

Least-Squares Construction of the Yield Curves for Italian Government Securities, 1957-1967 (*)

PART I GENERAL INTRODUCTION TO THE ITALIAN BOND MARKET
AND MAIN RESULTS (**)

Introduction

Economists quite often work on "heroic assumptions". On these lines it is mostly common to speak of "the rate of interest". Unfortunately, when we are confronted with actual market rates, we realize how difficult it is to select a "representative" rate of interest. The structure of interest rates appears to be widely spread and differentiated; moreover, it is not invariant with respect to time.

Many differentiating factors determine the observable variety of yields from different obligations: risk of default in promised payments, marketability, coupon rates, call provisions, tax advantages, eligibility as collateral for special purposes, and so forth. However, especially from a theoretical point of view, the most important determinant of the observed yield differentials seems to be the term to maturity of the considered obligations. To analyze this determinant a special substructure must be examined: the term structure of interest rates, where we are concerned with differences in yields from obligations being equal, except for their term to maturity.

In order to study this substructure it is therefore necessary to consider the yields to maturity of a group of homogeneous bonds.

(*) I wish to express my gratitude to Professor Sir John Hicks for his continuous help and encouragement, and to Mr. Robert Bacon for helpful advice. Responsibility for all remaining errors is of course entirely mine. Computations were performed at the Computing Laboratory of Oxford University.

(**) The second part of this paper, which is technically an Appendix to the first one, is specifically devoted to a description of the statistical procedure followed and reports the numerical data obtained. It will be published in the next issue of this *Review*.

Conventionally, the "yield to maturity" (or "internal rate of return") of a bond maturing in n years, at a given time t (${}_tY_n$), is that (annual) interest rate which equates the present values of the stream of payments (coupons C to be received as interest and principal F to be repaid at maturity) from the bond to its market price P :

$$P = \frac{C}{1 + {}_tY_n} + \frac{C}{(1 + {}_tY_n)^2} + \dots + \frac{C + F}{(1 + {}_tY_n)^n}$$

However, this conventionally calculated n -year yield is not in general equal to the true n -year-holding-period yield at the same time t . It would be equal only if the intermediate coupon receipts could actually be reinvested at the rate ${}_tY_n$, which clearly need not be true. Hence, the internal rate of return is not a completely unambiguous criterion to evaluate different bond investment opportunities (1). It should in fact be pointed out that if there is a flow of intermediate coupon payments from a bond with n years to maturity, the true redemption yield (i.e. the true n -year-holding-period yield) cannot in principle be defined *ex-ante*, as it will depend on the future spot rates, which are unknown at time t : the intermediate coupon payments will be invested at rates unknown at t .

A related but logically separate difficulty is due to the fact that the concept itself of maturity is not unambiguous once coupon payments are allowed for: the same date of final payment may imply different patterns of intermediate payments. Thus, especially in the case of long-term bonds, the average term-to-maturity of the payments stream is only very loosely related to the final redemption date. These problems have been raised by Macaulay, who proposed to indicate as "duration" the true longness of a loan. As he put it: "'duration' is a reality of which 'maturity' is only one factor" (2). He proposed as a measure of duration a weighted average of the maturities of the individual loans that correspond to each future

(1) This is only a particular case of the logical difficulties involved in using the internal rate of return as a criterion to evaluate investment opportunities in general. The relevant literature on this problem goes back at least to Fisher and Keynes. For a more recent analysis see J. HIRSHLEIFER, "On the Theory of the Optimal Investment Decision", *Journal of Political Economy*, August 1958. For other references see E. SOLOMON (ed.), *The Management of Corporate Capital*, Illinois, The Free Press of Glencoe, 1959 (A publication of the Graduate School of Business, The University of Chicago).

(2) See F. MACAULAY, *Some Theoretical Problems Suggested by the Movements of Interest Rates, Bond Yields and Stock Prices in the United States since 1856*, Publication No. 33, N.B.E.R., New York, 1938, p. 45.

payment. This, of course, brings us back to the problem of how to weight future loans to discount them back to their present values (3). Using, in a simple example, as discount rate the rate corresponding to the redemption yield of the bond, which admittedly seems the best procedure, Macaulay shows the strikingly different results obtained considering duration instead of maturity. From his results (4) it can easily be seen that, while for short-term bonds the two concepts are closely connected, especially for very-long-term bonds, the importance of the maturity date on duration "may be so small as to be almost negligible" (5).

To avoid these difficulties the theoretical analysis of the term structure is often made on the assumption that the coupon rate is equal to zero (i.e. on the Hicksian assumption that there are no payments prior to redemption). In this case in fact the concepts of "internal rate of return" and "true n -year-holding-period yield" and those of "maturity" and "duration" clearly coincide.

Once we have adjusted the observed interest rates so as to make them alike in every respect except term to maturity, we can construct a curve describing the relationship between these yields and term to maturity: the yield curve. Along the abscissa we measure years to maturity and along the ordinate annual yield to maturity. Empirically we shall observe only a certain number of yields from issues of different maturities; however, a smooth and continuous yield curve is normally constructed (6). The method of construction and smoothing of a yield curve is subjectively chosen. This must be taken into account when interpreting differences obtained in empirical investigations on the term structure of interest rates: different results possibly depending only on the different methods employed to fit the curve (7). The curves actually observed show a great

(3) Macaulay makes the point that *a priori* it would also be possible to use *future* (instead of *present*) value weighting, although this approach leads in general to absurd results. For a stimulating analysis of the problems and difficulties involved in the two concepts of maturity and duration, see *ibid.*, Chapter 2.

(4) *Ibid.*, p. 51.

(5) *Ibid.*, p. 44.

