.Y. State Tax Bracket Is	Your Total Tax Bracket Is	Savings Banks		Corporates		Tax-Free Bonds		
						After Tax Yields		Are		
\$ 8-\$12000	24%	6-1/2%	29%	3.55	4.26	4.97	5.68	5.00	6.00	7.00
\$12-\$16000	27%	8-1/2%	33%	3.35	4.02	4.69	5.36	5.00	6.00	7.00
\$16-\$20000	30%	11%	38%	3.10	3.72	4.32	4.96	5.00	6.00	7.00
\$20-\$24000	34%	12%	42%	2.90	3.48	4.06	4.64	5.00	6.00	7.00
\$24-\$28000	39%	14%	47%	2.65	3.18	3.77	4.24	5.00	6.00	7.00
\$28-\$32000	42%	14%	50%	2.50	3.00	3.50	4.00	5.00	6.00	7.00
\$32-\$36000	45%	14%	53%	2.35	2.82	3.29	3.76	5.00	6.00	7.00
\$36-\$40000	48%	14%	55%	2.25	2.70	3.15	3.60	5.00	6.00	7.00
\$40-\$44000	52%	14%	59%	2.05	2.46	2.87	3.28	5.00	6.00	7.00
\$44-\$52000	54%	14%	60%	2.00	2.40	2.80	3.20	5.00	6.00	7.00
\$52-\$64000	57%	14%	63%	1.85	2.22	2.59	2.96	5.00	6.00	7.00
\$64-\$76000	59%	14%	65%	1.75	2.10	2.45	2.80	5.00	6.00	7.00

APPENDIX H
TABLES OF EMPIRICAL DATA

NOTES TO APPENDIX TABLE I

Column (1)

Yield-to-maturity on municipal bonds (standard and Poor's Index. "An arithmetic average of the yield-to-maturity of 15 high grade municipal bonds based on the mean of monthly high-low prices. These bonds are a representative list, with regional distribution of high quality municipal bonds. For the most part they are serial issues, a twenty year period to maturity being maintained.")

Column (2)

Prime Rate of Interest as charged by commercial banks to large, most credit worthy customers on bank loans.

Source: Federal Reserve Bulletin.

Column (3)

Y: Income, defined as demand for liquidity. Gross National Product Column (9) less Government Payroll Column (10) billions of dollars.

Column (4)

Net Acquisition of Financial Assets Column (13), divided by Y, Column (3).

Column (5)

Dividend Yield: Dividend on an average share of common stock divided by the Price.

Source: Moody's Investment Services, Inc.

Notes to Appendix Table I (Continued)

Column (6)

Return on equity to common stock owners:

$$\frac{P_{t+1} + D}{P_t} - 1$$

P is Price per average share of common stock, Column (11), D is Dividend per average share of common stock, Column (12).

Column (7)

New Issues of Municipal Bonds issued during the quarter (millions of dollars).

Source: Federal Reserve Bulletin.

Column (8)

Tax Rate: Income tax rate on taxable income of \$40,000 for married tax-payers filing a joing return.

Source: Internal Revenue Service.

Column (9)

Gross National Product: seasonally adjusted quarterly totals at annual rates, current prices (billions of dollars).

Source: Federal Reserve Bulletin.

Column (10)

U. S. Government Civilian and Military salaries and wages, seasonally adjusted quarterly totals at annual rates, current prices (billions of dollars).

Source: Federal Reserve Bulletin.

Notes to Appendix Table I (Continued)

Column (11)

Price of a share of common stock on the New York Stock Exchange, quarterly average.

Source: Standard and Poor's Composite Index of Common Stocks.

Column (12)

Dividend for an average share of common stock on the New York Stock Exchange, quarterly average.

Source: Standard and Poor's Composite Index of Common Stocks.

Column (13)

Net Acquisition of Financial Assets by Commercial banks, seasonally adjusted, quarterly totals (millions of dollars).

Source: Flow of Funds, Board of Governors of the Federal Reserve.

APPENDIX TABLE I
Empirical Data for Variables in Model I

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Municipal Bond Yields	Prime Rate	Income, Y Billion	Net Acquisition of Financial Assets Y	Dividend Yield	Return on Equity	New Issues millions	Tax Rate
Yr	Qtr	%	%			%	%		%
142	1957 - 1	3.32	4.00	396.9	.034	4.16	-4.67	1,757	56.0
	2	3.75	4.00	401.3	-.004	3.79	8.50	1,690	56.0
	3	3.90	4.50	405.0	.022	4.27	-9.50	1,548	56.0
	4	3.47	4.50	398.3	.001	4.58	-4.62	1,962	56.0
	1958 - 1	3.45	4.00	385.4	.049	4.35	6.18	2,203	56.0
	2	3.26	3.50	388.0	.079	3.98	8.53	2,229	56.0
	3	3.96	4.00	396.4	-0.18	3.54	11.65	1,667	56.0
	4	3.84	4.00	409.3	.040	3.17	11.27	1,346	56.0
	1959 - 1	3.76	4.00	427.3	.019	3.28	1.10	2,157	56.0
	2	4.04	4.50	442.6	.006	3.09	6.31	2,504	56.0
	3	4.13	5.00	437.1	.016	3.13	-1.92	1,500	56.0
	4	4.05	5.00	442.6	.002	3.08	6.19	1,521	56.0
	1960 - 1	3.87	5.00	454.7	-.007	3.47	-6.78	1,886	56.0
	2	3.78	5.00	457.4	.020	3.39	3.72	2,251	56.0
	3	3.53	4.50	454.6	.031	3.64	-5.15	1,764	56.0
	4	3.45	4.50	453.9	.031	3.43	9.53	1,329	56.0
	1961 - 1	3.38	4.50	450.4	.033	3.11	12.79	2,122	56.0
	2	3.53	4.50	464.8	.031	3.10	.09	2,370	56.0
	3	3.54	4.50	474.7	.047	2.99	3.99	1,765	56.0
	4	3.49	4.50	488.3	.039	2.92	8.08	2,086	56.0

APPENDIX TABLE I (Continued)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Yr	Qtr								
1952	1	3.19	4.50	492.7	.045	3.00	-2.10	2,610	56.0
	2	3.24	4.50	501.6	.044	3.82	-20.56	2,534	56.0
	3	3.18	4.50	508.4	.023	3.71	3.71	1,626	56.0
	4	3.12	4.50	514.9	.056	3.41	13.24	1,788	56.0
1963	1	3.11	4.50	519.3	.037	3.29	6.32	2,798	56.0
	2	3.27	4.50	525.4	.047	3.25	5.03	2,889	56.0
	3	3.27	4.50	535.1	.018	3.12	4.11	1,967	56.0
	4	3.34	4.50	544.4	.055	3.15	5.60	2,453	56.0
1964	1	3.32	4.50	555.1	.037	3.02	6.04	2,660	50.5
	2	3.20	4.50	564.5	.036	2.95	4.19	2,764	50.5
	3	3.25	4.50	573.9	.045	2.87	3.76	2,641	50.5
	4	3.15	4.50	578.9	.049	3.00	1.57	2,479	50.5
1965	1	3.18	4.50	595.8	.059	3.00	2.40	2,747	48.0
	2	3.26	4.50	607.4	.040	3.11	-1.60	2,991	48.0
	3	3.36	4.50	620.1	.023	2.92	7.69	2,757	48.0
	4	3.56	5.00	635.9	.071	3.02	3.65	2,653	48.0
1966	1	3.72	5.50	655.3	.031	3.20	-2.73	2,869	48.0
	2	3.77	5.75	667.0	.052	3.44	-4.24	3,176	48.0
	3	4.11	6.00	676.9	.022	3.86	-8.84	2,434	48.0
	4	3.83	6.00	689.5	.018	3.69	5.96	2,609	48.0
1967	1	3.60	5.50	691.7	.054	3.29	13.17	4,046	48.0
	2	3.99	5.50	700.3	.032	3.17	1.27	3,799	48.0
	3	4.15	5.50	714.5	.079	2.92	7.48	3,038	48.0
	4	4.49	6.00	726.2	.056	2.89	.57	3,404	48.0