(6) A continuous curve obviously permits a better appraisal of the term structure, in comparison to that which might be obtained by means of a finite number of points; but the main reason for the construction of continuous yield curves is due to the necessity for many investigations of having a series of data on yields at different (precise) years (months) to maturity.

(7) I shall return in greater detail to this point, and in general to the technical problems connected with the construction of yield curves, in the second part of this paper.

variety of shapes; however, four general forms can be selected, as shown in Chart 1.

The curves empirically obtained are normally based on yearly, quarterly, or monthly market observations. They can be represented over a span of time by means of a three-dimensional chart following S. Homer's suggestions (8). For each term to maturity, average yields can be computed for the considered time span, thus obtaining a composite yield curve which, in the absence of secular trends, and

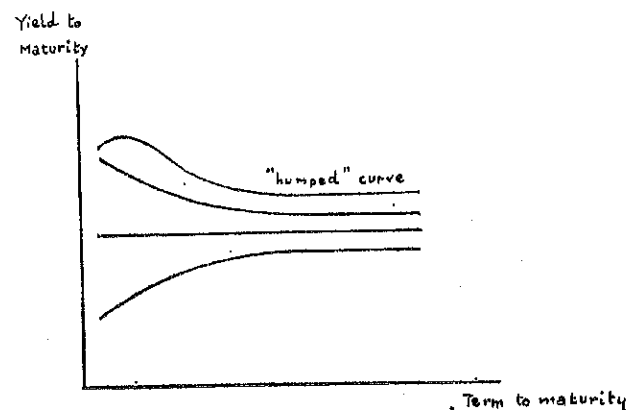


Chart 1 - Common Types of Yield Curves.

with cycles approximately balancing, should represent more or less "normal" conditions.

This study is precisely devoted to the construction of yield curves by means of least-squares interpolation analysis in relation to the Italian experience. As we have seen, in order to study in a meaningful way the term structure of interest rates, it is essential to construct reliable yield curves for a group of homogeneous securities. It is also evident that any quantitative analysis of the term structure requires the availability of statistical series of data on redemption yields derived from the actual construction of yield curves. Unfortunately, no such data are available in relation to the Italian experience. This study appears to be the first attempt in this direction: it should therefore be taken as a first step. However,

(8) S. HOMER, *A History of Interest Rates*, New Brunswick, Rutgers University Press, 1963, pp. 380-81.

the features of the Government securities selected and the theoretical procedure followed might perhaps be of some general interest.

In order to make this paper easier to read I left a detailed analysis of the technical problems connected with yield-curve-construction, together with a brief survey of the relevant literature on the subject and a description of the particular procedure followed in the second part of this paper. It is, however, immediately clear that the set of securities considered should represent a relevant share of the market, so as to avoid the difficulties of transactions in "thin" markets; next, the chosen securities must be actively traded, i.e. they should be highly "marketable" assets, to avoid as far as possible confusions between "liquidity premia" and transactions costs; thirdly, they should not present large gaps in the maturity continuum, which would obviously imply extremely serious difficulties for the construction of reliable yield curves; finally, and more generally, the securities selected should not differ with respect to important properties, which would make it difficult to obtain comparable redemption yields.

Section I of this paper aims therefore not only at giving a very brief introductory outline of the Italian financial system, and, in particular, of the Italian bond market (9) — so as to give the reader a brief knowledge of the institutional system in Italy — but should also provide an explanation of the reasons which led me to select a certain group of Treasury securities — the B.T.P. (*Buoni del Tesoro Poliennali*) — for the construction of the yield curves and the quantitative analysis of the term structure in relation to the Italian experience.

1. Some Notes on the Bond Market in Italy

1.1. *A Brief Outline of the Italian Financial System*

An attempt to give a comprehensive survey of Italy's financial system and its recent developments would certainly be too lengthy and probably out of place here (10). In this section I shall therefore

(9) For a detailed analysis of the post-war evolution of the Italian bond market see B. BIANCHI and E. PERFETTI, "Le emissioni di valori mobiliari", *Bollettino* of the Bank of Italy, September-October 1967, and ID., "Valori mobiliari, consistenze ed emissioni nette suddivise per gruppi di investitori", *Bollettino cit.*, September-December 1968.

(10) The best general references are the annual *Relazioni* of the Bank of Italy (abridged versions of the *Reports* are available in English). In particular, for an illuminating analysis of the post-war evolution of the Italian monetary system and of the general impacts of Italian

confine myself to elucidate the main points which are essentially peculiar to the Italian system and to underline the most important recent developments.

The Italian financial system is apparently characterized by its simplicity and by the rigidity of the banking sector. Thus, one reads that essential non-bank financial intermediaries, like building societies and hire-purchase finance companies, do not exist in Italy, while insurance institutions are rather backward and do not have a real impact on the financial market. When we come to the banking sector we find that by law there is a clear distinction between the deposit banks and investment banks. Deposit banks are restricted to short-term lending. Direct banking portfolio investment in equities is not allowed. Moreover, one single customer may not borrow from any one bank more than 20 per cent of that bank's capital and general reserves. Industrial long-term lending should therefore be confined to investment banks (11) which derive their resources mainly through bond issues. A cartel agreement among the banks, which is officially recognized by the monetary authorities, regulates minimum lending rates and maximum rates on deposits, all rates being linked to the official discount rate.

On the basis of the above elements one is clearly tempted to draw the conclusion that the links between long- and short-term markets are rather loose and that institutional segmentations should therefore play an essential role to explain the term structure of interest rates in Italy. This conclusion, however, does not appear to be correct. If we compare yields from securities differing only with respect to term to maturity, it is clear that the links between short and long rates have been fairly close; moreover, they can be shown to be consistent with an expectational approach to the explanation of the term structure, independently of market segmentations. In doing this, we must clearly compare yields from securities as far as possible identical in all respects, except term to maturity, which, in turn, implies the construction of yield curves for bonds with different redemption dates and their quantitative analysis. One must not jump, for example, to the conclusion that short-term rates in

monetary policy, see P. BARRI, "Monetary Developments in Italy from 1961 to 1965", in this Review, No. 76, March 1966, and *Studi sulla Moneta*, Milano, Giuffrè, 1965 (many essays are available in English).

(11) They are called *istituti speciali di credito*: special credit institutions, and are subdivided in: (1) *istituti speciali di credito mobiliare* and (2) *istituti speciali di credito immobiliare*.

Italy fluctuate less than long-term ones from the fact that the official discount rate (or the yield on 12-month Treasury bills) was practically the same during the 11 years considered in this study (1957-1967) (12), while yields on long-term government bonds showed remarkable fluctuations.

To avoid any possible misunderstanding I should like to make it clear that I am certainly *not* contending that market segmentations are *always* irrelevant. This would clearly be absurd. All I want to say is that segmentations in relation to the Italian domestic market have been essentially formal for the recent period considered in this study and did not prevent close links between long and short rates, at least with respect to the maturity range which will be explicitly examined, and to the important group of securities considered.

The reason why the stringent institutional ties mentioned above did not prevent close connections between long- and short-term rates in Italy is that they were not effectively implemented. Borrowers, for example, have commonly used nominally short-term loans to finance long-term investment, due to the practical facility of renewal. In fact, as we shall see, the share of private outstanding bonds with respect to government and government-backed bonds is relatively small. This reflects the common practice of firms to rely essentially for external financing either on continually renewed deposit-banks' credit or on the loans of the above mentioned special credit institutions, instead of issuing their own bonds. The reason for this behaviour is partly due to the fact that fiscal inducements (13) tend to bias towards this indirect form of financing, but is clearly also due to the great ease with which it is possible to obtain these loans, even for quite substantial amounts.

(12) For an analysis of the movements of the official discount rate and the yield on 12-month Treasury bills see below footnotes (16) to (19). It should be pointed out, from a general point of view, that in this paper I will not consider explicitly the important experiences and shifts in monetary policy which have taken place in 1968 and 1969. Precisely because of their importance a meaningful and detailed analysis would certainly be too long to be included in this paper.

(13) Borrowers must pay as direct taxes on their interest payments to lenders a share which progressively increased from 23.10 per cent in 1950 to 33.75 per cent in 1967. They have, in principle, the right of repayment (*diritto di rivalsa*) for these taxes from income recipients; but in practice, in order to give lenders a tax-free income, this right is not exercised. Since 1961, however, special credit institutions have been essentially exempted from payments of these taxes (they pay a subscription rate approximately equal to 1 per cent of their interest payments). If one takes also into account that capital taxes on the funds borrowed are, moreover, slightly favourable to the special credit institutions, it becomes clear that it is often cheaper to raise funds through the intermediation of these institutions.

Coming to the reasons why the formal distinction between deposit banks and special credit institutions is in practice blurred, the most important one is perhaps that the latter are in many cases just a "special section" of the former. The links are also reinforced by the fact that commercial banks can freely invest in bonds, i.e. they always have the choice between direct commercial credit (which, as we have seen, can be successively renewed to finance long-term investment) and portfolio investment in bonds. In general they can therefore either face default risk on commercial and industrial credit or face risks associated with changes in interest rates with respect to their bond portfolios (14).

The actual flexibility of the Italian banking system (15) is clearly shown by the fact that the cartel agreement has been in practice often infringed, with substantial fluctuations from the official rates. In particular, Anglo-Saxon readers should not interpret official statistics reporting that the discount rate has not been changed from 1958 to 1969 as an indication of a remarkable stability in the Italian money market during this period (16). The reason for this constancy is simply that credit from the central bank is not an automatic right; unlike the Bank of England, the Bank of Italy is no unlimited lender of last resort. Credit from the central bank is supplied to the banking system in the normal ways, i.e. through rediscounts and advances, but there is no automatic granting of credit. This is of course a most powerful weapon in the hands of the central bank, which makes policy decisions felt by varying the availability of credit and not its official cost. In other words, the official discount rate is clearly a non-market clearing rate. The impacts of policy directives are

(14) An important bias towards bond portfolio investment is that it implies lower clerical costs. One might even say that these costs are essentially fixed costs as, clearly, there is always diversification and therefore a certain amount of funds is anyhow invested in bonds; but, while the cost of having investment analysts and stock-exchange brokers is largely independent of the amounts transacted, this is certainly not true for commercial credit operations.

(15) One might point out, in relation to this point, that some special credit institutions cover operations quite similar to those of building societies, while commercial banks have recently branched out to cover operations similar to those of hire-purchase finance companies.

(16) The discount rate remained fixed at 4 per cent from April 1950 to May 1958; in June 1958 it was lowered to 3.50 per cent and stayed at that level until July-August 1969, when it was raised again to 4 per cent on "ordinary" paper, with a further 1.5 per cent increase for some banks, according to the relationship between required reserves and the amounts of paper discounted in the previous six months, thus bringing the total discount rate for some banks to 5.5 per cent (for the details of the measures introduced in 1969 see the July-August 1969 issue of the *Bollettino* of the Bank of Italy, p. 444).

enhanced because: (a) there is not a well-developed money market, and (b) these controls can be used in a selective way.