APPENDIX TABLE I (Continued)

		(9)	(10)	(11)	(12)	(13)
		GNP	Gov't.	Price	Dividend	Net Acquisition
		billion	Payrolls	C, stock	per share	Financial Assets
Yr	Qtr		billion	\$	\$	and Banks
						millions
144	1957 - 1	436.3	39.4	44.11	.38	13.6
	2	441.2	39.9	47.37	.49	-1.5
	3	445.6	40.6	42.42	.45	8.8
	4	438.9	40.6	39.99	.47	.5
	1958 - 1	427.1	41.7	42.10	.36	18.7
	2	430.4	42.4	45.24	.45	30.7
	3	439.8	43.4	50.06	.45	-7.2
	4	453.0	43.7	55.21	.49	16.6
	1959 - 1	472.0	44.7	55.44	.38	8.0
	2	487.8	45.2	58.47	.47	2.7
	3	482.7	45.6	56.88	.47	7.1
	4	488.5	45.9	59.89	.51	.7
	1960 - 1	501.3	46.6	55.34	.49	-3.1
	2	505.0	47.6	56.92	.48	9.0
	3	503.5	48.9	53.52	.47	14.0
	4	503.5	49.6	58.11	.51	13.9
	1961 - 1	500.8	50.4	65.06	.48	10.5
	2	516.1	51.3	64.64	.48	17.1
	3	525.8	52.1	66.73	.49	24.2
	4	542.2	53.9	71.55	.57	16.3

APPENDIX TABLE I (Continued)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Yr	Qtr								
1968	- 1	4.56	6.00	742.0	.027	3.13	-5.73	3,659	48.0
	2	4.56	6.50	763.2	.033	2.86	11.23	3,771	48.0
	3	4.47	6.00	777.6	.092	2.81	3.86	4,574	48.0
	4	4.91	6.75	791.3	.070	2.93	1.97	4,435	48.0
1969	- 1	5.34	7.50	807.0	.014	3.00	-1.52	2,787	48.0
	2	5.83	8.50	821.7	.043	3.13	-2.98	3,648	48.0
	3	6.35	8.50	835.2	.018	3.27	-3.91	2,464	48.0
	4	6.91	8.50	840.8	.011	3.31	-.24	2,982	48.0
1970	- 1	6.14	8.00	846.1	.038	3.47	-1.79	4,105	48.0
	2	7.06	8.00	856.3	.036	4.09	-17.99	3,728	48.0
	3	6.45	7.50	871.3	.063	3.55	16.86	4,465	48.0
	4	5.71	6.75	874.3	.039	3.20	10.38	5,862	48.0
1971	- 1	5.44	5.25	905.8	.059	2.93	9.67	6,701	48.0
	2	6.22	5.50	924.0	.073	2.99	.17	6,095	48.0
	3	5.52	6.00	938.3	.049	2.94	-.59	5,917	48.0

APPENDIX TABLE I (Continued)

Yr	Qtr	(9)	(10)	(11)	(12)	(13)
1962	- 1	547.8	55.1	69.55	.50	22.2
	2	557.2	55.6	54.75	.50	22.0
	3	564.4	56.0	56.27	.50	11.8
	4	572.0	57.1	63.10	.62	29.0
1963	- 1	577.4	58.1	66.57	.52	19.4
	2	584.2	58.8	69.37	.55	24.5
	3	594.7	59.6	71.70	.52	9.6
	4	605.8	61.4	75.02	.69	29.7
1964	- 1	617.7	62.6	78.98	.57	20.7
	2	628.0	63.5	81.69	.60	20.5
	3	638.9	65.0	84.18	.50	25.8
	4	645.1	66.2	84.75	.75	28.5
1965	- 1	662.7	66.9	86.16	.62	35.0
	2	675.4	68.0	84.12	.66	24.5
	3	690.0	69.9	89.96	.63	16.7
	4	708.4	72.5	92.43	.81	45.1
1966	- 1	729.5	74.2	89.23	.68	20.2
	2	743.3	76.3	84.74	.71	34.8
	3	755.9	79.0	76.56	.69	14.8
	4	770.7	81.2	80.33	.79	12.2
1967	- 1	774.4	82.7	90.20	.71	37.3
	2	784.5	84.2	90.64	.71	22.1
	3	800.9	86.4	96.71	.71	61.3
	4	815.9	89.7	96.47	.79	35.9

APPENDIX TABLE I (Continued)

		(9)	(10)	(11)	(12)	(13)
Yr	Qtr					
1968	1	834.0	92.0	90.20	.74	20.4
	2	857.4	94.2	99.58	.75	25.5
	3	875.2	97.6	102.67	.75	71.9
	4	890.2	98.9	103.86	.83	55.2
1969	1	907.0	100.0	101.51	.77	10.9
	2	923.5	101.8	97.71	.78	35.5
	3	941.7	106.5	93.12	.77	14.9
	4	948.9	108.1	92.06	.84	9.3
1970	1	958.5	112.4	89.63	.78	31.9
	2	970.6	114.3	72.72	.79	30.5
	3	987.4	116.1	84.20	.78	55.2
	4	991.8	117.5	92.15	.79	34.3
1971	1	1,027.2	121.4	100.31	.75	53.2
	2	1,046.9	122.9	99.70	.78	67.0
	3	1,063.5	125.2	98.34	.77	45.7
	4			102.09	.77	

NOTES TO APPENDIX TABLE II

Column (1)

Demand deposits adjusted (billions of dollars, not seasonally adjusted).

Data as of last Wednesday of Quarter

Source: Federal Reserve Bulletin.

Column (2)

Currency outside banks: (billions of dollars, not seasonally adjusted).

Data as of last Wednesday of Quarter

Source: Federal Reserve Bulletin.

Column (3)

M₁ Money Supply: Currency outside banks Column (2) plus Demand Deposits, Column (1).

Column (4)

Currency outside government: (millions of dollars).

Currency in circulation outside the Treasury and Federal Reserve Banks.

Data as of the end of the Quarter.

Source: Federal Reserve Bulletin.

Column (5)

Other deposits in Federal Reserve Banks (millions of dollars):

Sum of "Foreign deposits" and "other deposits".

Source: Federal Reserve Bulletin.

Notes to Appendix Table II (Continued)

Column (6)

Member Bank Reserves (millions of dollars): "Statement of Condition of the Federal Reserve Banks". Data as of the end of the Quarter.

Source: Federal Reserve Bulletin.

Column (7)

Federal Demand Debt. Column (6) + Column (5) + Column (4).