Special emphasis should be laid on the lack of an institutional and well-developed short-term market, like those for 3-month Treasury bills in the U.K. and in the U.S. There is in fact a market for Treasury bills in Italy (*buoni ordinari del tesoro*, or B.O.T.) but their yield is fixed by monetary authorities, the one on 12-month bills (17) being equal to the discount rate (18). These B.O.T. have been almost exclusively bought by banks to satisfy compulsory reserve requirements (19) and their yields did not have a significant con-

(17) Until November 1962 bills with term to maturity ranging from 1-2 to 10-12 months were issued. From then onwards there have been monthly issues (for given amounts of funds) with the only maturity of 12 months.

(18) It should be pointed out that while the stated yield is the same: 3.50 per cent, Treasury bills are quoted on a discount rather than a yield-to-maturity basis; thus a one-year bill is priced at 96.50 (per cent of par), which implies that the true yield to maturity is 3.63 (and not 3.50) per cent. To bring the picture up to date it should be pointed out that from May 1969 the stated yield has been raised to 3.75 per cent (the true yield being thus 3.90 per cent).

(19) In Italy compulsory reserves are not sterile assets. To satisfy reserve requirements banks can use either cash or short-term (12-month) bills or (from September 1965), subject to certain restrictions, some government and government-guaranteed issues. The rate paid on compulsory currency reserves deposits by the central bank is practically equal to the rate on short-term bills (for an extensive analysis of required reserves in the Italian system see F. MASERA, *La riserva obbligatoria nel sistema istituzionale italiano*, mimeographed note, Bank of Italy, Rome, August 28, 1968).

Attention should be directed to the fact that since November 1962 a distinction has been introduced between bills immediately used to satisfy reserve requirements (which from June 1958 up to May 1969 have always been issued at the fixed price of 96½) and bills which banks intended to use as free investment, the price for these bills being determined by monthly auctions. This attempt to influence short-term rates directly has, however, practically failed. This is due to different reasons. The main one is probably that, while free rates determined in the secondary market for securities of the same maturities have always been higher than the 3.63 yield on fixed-price B.O.T., the Bank of Italy has, however, always prevented the effective auction rate on B.O.T. going above the 3.63 ceiling (when the auction price was approaching the 96½ floor, the central bank stepped in to buy any remaining bills). The auction rate, therefore, has always remained close to the 3.63 ceiling (some banks have invested in B.O.T., even if at lower yields than those obtainable buying other securities of the same term to maturity, because the B.O.T. may be sold to the central bank at will, at prices equal to the ones realized at the last auction; in other words, the B.O.T. are essentially considered to have the same degree of liquidity as cash by the banking system). The differences between the rates on the B.O.T. and those on secondary-market securities of the same term to maturity will be clearly shown in the following section (see below pp. 362, 364-366 and Chart 4).

To bring the picture up to date also in this case it should be pointed out that starting from May 1969 the Bank of Italy abandoned the policy of preventing the auction rate from going above the rate on bills bought to satisfy reserve requirements. Thus in May and June 1969 we find that the auction rate is 4.44 per cent, and in July-August it reaches 4.99 per cent, while, as we have seen, the rate on bills used to satisfy reserve requirements is

nection, as we shall see, with the free market rates determined in the secondary market for securities of the same maturities.

1.2. The Bond Market: Structure and Recent Developments

For the reasons already pointed out, one of the most relevant features of the Italian bond market is the clear predominance of public and semi-public bonds and bonds issued by special credit institutions with respect to private corporate bonds. This is shown by Tables 1 and 2, where it is possible to find a breakdown of fixed-interest securities (outstanding amounts and net new issues) according to issuers from 1950 to 1967. In 1950 the outstanding amount of bonds issued by private industrial corporations was Lit. 161.9 md., i.e. 14.7 per cent of the total amount of fixed-interest securities; while in 1967 the absolute figure is Lit. 954.0 md., i.e. only 5.2 per cent of the total (20). The growing importance of special credit institutions is clearly shown by the fact that in 1950 the *Istituti di Credito Mobiliare* and those of *Credito Immobiliare*, taken together, accounted for 18.3 per cent of the market for fixed-interest securities, while in 1967 their share is 41.7 per cent. Another important feature of the recent evolution of the Italian bond market is the increasing weight of public holding companies (IRI, ENI, ENEL). This is due to two main reasons. First of all, IRI and ENI have been rapidly expanding and their main source of finance is through bond issues; on top of this, in 1962 the Italian electricity industry was nationalized; the compensations for the expropriation were paid through successive bond issues, which essentially explain the very relevant share in net new issues of public holding companies especially in 1963, 1964 and 1965 (see Table 2). For all these causes we find that in 1950 the outstanding amount of bonds issued by public holding companies was Lit. 53.5 md. (4.8 per cent of total), while

from May 1969 3.90 per cent (on these points see also A. FAZIO, "Monetary Base and the Control of Credit in Italy", this *Review*, June 1969, pp. 150-154).

From a general point of view it should be underlined that the recent increase in the discount rate and in the rates of Treasury bills are not an expression of a restrictive monetary policy. These measures are part of a package intended to stem the recent serious capital outflow from Italy.

(20) See Table 1, under the heading "Industrial Corporations (Others)". The *Autostrade Spa* (Motorways Company), which has very recently become an important bond issuer is in fact a member of the IRI Group, which is one of the three big Public Holding Companies (together with ENEL, the national electric energy agency, and ENI, the petrochemical group).