APPENDIX TABLE II

Empirical Data for Variables in Model II

Yr	Qtr	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Demand Deposits Adj. billions	Currency Outside Banks billions	M1 billions	Currency Outside Gov. billions	Other Deposits million	Member Bank Reserve million	Federal Demand Debt million
150	1952 - 1	94.8	25.7	120.5	28.5	845	19,733	49,051
	2	95.8	26.0	121.8	29.0	846	19,381	49,252
	3	96.4	26.6	123.0	29.4	881	20,066	50,566
	4	101.5	27.5	129.0	30.4	1,005	19,950	51,388
	1953 - 1	97.4	26.9	124.3	29.8	878	19,322	49,954
	2	97.2	27.1	124.3	30.1	703	19,561	50,389
	3	97.7	27.5	125.2	30.3	864	19,309	50,448
	4	103.3	27.8	131.1	30.8	916	20,160	51,857
	1954 - 1	96.7	26.9	123.6	29.7	857	19,194	49,758
	2	98.1	27.1	125.2	29.9	922	19,011	49,855
	3	101.2	26.9	128.1	30.0	883	18,676	49,544
	4	106.7	27.4	134.1	30.5	931	18,876	50,256
	1955 - 1	102.4	26.7	129.1	29.8	805	18,635	48,881
	2	103.2	27.1	130.3	30.1	757	18,715	49,117
	3	104.9	27.2	132.1	30.4	778	18,711	49,609
	4	109.8	27.9	137.7	31.2	956	19,005	51,119
	1956 - 1	104.4	27.2	131.6	30.3	977	18,799	49,886
	2	105.0	27.5	132.5	30.7	610	18,443	50,135
	3	105.4	27.4	132.8	30.8	561	18,831	50,209
	4	110.8	28.5	139.3	31.8	748	19,059	51,607

APPENDIX TABLE II (Continued)

Yr	Qtr	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1957	- 1	105.2	27.4	132.6	30.6	615	18,629	49,829
	2	105.6	27.8	133.4	31.1	757	18,376	50,258
	3	105.5	27.8	133.3	31.1	598	18,399	50,705
	4	109.1	28.9	138.0	31.8	602	19,034	50,968
1958	- 1	104.6	27.4	132.0	30.6	644	18,532	49,842
	2	105.7	27.8	133.5	31.2	689	18,784	50,645
	3	108.1	27.9	136.0	31.2	653	18,147	50,045
	4	115.5	28.7	144.2	32.2	663	18,504	51,360
1959	- 1	110.3	27.9	138.2	31.3	696	18,192	50,137
	2	110.7	28.3	139.0	31.9	657	17,640	50,211
	3	111.4	28.5	139.9	31.8	760	17,760	50,368
	4	115.4	29.4	144.8	32.7	709	18,932	51,804
1960	- 1	108.8	28.1	136.9	31.6	504	18,027	50,159
	2	107.8	28.3	136.1	31.9	616	18,294	50,836
	3	109.3	28.3	137.6	32.2	609	18,570	51,330
	4	115.1	29.3	144.4	33.0	745	19,283	53,047
1961	- 1	110.3	28.0	138.3	31.8	623	18,809	51,271
	2	110.3	29.4	139.7	32.2	455	19,042	51,743
	3	112.4	28.6	141.0	32.7	598	19,372	52,689
	4	120.5	30.1	150.6	34.0	473	20,118	54,545
1962	- 1	113.0	28.9	141.9	33.0	487	19,547	53,030
	2	112.1	30.4	142.5	33.6	591	19,924	54,141
	3	114.1	29.4	143.5	34.0	507	20,034	54,545
	4	123.3	30.9	153.2	35.3	512	20,040	55,833

APPENDIX TABLE II (Continued)

Yr	Qtr	(1)	(2)	(3)	(4)	(5)	(6)	(7)
152	1963 - 1	115.4	30.1	145.5	34.4	373	19,516	54,320
	2	115.3	31.8	147.1	35.3	409	19,735	55,437
	3	117.0	31.1	148.1	35.9	345	19,945	56,235
	4	124.6	33.5	158.1	37.6	366	20,746	58,715
	1964 - 1	118.8	32.1	150.9	36.6	355	20,213	57,183
	2	120.3	33.0	153.3	37.5	335	20,558	58,434
	3	122.7	33.2	155.9	38.2	332	20,927	59,483
	4	132.2	34.9	167.1	39.7	367	21,609	61,674
	1965 - 1	123.0	33.8	156.8	38.8	338	21,240	60,363
	2	124.4	34.5	158.9	39.5	324	21,709	61,541
	3	126.3	34.9	161.2	40.3	405	21,729	62,481
	4	138.3	37.0	175.3	42.2	385	22,719	65,310
	1966 - 1	130.3	35.8	166.1	41.4	449	22,160	64,003
	2	131.0	37.1	168.1	42.3	546	22,534	65,376
	3	129.3	36.8	166.1	43.0	538	23,240	66,769
	4	139.3	39.0	178.3	44.6	593	23,830	69,002
	1967 - 1	132.1	37.6	169.7	43.7	579	23,405	67,657
	2	134.6	39.7	174.3	44.6	592	23,518	68,677
	3	136.8	38.7	175.5	45.2	599	24,200	69,988
	4	150.2	41.1	191.3	47.0	601	25,260	72,861
	1968 - 1	140.0	39.8	179.8	46.1	671	25,580	72,389
	2	144.3	42.3	186.6	47.5	652	25,713	73,851
	3	143.9	41.5	185.4	48.5	581	26,077	75,132
	4	163.8	43.5	207.3	50.6	683	27,221	78,513

APPENDIX TABLE II (Continued)

Yr	Qtr	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1969	- 1	147.9	42.8	190.7	49.4	615	26,754	76,805
	2	149.5	44.5	194.0	50.7	565	27,317	78,575
	3	148.8	44.1	192.9	51.4	582	26,971	78,991
	4	168.3	46.4	214.7	53.6	604	28,031	82,226
1970	- 1	151.6	45.4	197.0	52.4	982	27,473	80,867
	2	154.6	47.0	201.6	54.1	966	27,567	82,668
	3	154.9	47.3	202.2	55.0	891	28,825	84,647
	4	169.6	49.8	219.4	57.0	880	29,265	87,158
1971	- 1	159.4	48.8	208.2	56.1	857	29,686	86,666
	2	164.5	50.5	215.0	58.0	853	20,023	88,845
	3	161.9	50.5	212.4	59.0	863	30,802	90,677
	4	181.7	53.1	234.8	61.1	1,018	31,329	93,407
1972	- 1	174.9	52.1	221.0	60.1	767	31,921	92,825
	2	177.0	53.3	230.3	61.9	751	32,539	95,164

NOTES TO APPENDIX TABLE IIa

Column (1)

Reserve requirements index: Weighted average of reserve requirements for central reserve city banks, reserve city banks, and country banks on net demand deposits at the end of the quarter. The weights are .32 (central reserve city banks), .40 (reserve city banks) and .28 (country banks).

Column (2)

Volume of Federal Demand Debt, Column (7) Table II divided by Required Reserve Ratio, Column (1) Table IIa.

Column (3)

Volume of Federal Demand Debt, Column (7) Table II less currency outside Government, Column (4) Table II; the result divided by Required Reserve Ratio, Column (1) Table IIa and that result plus currency outside Government, Column (4), Table II. This is the potential demand deposits and is used as one definition of money supply.

Column (4)

GNP: Gross National Product, seasonally adjusted quarterly totals at annual rates, current prices (billions of dollars).

Source: Survey of Current Business

Column (5)

Government Payrolls: Government Civilian and Military Salaries and Wages, seasonally adjusted quarterly totals at annual rates, current prices (billions of dollars).