ITALIAN FIXED-INTEREST SECURITIES: OUTSTANDING AMOUNTS
(NOMINAL VALUES, IN MILLIARDS OF LIRE)

TABLE 1

Period	State Bonds		Credit Consortium for Public Works	Special Credit Institutions		Public Holding Companies	Local Authorities	Industrial Corporations		Foreign Bonds	Total
	B.T.P.	Others		Mobil.	Immobil.			Autostr. Spa	Others		
Dec. 1950	324.0	310.9	48.5	140.7	60.8	53.5	2.6	—	161.9	—	1,102.9
» 1951	446.2	306.6	46.9	171.6	82.9	53.5	2.6	—	167.3	—	1,277.6
» 1952	578.4	301.5	85.3	249.4	107.0	122.9	5.5	—	181.0	—	1,631.0
» 1953	778.9	296.6	123.6	323.6	147.8	159.3	8.4	—	194.0	—	2,032.2
» 1954	987.6	327.8	129.8	410.3	200.5	187.2	8.3	—	203.9	—	2,446.4
» 1955	1,230.3	327.3	197.0	509.9	264.5	201.9	8.3	—	218.8	—	2,958.0
» 1956	1,437.6	225.7	191.5	598.3	328.2	250.6	8.2	—	247.6	—	3,358.7
» 1957	1,548.2	330.3	185.0	679.9	405.3	322.3	8.0	—	284.4	—	3,763.4
» 1958	1,555.1	348.1	177.8	831.5	493.1	486.8	7.8	—	347.8	—	4,248.0
» 1959	1,859.0	351.8	229.9	1,010.2	593.5	575.4	12.7	—	378.1	—	5,010.6
» 1960	1,999.6	354.9	260.9	1,295.2	738.9	635.5	12.3	—	576.6	—	5,882.9
» 1961	2,010.5	353.6	417.4	1,591.3	986.3	750.9	23.8	—	703.2	15.0	6,846.0
» 1962	1,913.0	354.4	593.3	2,057.9	1,278.9	810.9	23.4	—	913.1	45.0	7,989.9
» 1963	1,724.8	351.7	730.2	2,554.8	1,614.3	1,102.1	22.9	50.0	959.8	66.3	9,176.9
» 1964	1,731.9	419.1	808.7	3,070.9	1,801.6	1,615.7	22.4	55.0	992.3	78.2	10,775.8
» 1965	1,837.8	492.0	1,431.8	3,495.1	2,195.1	2,207.1	22.0	160.0	983.8	92.1	12,916.8
» 1966	2,477.4	589.6	2,318.5	4,025.8	2,609.3	2,536.0	44.0	160.0	990.5	175.5	15,926.6
» 1967	2,472.2	1,066.0	2,902.6	4,687.0	3,035.4	2,799.4	52.4	360.0	954.0	197.4	18,526.4

Source: *Bollettini* of the Bank of Italy 1967-1968.

ITALIAN FIXED-INTEREST SECURITIES: NET NEW ISSUES:
(PRICES AT ISSUE, IN MILLIARDS OF LIRE)

TABLE 2

Period	State Bonds		Credit Consortium for Public Works	Special Credit Institutions		Public Holding Companies	Local Authorities	Industrial Corporations		Foreign Bonds	Total
	B.T.P.	Others		Mobil.	Immobil.			Autostr. Spa	Others		
1950	191.4	— 5.1	20.3	26.5	24.4	6.5	— 0.1	—	31.0	—	294.9
1951	119.0	— 4.3	— 1.6	26.9	18.4	—	—	—	5.1	—	163.5
1952	128.9	— 5.1	36.4	70.1	19.8	62.9	2.7	—	13.3	—	329.0
1953	196.5	— 4.9	35.9	66.4	34.7	34.0	—	—	13.0	—	378.3
1954	203.9	29.6	— 2.8	77.3	44.8	26.0	— 0.1	—	9.4	—	388.1
1955	237.0	— 0.5	71.0	90.0	55.1	13.7	—	—	14.6	—	480.9
1956	201.5	— 1.6	— 5.5	79.7	53.5	46.3	— 0.1	—	27.8	—	401.6
1957	110.6	4.6	— 6.5	73.2	65.0	68.4	— 0.2	—	35.2	—	350.3
1958	— 5.2	17.8	— 7.2	140.1	75.0	155.4	— 0.2	—	61.1	—	436.8
1959	301.3	3.7	51.0	172.0	90.8	83.2	4.7	—	29.7	—	736.4
1960	140.6	3.1	39.3	275.7	136.3	59.3	— 0.4	—	196.4	—	850.3
1961	10.9	— 1.3	143.4	283.9	229.6	115.4	11.4	—	126.0	14.8	934.1
1962	— 97.5	0.8	170.6	445.9	278.6	59.0	— 0.4	—	205.9	29.6	1,092.5
1963	— 188.2	— 2.7	137.4	469.8	304.9	274.7	— 0.5	48.0	46.4	20.9	1,100.7
1964	3.6	65.2	158.8	479.6	241.1	468.8	— 0.5	4.9	28.1	11.9	1,461.5
1965	105.9	72.0	500.7	387.9	258.8	557.4	— 0.4	101.2	— 11.7	13.3	1,984.7
1966	639.6	95.8	832.3	501.9	358.8	313.9	—	—	2.9	—	2,846.9
1967	— 5.2	462.3	554.4	620.3	366.3	246.4	8.0	194.5	— 38.0	21.5	2,430.5

Source: *Bollettini* of the Bank of Italy 1967-1968.

in 1967 the amount is Lit. 2,799.4 md. (15.1 per cent of total); if we add the bonds issued by the *Autostrade Spa*, the 1967 figure becomes Lit. 3,159.4 md. (17.0 per cent of total).