Source: Survey of Current Business

Notes To Appendix Table IIa (Continued)

Column (6)

Y: Gross Private Product: Column (4) less Column (5)

APPENDIX TABLE IIa

Empirical Data for Variables in Model II

Yr	Qtr	(1)	(2)	(3)	(4)	(5)	(6)
		Required Reserve Ratio	M/R	$\frac{M-C}{R} + C$	GNP billions	Gov. billions	Y billions
156	1952 - 1	.196	250.3	133.5	339.7	31.7	308.0
	2	.196	251.3	132.2	342.6	32.1	310.5
	3	.196	257.0	136.3	343.0	32.8	310.2
	4	.196	262.2	137.3	359.0	33.0	326.0
	1953 - 1	.196	254.8	132.8	361.8	33.4	328.4
	2	.196	257.1	133.5	369.9	33.6	336.3
	3	.183	275.7	140.5	367.2	33.6	333.6
	4	.183	283.4	145.9	360.5	33.4	327.1
	1954 - 1	.183	271.9	139.3	358.3	33.6	324.7
	2	.180	277.0	140.7	387.6	33.6	354.0
	3	.170	291.4	145.0	358.8	33.9	324.9
	4	.170	295.6	146.7	367.1	34.3	332.8
	1955 - 1	.170	287.5	142.0	377.3	35.0	342.3
	2	.170	289.0	141.3	387.4	36.1	351.3
	3	.170	291.8	143.3	396.8	36.2	360.6
	4	.170	300.7	148.6	401.9	36.5	365.4
	1956 - 1	.170	293.4	145.3	405.2	37.0	368.2
	2	.170	295.0	145.0	410.8	37.6	373.2
	3	.170	295.3	145.1	416.7	38.2	378.5
	4	.170	303.6	148.4	426.0	38.6	387.4

Appendix Table IIa (Continued)

Yr	Qtr	(1)	(2)	(3)	(4)	(5)	(6)
157	1957 - 1	.170	293.1	143.8	436.3	39.4	396.9
	2	.170	295.5	143.8	441.2	39.9	401.3
	3	.170	298.3	146.6	445.6	40.6	405.0
	4	.170	299.8	144.4	438.9	40.6	398.3
	1958 - 1	.163	305.8	148.3	427.1	41.7	385.4
	2	.154	328.9	157.6	430.4	42.4	388.0
	3	.154	325.0	153.3	439.8	43.4	396.4
	4	.154	333.5	156.7	453.0	43.7	409.3
	1959 - 1	.154	325.6	153.8	472.0	44.7	427.3
	2	.154	326.0	150.7	487.8	45.2	442.6
	3	.154	327.0	152.1	482.7	45.6	437.1
	4	.154	336.4	157.4	488.5	45.9	442.6
	1960 - 1	.154	325.7	152.0	501.3	46.6	454.7
	2	.154	330.1	154.7	505.0	47.6	457.4
	3	.153	335.5	157.6	503.5	48.9	454.6
	4	.152	349.0	164.8	503.5	49.6	453.9
	1961 - 1	.152	337.3	159.7	500.0	50.4	450.4
	2	.152	340.4	160.5	516.1	51.3	464.8
	3	.152	346.6	164.1	525.8	52.1	473.7
	4	.152	358.8	169.4	542.2	53.9	488.3
	1962 - 1	.152	348.9	164.8	547.8	55.1	492.7
	2	.152	356.2	168.6	557.2	55.6	501.6
	3	.152	358.8	169.1	564.4	56.0	508.4
	4	.152	367.3	170.5	572.0	57.1	514.9

Appendix Table IIa (Continued)

Yr	Qtr	(1)	(2)	(3)	(4)	(5)	(6)
158	1963 - 1	.152	357.4	165.3	577.4	58.1	519.3
	2	.152	364.7	167.8	584.2	58.8	525.4
	3	.152	370.0	169.4	594.7	59.6	535.1
	4	.152	386.3	176.5	605.8	61.4	544.4
	1964 - 1	.152	376.2	172.0	617.7	62.6	555.1
	2	.152	384.4	175.0	628.0	63.5	564.5
	3	.152	391.3	178.1	638.9	65.0	573.9
	4	.152	405.8	184.3	645.1	66.2	578.9
	1965 - 1	.152	397.1	180.8	662.7	66.9	595.8
	2	.152	404.9	184.5	675.4	68.0	607.4
	3	.152	411.1	186.0	690.0	69.9	620.1
	4	.152	429.7	194.2	708.4	72.5	635.9
	1966 - 1	.152	421.1	190.1	729.5	74.2	655.3
	2	.152	430.1	194.1	743.3	76.3	667.0
	3	.152	439.3	199.4	755.9	79.0	676.9
	4	.152	454.0	205.3	770.7	81.2	689.5
	1967 - 1	.152	445.1	201.5	774.4	82.7	691.7
	2	.152	451.8	203.2	784.5	84.2	700.3
	3	.152	460.4	208.3	800.9	86.4	714.5
	4	.152	479.3	217.1	815.9	89.7	726.2
	1968 - 1	.152	476.2	218.8	834.0	92.0	742.0
	2	.157	470.4	215.4	857.4	94.2	763.2
	3	.157	478.5	218.3	875.2	97.6	777.6
	4	.157	500.1	228.3	890.2	98.9	791.3

Appendix Table IIa (Continued)

Yr	Qtr	(1)	(2)	(3)	(4)	(5)	(6)
159	1969 - 1	.157	489.2	223.8	907.0	100.1	807.0
	2	.162	500.5	222.8	923.5	101.8	82.17
	3	.162	487.6	221.5	941.7	106.5	835.2
	4	.162	507.6	230.4	948.9	108.1	840.8
	1970 - 1	.162	499.2	228.1	958.5	112.4	846.1
	2	.162	510.3	230.3	970.6	114.3	856.3
	3	.162	522.5	238.4	987.4	116.1	871.3
	4	.162	538.0	243.1	911.8	117.5	874.3
	1971 - 1	.162	535.0	244.7	1,027.2	121.4	905.8
	2	.162	548.4	248.6	1,046.9	122.9	924.0
	3	.162	559.7	254.5	1,063.5	125.2	938.3
	4	.162	576.6	260.7	1,048.2	126.9	921.3
	1972 - 1	.162	573.0	261.9	1,112.5	130.9	981.6
	2	.162	587.4	267.4	1,142.4	132.6	1,009.8

NOTES TO APPENDIX TABLE IIb

Column (1)

ΔC : Net change in outstanding corporate securities (millions of dollars).

Source: Federal Reserve Bulletin

Column (2)

$S+I$: Short-term U. S. Government Debt - securities maturing within one year plus Intermediate-term U. S. Government Debt - securities maturing from one to five years (millions of dollars).

Source: Federal Reserve Bulletin

Column (3)

$\Delta(S+I)$: Change in sum of U. S. Government short-term and Intermediate debt from one quarter to the next.

Column (4)

L : Long-term U. S. Government Debt - securities maturing in five years or more (million of dollars).

Source: Federal Reserve Bulletin

Column (5)

ΔL : Change in Long-term U. S. Government Debt from one quarter to the next.

Appendix Table IIb (Continued)

Column (6)

$\Delta(S+I)+\Delta L$: Sum of Column (3) and Column (5): Total change in U. S. Government debt.

Many of the variables listed in Tables II, IIa and IIb are the same as those used by Okan, A. in his study of U. S. Government Bond interest rates, "Monetary Policy, Debt Management and Interest Rates: A Quantitative Appraisal" as published in Stabilization Policies by Brown, E. C., Prentice-Hall, N. J., 1963, pp 331-380.