The increasing relative shares of special credit institutions and public holding companies are matched by a relative decline not only of private corporate bonds, but also of Government securities: these last are issued either directly — *titoli di stato* (state bonds) — or through a public special credit institution — the *Consorzio di credito per le opere pubbliche* or, for short, CREDIOP (Credit Consortium for Public Works). Thus, although the outstanding amount of all Government securities was Lit. 683.4 md. in 1950 and increased to Lit. 6,440.8 md. in 1967, in relative terms there is a decline from 62.0 per cent of total to 34.8 per cent of total. This relative decline is, however, the result of two opposite tendencies: a strong decline in direct Government issues which more than outweighs the relative increase of issues through the Credit Consortium for Public Works. In particular, there is a sharp relative decline in Government bonds other than B.T.P.: these securities accounted for 28.2 per cent of total fixed-interest securities in 1950, while their share in 1967 is only 5.8 per cent of total.

When we come to B.T.P., while it is clear that their relative importance has also decreased from 1950 (29.4 per cent of total outstanding amount) to 1967 (13.3 per cent of total), it is also evident that they represent the most relevant set of homogeneous securities in the Italian market. These bonds have a maximum maturity of 9 years, and all outstanding issues have practically identical features, apart from term to maturity; in particular, same coupon payments, same tax exemptions, same special privileges, no call provisions and they are, of course, perfectly homogeneous with respect to credit-worthiness and safety. If we take into account that, on the contrary, bonds issued by the Credit Consortium for Public Works differ with respect to many important features, this being also true for bonds issued by Special Credit Institutions and by Public Holding Companies, which may also be considered by buyers as different with respect to credit risk, we can conclude that the B.T.P. have been the only important set of homogeneous securities in recent years in relation to the Italian bond market.

Another important factor which makes the B.T.P. suitable for the construction of reliable yield curves is that these bonds have been widely traded, i.e. they enjoyed a high and uniform market-ability during the whole postwar period. In particular, they have

been a common portfolio investment of firms, households and deposit banks, while the share held by institutional investors is very small, as is clearly shown in Tables 3 and 4. Thus, from Table 3 we can observe that while the B.T.P. held by the personal sector, companies and by deposit banks, altogether, accounted for approximately 85 per cent of total for the whole period considered, the percentage share of B.T.P. held by Insurance and Social Security Institutions was 5.8 in 1950 and since then has been declining, to reach an approximately constant 3 per cent in the 1960's. The other main investors in B.T.P., apart from special credit institutions which have always accounted for less than 1 per cent of total (1 per cent in 1967), have been the Bank of Italy and the "Cassa Depositi e Prestiti" (21), with a declining weight of the latter, which in 1964 completely sold out its B.T.P. investments.

The above distribution by the type of investor of the B.T.P. appears to point out that a relevant share of these bonds is held for temporary investment purposes (22); the B.T.P. should therefore constitute a highly sensitive and rather sophisticated market (23).

The maximum term to maturity of only nine years of the B.T.P. may be considered a disadvantage for studies of the term structure of interest rates. It would of course be desirable to consider also longer-term bonds; however, it should be observed that for many econometric investigations on the term structure (for example for all Meiselman-type models (24) aimed at explaining the process of

(21) The "Cassa Depositi e Prestiti" (or Cassa DD.PP.) is a credit institution directly run by the Treasury. It derives its resources through the Post Office System (either postal savings proper, or payments to the State made by means of postal current accounts). These funds are either lent to Local Authorities at special privileged rates, or invested in Government and Government-guaranteed bonds, or, finally, deposited in special current accounts with the Treasury, to finance current expenditures.

Clearly, by means of the "Cassa DD.PP.", the Treasury can have a direct impact on the Italian monetary system (for a general analysis of these problems see G. STAMMATI, *Lezioni di Politica Economica*, Roma, De Santis, 1965, part. Chap. 2).

(22) In order to have more reliable evidence on this point, it would be desirable to have at least some knowledge of the further breakdown of the B.T.P. held by the personal sector and by companies, respectively.

(23) In particular, this appears to be a necessary condition to hypothesize the validity of any expectational model of the term structure. In other words, a necessary condition for an expectational model to hold is that the *marginal* investor must be potentially interested in portfolio speculations (switchings) during the lifetime of the securities he owns (on this point see, for example, J. Hicks, "The Yield on Consols", being Essay 5 in his *Critical Essays in Monetary Theory*, Oxford, Oxford University Press, 1967, pp. 92-94).

(24) See D. MEISELMAN, *The Term Structure of Interest Rates*, Englewood Cliffs, N.J., Prentice Hall, 1962, Chapter 2.

ITALIAN B.T.P.: OUTSTANDING AMOUNTS BY TYPE OF INVESTOR
(NOMINAL VALUES, IN MILLIARDS OF LIRE)

TABLE 3

Period	Bank of Italy	Cassa DD.PP.	Deposit Banks	Special Credit Insts.	Insurance and Social Security Insts.	Personal Sector and Companies	Total
Dec. 1950	9.5	22.8	105.1	1.2	18.7	166.7	324.0
» 1951	20.2	32.8	129.8	1.2	25.1	237.1	446.2
» 1952	24.1	42.8	188.0	1.8	29.3	292.4	578.4
« 1953	32.6	52.3	259.4	2.4	35.5	396.7	778.9
» 1954	62.1	63.1	293.7	3.9	40.3	524.5	987.6
» 1955	89.1	62.6	371.6	4.9	45.3	656.8	1,230.3
» 1956	110.6	62.6	464.5	9.5	50.5	739.9	1,437.6
» 1957	147.2	62.5	481.1	5.8	55.9	795.7	1,548.2
» 1958	149.4	62.4	494.6	5.9	46.1	796.7	1,555.1
» 1959	171.2	62.4	560.4	7.3	49.5	1,008.2	1,859.0
» 1960	177.9	61.8	541.9	16.2	57.1	1,144.7	1,999.6
» 1961	188.4	62.0	549.5	16.9	58.0	1,145.7	2,010.5
» 1962	132.8	20.0	572.6	11.7	60.1	1,115.8	1,913.0
» 1963	109.8	10.0	538.4	11.0	53.0	1,002.6	1,724.8
» 1964	162.6	—	534.8	10.5	51.6	972.4	1,731.9
» 1965	163.3	—	601.7	16.8	51.4	1,004.6	1,837.8
» 1966	191.2	—	936.0	23.0	73.6	1,253.6	2,477.4
» 1967	210.9	—	889.5	24.8	73.4	1,273.6	2,472.2

SOURCE: The basic data used to construct Tables 3 and 4 were kindly made available through personal communication with the Research Department of the Bank of Italy.