APPENDIX TABLE IIb

Yr	Qtr	(1)	(2)	(3)	(4)	(5)	(6)
		ΔC millions	S+I millions	$\Delta(S+I)$	L millions	ΔL	ΔL + $\Delta(S+I)$
162	1952 - 1	1,151	71,625	-630	44,870	489	-141
	2	1,613	70,988	-637	44,085	-785	-1,422
	3	1,181	69,558	-1,430	48,125	4,040	2,610
	4	1,244	72,550	2,992	48,052	-73	2,919
	1953 - 1	1,012	71,567	-983	47,177	-875	-1,858
	2	1,638	74,647	3,080	44,482	-2,695	385
	3	894	79,599	4,952	44,462	-20	4,932
	4	1,277	79,108	-491	46,056	1,549	1,058
	1954 - 1	862	65,294	-13,814	56,519	10,463	-2,351
	2	1,016	65,189	-105	56,583	64	-41
	3	1,377	70,612	5,423	55,603	-980	4,443
	4	721	69,724	-888	59,694	4,091	3,203
	1955 - 1	949	64,581	-5,143	61,464	1,770	-3,373
	2	1,034	66,440	1,859	61,436	-28	1,831
	3	915	69,717	3,277	62,175	739	4,016
	4	1,585	75,787	6,070	58,443	3,732	9,802
	1956 - 1	970	72,810	-2,977	58,450	7	-2,970
	2	1,428	67,955	-4,855	58,349	-101	-4,956
	3	1,531	71,688	3,733	56,111	-2,238	1,495
	4	1,240	85,456	13,768	44,998	-11,113	2,655

Appendix Table IIb (Continued)

Yr	Qtr	(1)	(2)	(3)	(4)	(5)	(6)
163	1957 - 1	1,824	86,575	1,119	44,975	-23	1,096
	2	1,741	87,942	1,367	40,237	-4,738	-3,371
	3	2,000	92,238	4,296	40,211	-26	4,270
	4	1,890	95,039	2,801	38,576	-1,635	1,166
	1958 - 1	2,262	88,321	-6,718	44,420	5,844	-874
	2	1,195	82,365	-5,956	52,226	7,806	1,850
	3	1,266	91,066	8,701	45,016	-7,210	1,491
	4	1,386	97,641	6,575	44,977	-39	6,536
	1959 - 1	903	102,088	4,447	41,843	-3,134	1,313
	2	983	102,594	506	42,389	546	1,052
	3	967	107,111	4,517	42,345	-44	4,473
	4	1,406	111,941	4,830	42,285	-60	4,770
	1960 - 1	880	112,999	1,058	36,546	5,739	-4,681
	2	1,090	116,523	3,524	35,955	-591	2,933
	3	1,206	113,863	-2,660	37,541	1,586	-1,074
	4	1,859	116,280	2,417	37,235	-306	2,111
	1961 - 1	718	109,101	-7,179	42,423	5,188	-1,991
	2	2,018	111,211	2,110	40,181	-2,242	-132
	3	798	116,555	5,344	39,186	-995	4,349
	4	1,581	121,289	4,734	37,311	-1,875	2,859
	1962 - 1	938	117,306	-3,983	41,018	3,707	-276
	2	1,813	115,451	-1,855	42,057	1,039	-816
	3	734	112,733	2,718	46,049	3,992	1,274
	4	1,543	117,333	4,600	45,219	-830	3,770

Appendix Table IIb (Continued)

Yr	Qtr	(1)	(2)	(3)	(4)	(5)	(6)
1964	1963 - 1	1,009	111,287	-6,046	50,762	5,543	-503
	2	1,473	110,028	-1,259	50,333	-429	-1,688
	3	929	107,720	-2,308	52,785	2,452	144
	4	1,201	112,898	5,178	49,191	-3,594	1,584
	1964 - 1	1,235	112,501	-397	49,948	757	360
	2	1,927	110,387	-2,114	49,188	-760	-2,874
	3	1,265	103,744	-6,643	57,806	-8,618	-15,261
	4	2,043	113,353	9,609	49,912	-7,894	1,715
	1965 - 1	1,305	109,652	-3,701	52,631	2,719	-982
	2	2,755	103,004	-6,648	54,217	1,586	-5,062
	3	1,975	105,450	2,446	49,960	-4,257	-1,811
	4	2,084	110,547	5,097	49,883	-77	5,020
	1966 - 1	3,233	112,097	1,550	48,787	-1,096	454
	2	2,841	104,880	-7,217	48,686	-101	-7,318
	3	2,789	109,625	4,745	46,325	-2,361	2,384
	4	2,225	115,295	5,670	43,857	-2,468	3,202
	1967 - 1	3,522	116,982	1,687	41,611	-2,246	-559
	2	3,660	106,577	-10,405	39,928	-1,683	-12,088
	3	4,854	119,351	12,774	35,860	-4,068	8,706
	4	3,924	126,041	6,690	34,720	-1,140	5,550
	1968 - 1	2,711	123,206	-2,835	38,366	3,646	811
	2	3,816	116,392	-6,814	40,545	2,179	-4,635
	3	3,482	120,577	4,185	42,475	1,930	6,115
	4	3,953	126,063	5,486	39,715	-2,760	2,726

Appendix Table IIb (Continued)

Yr	Qtr	(1)	(2)	(3)	(4)	(5)	(6)
1969	- 1	3,676	131,110	5,047	37,825	-1,890	3,157
	2	3,861	119,493	-11,617	36,517	-1,308	-12,925
	3	3,117	129,695	10,202	31,294	-5,223	4,979
	4	3,101	134,265	4,570	28,151	-3,143	1,427
1970	- 1	3,480	140,193	5,928	25,857	-2,294	3,634
	2	6,330	133,476	-6,717	24,435	-1,422	-8,139
	3	6,051	136,564	3,088	25,909	1,474	4,562
	4	6,964	141,234	4,670	27,246	1,337	6,007
1971	- 1	6,989	134,978	-6,256	30,939	3,693	-2,563
	2	6,294	133,360	-1,618	28,504	-2,435	-4,053
	3	4,510	136,656	3,296	27,176	-1,328	1,968
	4	5,935	142,464	5,808	30,910	3,734	9,542
1972	- 1	4,698	147,377	4,913	29,404	-1,506	3,407
	2	5,050	136,665	-10,712	29,314	-90	-10,802

NOTES TO APPENDIX TABLE III

Column (1)

R_1 : Actual market yield rate on municipal bonds of one year maturity as reported by Salomon Bros. Bond index is from prime grade securities and the annual yield rate is an average of monthly rates.

Source: Salomon Bros., New York, N. Y.

Column (2)

R_2 : Actual market yield rate on municipal bonds of two year maturity, prime grade, Salomon Bros. index.

Column (3)

${}_{t+1}r_{1t}$: Forward yield rate on a municipal bond of one year maturity starting at the beginning of period $t+1$, implied by the market rates existing at the beginning of period, t .

$${}_{t+1}r_{1t} = \frac{(1+tR_{2t})^2}{(1+tR_{1t})} - 1$$

Column (4)

E_t : Error between actual and expected short-term municipal bond yield rates, Column (1) at time, t , less Column (3) at time, $t-1$.

Column (5)

R_{30} : Actual market yield rate on municipal bonds of 30 year maturity as reported by Salomon Bros. Bond index is from prime grade securities and the annual yield rate is an average of monthly rates.

Source: Salomon Bros., New York, N. Y.

Appendix Table III (Continued)

Column (6)

ΔR_{30} : Change in yield rate on municipal bonds of prime grade from one year to the next. Maturity is 30 years, annual rate is average of monthly rates.