ITALIAN B.T.P.: NET NEW ISSUES BY TYPE OF INVESTOR
(PRICES AT ISSUE, IN MILLIARDS OF LIRE)

TABLE 4

Period	Bank of Italy	Cassa DD.PP.	Deposit Banks	Special Credit Insts.	Insurance and Social Security Insts.	Personal Sector and Companies	Total
1950	3.8	1.0	74.5	0.2	3.7	108.2	191.4
1951	10.3	9.8	23.7	0.0	6.4	68.8	119.0
1952	3.7	9.7	57.5	0.5	4.1	53.4	128.9
1953	8.4	9.8	68.4	0.6	5.9	103.4	196.5
1954	28.3	9.8	33.4	1.5	4.6	126.3	203.9
1955	26.7	0.1	73.8	0.9	4.6	130.9	237.0
1956	17.4	0.1	84.5	4.3	5.2	90.0	201.5
1957	35.0	— 0.1	16.0	— 3.4	5.1	58.0	110.6
1958	2.1	— 0.1	16.3	0.1	— 9.1	— 14.5	— 5.2
1959	21.1	0.0	68.0	1.4	3.4	207.4	301.3
1960	7.1	0.3	— 15.9	8.9	7.9	132.3	140.6
1961	10.7	0.2	9.7	0.7	0.7	— 11.1	10.9
1962	— 51.9	— 42.0	27.8	— 5.2	2.1	— 28.3	— 97.5
1963	— 21.0	— 9.8	— 33.2	— 0.5	— 6.8	— 116.9	— 188.2
1964	54.1	— 10.0	— 2.8	— 0.6	— 1.4	— 35.7	3.6
1965	1.1	—	69.1	6.3	0.0	29.4	105.9
1966	27.9	—	333.3	6.1	21.9	250.4	639.6
1967	19.8	—	— 45.4	1.8	— 0.2	18.8	— 5.2

SOURCE: (see Table 3).

revision of expectations, and not explicitly the level of interest rates) the maximum term to maturity of nine years does not represent a serious limitation. In fact, other securities (CREDIOP, Special Credit Institutions, Public Holding Companies) which have longer terms to maturity, in addition to the difficulties already pointed out, present large gaps in the maturity continuum, while the B.T.P. from 1950 onwards have been issued rather regularly (see Table 2), which implies that approximately from 1957-58 they have presented a fairly well-distributed maturity composition (25).

To conclude this very brief analysis of the composition of the Italian bond market we should mention the Local Authorities and Foreign Bonds issues. The former are in fact municipal obligations, which occupy a relatively unimportant and practically constant position during the whole period examined: in 1950 they represent 0.2 per cent of the total market, while in 1967 their share is 0.3 per cent of total. With respect to Foreign Bonds issues, it should be pointed out that the data reported do not refer to portfolio investments abroad of Italian residents: we have to do with bonds issued by international institutions directly in Lire and floated in the Italian market.

As a final remark on the composition of the market for fixed-interest securities in Italy, it is necessary to observe that, unfortunately, there are no data available on the maturity distribution of outstanding bonds on an aggregate basis. This is certainly a serious disadvantage, which, in particular, prevents any attempt to test the effects of changes in the maturity composition of the outstanding debt. With reference to this point, it should be made clear that the available data on the composition of the public debt, which may be found even in semi-official publications, are completely misleading, in that they do not take into account the true term to maturity of outstanding issues: bonds are classified as long-term if they were long-term at the date of issue, irrespective of their true term to maturity when the classification of the public debt is prepared.

Given that all the original data which are needed for the construction of a true term-to-maturity breakdown of the outstanding debt are available to the Italian central bank, and considering their

(25) For a more detailed and specific analysis of the problems connected with the construction of yield curves based on B.T.P. data, the reader is referred to the second part of this study.

growing interest in open-market operations across the whole maturity continuum, one would certainly like the Bank of Italy to consider the opportunity of adding this set of data to their *Bollettino*.

Finally, Tables 5 and 6 give us a rough idea of the relative importance of fixed-interest securities in the Italian stock exchange market and, more generally, of the orders of magnitude involved. Table 5 shows that after an all-time peak in 1961 when shares were valued (market-prices) Lit. 20,772.4 md., share prices fell heavily, and in 1967 they still totalled only 17,289.0 md. Fixed-interest securities figures of Table 6 are not strictly comparable as they represent nominal values (26), but they provide a fairly accurate indication of the very recent extraordinary expansion of this sector of the stockexchange market. Thus, for example, from 1963 to 1967 the outstanding amount of bonds leapt from Lit. 9,176.9 md. to Lit. 18,526.4 md., with a more than 100 per cent increase. The recent increase in the propensity towards credit-capital with respect to risk-capital is also emphasized by Table 6, which reports the net new issues of bonds and shares at market prices (27).