APPENDIX TABLE III

Empirical Data for Variables in Model III
(yearly observations)

	(1)	(2)	(3)	(4)	(5)	(6)
	R_1	R_2	$t+1r_{1t}$	E_t , Error	R_{30}	ΔR_{30}
Year	%	%	%	%	%	%
1959	2.20	2.35	2.50		3.35	
1960	2.05	2.30	2.54	-.45	3.40	.05
1961	1.50	1.75	2.00	-1.04	3.35	-.05
1962	1.60	1.75	1.89	-.40	3.20	-.15
1963	1.75	1.90	2.05	-.14	3.20	.00
1964	2.10	2.25	2.39	.05	3.25	.05
1965	2.35	2.50	2.64	-.04	3.30	.05
1966	3.40	3.45	3.50	.76	3.75	.45
1967	3.00	3.15	3.30	-.50	3.90	.15
1968	3.30	3.45	3.60	.00	4.35	.45
1969	4.55	4.70	4.84	.95	5.65	1.30
1970	4.35	4.50	4.64	-.49	6.35	.70
1971	2.90	3.10	3.30	-1.74	5.55	-.80
1972	2.75	3.00	3.25	-.55	5.20	-.35
1973	3.95	4.05	4.14	.75	5.20	.00

NOTES TO APPENDIX TABLE IIIa

Column (1)

R_1 : Actual market yield rate on prime municipal bonds of one-year maturity as reported by Salomon Bros. Index. Observations are monthly averages.

Source: Salomon Bros., New York, N. Y.

Column (2)

R_2 : Same as Column (1) except municipal bonds have a two-year maturity.

Column (3)

${}_{t-1}r_{1t}$: Forward rate on prime municipal bonds of one-year maturity starting at the beginning of period, $t+1$, implied by the market yields existings at the beginning of period, t .

$${}_{t+1}r_{1t} = \frac{(1+tR_{2t})^2}{(1+tR_{1t})} - 1$$

Column (4)

E_t : Error between actual and expected short-term municipal bond yield rates. Column (1) less Column (3).

Column (5)

R_{30} : Actual market yield-to-maturity on prime grade municipal bonds of 30-year maturity as reported by Salomon Bros. Index. Observations are monthly averages.

Source: Salomon Bros., New York, N. Y.

Appendix Table IIIa (Continued)

Column (6)

ΔR_{30} change in yield on prime grade municipal bonds of 30 year maturity from one month to the next.

APPENDIX TABLE IIIa

Empirical Data for Variables in Model III
(monthly observations)

	(1)	(2)	(3)	(4)	(5)	(6)
	R_1	R_2	$t+1^r 1_t$	E, Error	R_{30}	ΔR_{30}
Year	%	%	%	%	%	%
1962-J	1.75	1.85	1.95	-.25	3.30	.00
F	1.70	1.80	1.90	-.25	3.25	-.05
M	1.65	1.85	2.05	-.25	3.30	.05
A	1.60	1.85	2.10	-.45	3.20	-.10
M	1.55	1.70	1.85	-.55	3.15	-.05
J	1.55	1.70	1.85	-.30	3.25	.10
J	1.60	1.75	1.90	-.25	3.25	.00
A	1.70	1.80	1.90	-.20	3.35	.10
S	1.65	1.70	1.75	-.25	3.25	-.10
O	1.60	1.70	1.80	-.15	3.15	-.10
N	1.50	1.65	1.80	-.30	3.10	-.05
D	1.60	1.65	1.70	-.20	3.10	.00
1963-J	1.60	1.70	1.80	-.10	3.10	.00
F	1.60	1.80	2.00	-.20	3.15	.05
M	1.60	1.75	1.90	-.40	3.15	.00
A	1.55	1.70	1.85	-.35	3.10	-.05
M	1.60	1.75	1.90	-.25	3.15	.05
J	1.65	1.80	1.95	-.25	3.15	.00
J	1.75	1.90	2.05	-.20	3.20	.05
A	1.90	2.00	2.10	-.15	3.20	.00
S	1.95	2.05	2.15	-.15	3.20	.00
O	2.00	2.05	2.10	-.15	3.25	.05
N	1.95	2.10	2.25	-.15	3.25	.00
D	2.00	2.15	2.30	-.25	3.30	.05
1964-J	2.05	2.15	2.25	-.25	3.25	-.05
F	2.00	2.10	2.20	-.25	3.20	-.05
M	2.00	2.10	2.20	-.20	3.20	.00
A	2.10	2.30	2.50	-.10	3.35	.15
M	2.10	2.30	2.50	-.40	3.30	-.05
J	2.10	2.25	2.40	-.40	3.25	-.05
J	2.15	2.25	2.35	-.25	3.25	.00
A	2.15	2.25	2.35	-.20	3.25	.00
S	2.15	2.25	2.35	-.20	3.25	.00
O	2.20	2.30	2.40	-.15	3.30	.05
N	2.20	2.30	2.40	-.20	3.30	.00
D	2.20	2.40	2.60	-.20	3.25	-.05

Appendix Table IIIa (Continued)

Year	(1)	(2)	(3)	(4)	(5)	(6)
1965-J	2.25	2.35	2.45	-.35	3.20	-.05
F	2.20	2.25	2.30	-.25	3.15	-.05
M	2.25	2.35	2.45	-.05	3.25	.10
A	2.25	2.40	2.55	-.20	3.20	-.05
M	2.25	2.40	2.55	-.30	3.20	.00
J	2.25	2.40	2.55	-.30	3.25	.05
J	2.30	2.45	2.60	-.25	3.35	.10
A	2.30	2.45	2.60	-.30	3.35	.00
S	2.40	2.50	2.60	-.20	3.35	.00
O	2.50	2.65	2.80	-.10	3.40	.05
N	2.50	2.70	2.90	-.30	3.40	.00
D	2.60	2.80	3.00	-.30	3.50	.10
1966-J	2.90	3.00	3.10	-.10	3.60	.10
F	2.90	3.00	3.10	-.20	3.50	-.10
M	3.15	3.20	3.25	.05	3.75	.25
A	3.10	3.15	3.20	-.15	3.50	-.25
M	3.15	3.25	3.35	-.05	3.55	.05
J	3.25	3.35	3.45	-.10	3.60	.05
J	3.30	3.45	3.60	-.15	3.80	.20
A	3.70	3.70	3.70	.10	3.80	.00
S	4.10	4.10	4.10	.40	4.10	.30
O	3.90	3.90	3.90	-.20	3.90	-.20
N	3.75	3.75	3.75	-.15	3.75	-.15
D	3.65	3.70	3.75	-.10	3.85	.10
1967-J	3.50	3.50	3.50	-.25	3.65	-.20
F	2.75	2.85	2.95	-.75	3.35	-.30
M	2.90	3.00	3.10	-.05	3.70	.35
A	2.75	2.80	2.85	-.35	3.65	-.05
M	2.45	2.65	2.85	-.40	3.75	.10
J	2.55	2.75	2.95	-.30	3.95	.20
J	3.00	3.20	3.40	.05	4.05	.10
A	3.15	3.30	3.45	-.25	3.90	-.15
S	3.05	3.20	3.35	-.40	3.95	.05
O	3.15	3.25	3.35	-.20	4.15	.20
N	3.25	3.40	3.55	-.10	4.15	.00
D	3.55	3.70	3.85	.00	4.30	.15
1968-J	3.55	3.70	3.85	-.30	4.30	.00
F	3.25	3.40	3.55	-.60	4.10	-.20
M	3.35	3.55	3.75	-.20	4.30	.20
A	3.50	3.70	3.90	-.25	4.45	.15
M	3.50	3.60	3.70	-.40	4.35	-.10
J	3.75	3.85	3.95	.05	4.45	.10
J	3.60	3.70	3.80	-.35	4.30	-.15
A	3.05	3.25	3.45	-.75	4.10	-.20
S	3.00	3.20	3.40	-.45	4.40	.30
O	2.90	3.10	3.30	-.50	4.35	-.05
N	3.00	3.25	3.50	-.30	4.60	.25
D	3.15	3.30	3.45	-.35	4.65	.05

Appendix Table IIIa (Continued)

Year	(1)	(2)	(3)	(4)	(5)	(6)
1969-J	3.70	3.90	4.10	.25	4.90	.25
F	4.00	4.00	4.00	-.10	4.95	.05
M	4.00	4.05	4.10	.00	5.10	.15
A	4.20	4.30	4.40	.10	5.40	.30
M	4.00	4.10	4.20	-.40	5.15	-.25
J	4.50	4.70	4.90	.30	5.80	.65
J	5.00	5.05	5.10	.10	5.70	-.10
A	5.00	5.10	5.20	-.10	5.80	.10
S	5.20	5.40	5.60	.00	6.35	.55
O	5.00	5.10	5.20	-.60	6.00	-.35
N	5.00	5.15	5.30	-.20	6.00	.00
D	5.25	5.35	5.45	-.05	6.50	.50
1970-J	5.40	5.60	5.80	-.05	6.60	.10
F	5.00	5.10	5.20	-.80	6.55	-.05
M	4.45	4.55	4.65	-.75	5.90	-.65
A	4.30	4.40	4.50	-.35	6.10	.20
M	4.75	4.85	4.95	.25	6.65	.55
J	5.00	5.15	5.30	.05	6.95	.30
J	4.80	5.00	5.20	-.50	6.80	-.15
A	4.40	4.60	4.80	-.80	6.45	-.35
S	4.00	4.15	4.30	-.80	6.10	-.35
O	4.00	4.25	4.50	-.30	6.40	.30
N	3.60	3.75	3.90	-.90	6.25	-.15
D	2.50	2.75	3.00	-1.40	5.25	-1.00
1971-J	3.05	3.25	3.45	.05	5.50	.25
F	2.60	2.70	2.80	-.85	5.20	-.30
M	2.40	2.60	2.80	-.40	5.40	.20
A	2.25	2.50	2.75	-.55	5.20	-.20
M	2.75	2.90	3.05	.00	5.70	.50
J	3.25	3.45	3.65	.20	6.05	.35
J	3.45	3.65	3.85	-.20	6.25	.20
A	3.30	3.50	3.70	-.55	6.00	-.25
S	3.10	3.30	3.50	-.60	5.60	-.40
O	3.00	3.20	3.40	-.50	5.25	-.35
N	2.70	2.90	3.10	-.70	5.15	-.10
D	2.90	3.15	3.40	-.20	5.40	.25

NOTES ON APPENDIX TABLE IIIb

Column (1)

R_{20} : Average yield to maturity of the four top grades of municipal bonds with maturities of 20 years or more as reported by Moody's Investors Service, Inc. Moody's tax-exempt bond averages are constructed from a broad sampling of general market names selling in the new-issue market.

Source: Moody's Investors Services, Inc.

Column (2)

R_{10} : Average yield-to-maturity on general obligation state bonds with maturity of 10 years. The same procedures are followed by Moody's Investors Service as outlined for Column (1).

Source: Moody's Investors Services, Inc.

Column (3)

${}_{t+10}r_{10t}$: Forward interest rate or yield on an average municipal bond of 10 year maturity starting at the beginning of period $t+10$, implied by the market yields existing at the beginning of period, t .

$${}_{t+10}r_{10t} = \frac{(1+{}^R_{20t})^2}{(1+{}^R_{10t})} - 1$$

APPENDIX TABLE IIIb

Empirical Data for Variables in Model III
(monthly observations)

Year	(1) $R_{20} \%$	(2) $R_{10} \%$	(3) $t+10r_{10t} \%$
1952-J	2.14	1.54	2.74
F	2.10	1.52	2.68
M	2.09	1.48	2.70
A	2.04	1.45	2.63
M	2.05	1.44	2.66
J	2.14	1.49	2.79
J	2.17	1.53	2.81
A	2.23	1.56	2.90
S	2.35	1.69	3.01
O	2.43	1.76	3.10
N	2.41	1.67	3.16
D	2.44	1.71	3.18
1953-J	2.52	1.78	3.27
F	2.65	1.89	3.42
M	2.76	1.94	3.59
A	2.76	1.96	3.57
M	2.84	2.06	3.63
J	3.12	2.35	3.90
J	3.03	2.37	3.69
A	2.99	2.28	3.70
S	2.99	2.25	3.74
O	2.83	2.07	3.60
N	2.64	1.86	3.43
D	2.67	1.82	3.53
1954-J	2.62	1.76	3.49
F	2.54	1.65	3.44
M	2.50	1.62	3.39
A	2.56	1.70	3.43
M	2.59	1.72	3.47
J	2.59	1.72	3.47
J	2.39	1.53	3.26
A	2.31	1.47	3.16
S	2.34	1.49	3.20
O	2.37	1.52	3.23
N	2.34	1.52	3.17
D	2.40	1.55	3.26

Appendix Table IIb (Continued)

Year	(1)	(2)	(3)
1955-J	2.48	1.69	2.74
F	2.49	1.75	2.68
M	2.49	1.76	2.70
A	2.50	1.78	2.63
M	2.48	1.79	2.66
J	2.49	1.84	2.79
J	2.62	2.03	2.81
A	2.69	2.12	2.90
S	2.70	2.13	3.01
O	2.64	2.10	3.10
N	2.60	2.06	3.16
D	2.70	2.21	3.18
1956-J	2.69	2.24	3.14
F	2.63	2.21	3.05
M	2.67	2.24	3.10
A	2.83	2.40	3.26
M	2.83	2.43	3.23
J	2.71	2.32	3.10
J	2.79	2.39	3.19
A	2.94	2.52	3.36
S	3.06	2.67	3.45
O	3.12	2.70	3.54
N	3.39	2.95	3.83
D	3.57	3.18	3.96
1957-J	3.51	3.15	3.87
F	3.29	2.99	3.59
M	3.36	3.02	3.70
A	3.35	3.01	3.69
M	3.48	3.10	3.86
J	3.65	3.25	4.05
J	3.65	3.30	4.00
A	3.84	3.47	4.21
S	3.89	3.52	4.26
O	3.74	3.40	4.08
N	3.67	3.37	3.97
D	3.33	3.05	3.61

Appendix Table IIIb (Continued)

Year	(1)	(2)	(3)
1958-J	3.17	2.81	3.53
F	3.15	2.68	3.62
M	3.23	2.69	3.77
A	3.16	2.58	3.74
M	3.12	2.51	3.73
J	3.15	2.53	3.77
J	3.23	2.62	3.84
A	3.50	2.77	4.24
S	3.74	3.02	4.47
O	3.69	3.01	4.37
N	3.59	2.99	4.19
D	3.57	3.02	4.12
1959-J	3.60	3.13	4.07
F	3.57	3.12	4.02
M	3.44	2.99	3.89
A	3.53	3.04	4.02
M	3.70	3.15	4.25
J	3.80	3.23	4.37
J	3.92	3.36	4.48
A	3.84	3.25	4.43
S	3.95	3.41	4.49
O	3.90	3.41	4.39
N	3.81	3.34	4.28
D	3.84	3.35	4.33
1960 - J	3.92	3.43	4.41
F	3.84	3.31	4.37
M	3.77	3.23	4.31
A	3.72	3.17	4.27
M	3.75	3.21	4.29
J	3.74	3.20	4.28
J	3.73	3.15	4.31
A	3.57	3.02	4.12
S	3.55	2.91	4.19
O	3.64	3.03	4.25
N	3.57	2.94	4.20
D	3.53	2.89	4.17

Appendix Table IIIb (Continued)

Year	(1)	(2)	(3)
1961-J	3.56	2.91	4.21
F	3.54	2.87	4.21
M	3.60	2.93	4.27
A	3.61	2.97	4.25
M	3.57	2.92	4.22
J	3.63	3.00	4.26
J	3.63	3.02	4.24
A	3.62	3.02	4.22
S	3.64	2.99	4.29
O	3.59	2.95	4.23
N	3.57	2.94	4.20
D	3.63	2.93	4.33

NOTES ON APPENDIX TABLE IIIc

Column (1)

R_{10} : Average yield-to-maturity on general obligation state bonds with maturity of 10 years. These averages are constructed from a broad sampling of general market names selling in the new-issue market.

Source: Moody's Investors Service, Inc.

Column (2)

E_t : Error between actual and expected yields of 10 year municipal bonds Column (1) at time, t , less Column (3) Table IIIb at time, $t-10$.

Column (3)

R_{20} : Average yield-to-maturity of the four top grades of municipal bonds with maturities of 20 years or more as reported by Moody's Investors Service, Inc. Moody's tax-exempt bond averages are constructed from a broad sampling of general market names selling in the new-issue market.

Source: Moody's Investors Service, Inc.

Column (4)

ΔR_{20} : Change in interest rate or yield on high grade municipal bonds of 20 year or longer maturity from one month to the next.

APPENDIX TABLE IIIc

Empirical Data for Variables in Model III

Year	(1)	(2)	(3)	(4)
	R_{10} %	error %	R_{20} %	ΔR_{20} %
1962-J	2.93	.19	3.55	-.08
F	2.82	.14	3.40	-.15
M	2.75	.05	3.30	-.10
A	2.68	.05	3.21	-.09
M	2.70	.04	3.21	.00
J	2.78	-.01	3.31	.10
J	2.84	.03	3.37	.06
A	2.80	-.10	3.38	.01
S	2.71	-.30	3.28	-.10
O	2.64	-.46	3.21	-.07
N	2.57	-.59	3.15	-.06
D	2.63	-.55	3.22	.07
1963-J	2.63	-.64	3.22	.00
F	2.65	-.77	3.21	-.01
M	2.64	-.95	3.21	.00
A	2.63	-.94	3.21	.00
M	2.66	-.97	3.21	.00
J	2.75	-1.15	3.31	.10
J	2.75	-.94	3.31	.00
A	2.76	-.94	3.28	-.03
S	2.83	-.91	3.31	.03
O	2.88	-.72	3.33	.02
N	2.93	-.50	3.36	.03
D	2.89	-.64	3.33	-.03
1964-J	2.86	-.63	3.29	-.04
F	2.82	-.62	3.27	-.02
M	2.93	-.46	3.33	.06
A	2.92	-.51	3.30	-.03
M	2.93	-.54	3.29	-.01
J	2.94	-.53	3.20	.00
J	2.92	-.34	3.26	-.03
A	2.91	-.25	3.27	.01
S	2.93	-.27	3.30	.03
O	2.95	-.28	3.31	.01
N	2.93	-.24	3.27	-.04
D	2.87	-.39	3.33	.06

Appendix Table IIIc (Continued)

Year	(1)	(2)	(3)	(4)
1965-J	2.83	-.45	3.18	-.15
F	2.84	-.40	3.18	.00
M	2.94	-.29	3.28	.10
A	2.94	-.29	3.28	.00
M	2.94	-.23	3.28	.00
J	2.99	-.15	3.32	.04
J	3.01	-.20	3.34	.02
A	3.00	-.26	3.32	-.02
S	3.09	-.18	3.41	.09
O	3.14	-.04	3.46	.05
N	3.17	.03	3.50	.04
D	3.24	.05	3.56	.06
1966-J	3.79	.65	3.56	.00
F	3.35	.30	3.66	.10
M	3.43	.33	3.78	.12
A	3.37	.11	3.68	-.10
M	3.44	.21	3.76	.08
J	3.51	.41	3.84	.08
J	3.74	.55	4.02	.18
A	3.90	.54	4.16	.14
S	3.95	.50	4.18	.02
O	3.86	.32	4.09	-.09
N	3.81	-.02	4.01	-.08
D	3.83	-.13	4.01	.00
1967-J	3.55	-.32	3.74	-.27
F	3.29	-.30	3.62	-.12
M	3.29	-.41	3.62	.00
A	3.22	-.47	3.67	.05
M	3.44	-.42	3.94	.27
J	3.54	-.51	4.02	.08
J	3.72	-.28	4.11	.09
A	3.71	-.50	4.06	-.05
S	3.76	-.50	4.14	.08
O	3.81	-.27	4.25	.11
N	3.92	-.05	4.32	.07
D	4.10	.49	4.42	.10

Appendix Table IIIc (Continued)

Year	(1)	(2)	(3)	(4)
1968-J	3.97	.44	4.31	-.11
F	3.89	.27	4.28	-.03
M	4.08	.31	4.54	.26
A	3.98	.24	4.44	-.10
M	4.16	.43	4.59	.15
J	4.12	.35	4.59	.00
J	3.98	.14	4.45	-.14
A	3.78	-.46	4.29	-.16
S	3.87	-.60	4.45	.16
O	3.87	-.50	4.49	.04
N	4.02	-.17	4.60	.11
D	4.18	.06	4.76	.16
1969-J	4.29	.22	4.89	.13
F	4.50	.48	5.02	.13
M	4.69	.80	5.25	.23
A	4.70	.68	5.24	-.01
M	4.86	.61	5.39	.15
J	5.43	1.06	5.78	.39
J	5.41	.93	5.80	.02
A	5.57	1.14	5.98	.18
S	5.74	1.25	6.21	.23
O	5.67	1.28	6.12	-.09
N	5.79	1.51	6.25	.13
D	6.20	1.87	6.84	.59
1970-J	5.96	1.55	6.74	-.10
F	5.62	1.25	6.47	-.27
M	5.25	.94	6.08	-.39
A	5.48	1.21	6.50	.42
M	5.96	1.67	7.00	.50
J	6.11	1.83	7.12	.12
J	5.75	1.44	6.68	-.44
A	5.43	1.31	6.27	-.41
S	5.10	.91	6.18	-.09
O	4.90	.65	6.41	.23
N	4.38	.18	6.04	-.37
D	4.04	-.13	5.49	-.55

Appendix Table IIIc (Continued)

Year	(1)	(2)	(3)	(4)
1971-J	4.01	-.20	5.34	-.15
F	4.01	-.20	5.28	-.06
M	4.03	-.24	5.26	-.02
A	4.15	-.10	5.49	.23
M	4.76	.54	5.99	.50
J	4.80	.54	5.98	-.01
J	4.87	.63	6.12	.14
A	4.71	.49	5.84	-.28
S	4.32	.03	5.45	-.39
O	3.95	-.28	5.05	-.40
N	4.18	-.02	5.20	.15
D	4.26	-.07	5.24	.04

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