2. Main Features of the Estimated Yield Curves

On the basis of the analysis developed in Section I, I decided to use the B.T.P. yield-data as starting point for the construction of yield curves in relation to the Italian experience. A description of the least-squares interpolating procedure followed, and the estimated annual redemption yields obtained for the maturity range from 1 to 9 years are reported in the second part of this paper, which, for

(26) Data on fixed-interest securities at market prices are not available; on the other hand, data of nominal values of shares are practically meaningless. According to the definitions of the Bank of Italy bills data are not reported together with other fixed-interest securities; this, however, does not make any relevant difference since, as we have seen, the market for Treasury bills is relatively unimportant and "segmented" from the bond market.

For a general introduction to the technical procedures and definitions used in the construction of all the tables of this section the reader is referred to the two mentioned articles by B. Bianchi and E. Peretti (*Bollettino*, Sept-Oct. 1967 and Sept-Dec. 1968). In particular, it should be pointed out that, in relation to fixed-interest securities, the differences between end-of-period stocks are not identical with the net new issues during the period, as the latter are valued according to their prices at issue, while the former are based on nominal values.

(27) The trend is still continuing: the figures for 1968 net new issues are: fixed-interest securities Lit. 3,092.2 md. (86.7 per cent); shares Lit. 472.7 md. (13.3 per cent).

ITALIAN FIXED-INTEREST SECURITIES AND SHARES: OUTSTANDING AMOUNTS
(IN MILLIARDS OF LIRE) TABLE 5

Period	Fixed-Interest Securities		Shares		Total	G.N.P. (current prices) (3)
	Outstanding Amount (1)	% of total	Outstanding Amount (2)	% of total		
Dec. 1950						
» 1951	1,102.9	42.1	1,516.5	57.9	2,619.4	
» 1952	1,277.6	41.2	1,821.3	58.8	3,098.9	10,499
» 1953	1,631.0	42.6	2,195.6	57.4	3,826.6	11,280
» 1954	2,032.2	42.5	2,750.5	57.5	4,782.7	12,486
» 1955	2,446.4	43.4	3,190.1	56.6	5,636.5	13,324
» 1956	2,958.0	35.6	5,360.0	64.4	8,318.0	14,641
» 1957	3,358.7	38.2	5,482.4	61.8	8,870.1	15,908
» 1958	3,762.4	36.8	6,472.8	63.2	10,236.2	17,081
» 1959	4,248.0	38.1	6,895.7	61.9	11,143.7	18,340
» 1960	5,010.6	31.1	11,101.6	68.9	16,112.2	19,437
» 1961	5,882.9	24.8	17,815.9	75.2	23,698.8	21,071
» 1962	6,846.0	24.8	20,772.4	75.2	27,618.4	23,363
» 1963	7,989.9	29.6	18,983.6	70.4	26,973.5	26,330
» 1964	9,176.9	34.4	17,462.6	65.6	26,639.5	30,193
» 1965	10,775.8	43.2	14,182.7	56.8	24,958.5	33,977
» 1966	12,916.8	46.3	14,973.0	53.7	27,889.8	35,648
» 1967	15,926.6	46.3	18,445.7	53.7	34,372.3	38,493
	18,526.4	51.7	17,289.0	48.3	35,815.4	41,849

Sources: *Bollettini* of the Bank of Italy 1967-1968; ISCO, *Quadri della Contabilità Nazionale* 1951-1966, Roma, 1967, and ISTAT, *Annuario Statistico* 1968, Roma, 1968.

(1) Nominal values.

(2) Market values.

(3) G.N.P. data refer to the whole year indicated in the first column. The 1950 datum is not available on a comparable basis with the others, due to revisions to the definitions of the Italian national income statistics.

ITALIAN FIXED-INTEREST SECURITIES AND SHARES: NET NEW ISSUES
(IN MILLIARDS OF LIRE) TABLE 6

Period	Fixed-Interest Securities		Shares		Total	Gross Investment (current prices) (2)
	Net Issue (1)	% of total	Net Issue (1)	% of total		
1950						
1951	294.9	84.8	53.0	15.2	347.9	
1952	163.5	67.9	77.4	32.1	240.9	2,095
1953	329.0	81.3	75.7	18.7	404.7	2,132
1954	378.3	73.5	136.6	26.5	514.9	2,445
1955	388.1	72.8	145.1	27.2	533.2	2,650
1956	480.9	76.0	144.2	23.1	625.1	3,184
1957	401.6	68.0	180.9	31.1	582.5	3,417
1958	350.3	67.6	168.1	32.4	518.4	3,801
1959	435.8	66.3	222.3	33.7	659.1	3,891
1960	736.4	76.6	225.0	23.4	961.4	4,233
1961	850.3	63.2	495.7	36.8	1,346.0	5,068
1962	934.1	64.5	514.6	35.5	1,448.7	5,760
1963	1,092.5	60.4	715.5	39.6	1,808.0	6,531
1964	1,100.7	73.5	397.5	26.5	1,498.2	7,496
1965	1,461.5	71.5	581.3	28.5	2,042.8	7,407
1966	1,984.7	83.0	406.3	17.0	2,391.0	6,974
1967	2,846.9	85.8	470.1	14.2	3,317.0	7,540
	2,430.5	86.0	395.6	14.0	2,826.1	8,615

Sources: *Bollettini* of the Bank of Italy 1967-1968; ISCO, *Quadri della Contabilità Nazionale* 1951-1966, Roma, 1967, and ISTAT, *Annuario Statistico* 1968, Roma, 1968.

(1) Prices at issue.

(2) The 1950 datum is not available on a comparable basis with the others, due to revisions to the definitions of the Italian national income statistics.

brevery, I will hereafter call "Appendix" (28). In this section I shall therefore confine myself to outlining the main features of the curves obtained.

It is, first of all, evident from the data of Appendix A.7 that the interpolating curves may have a great freedom of shape, and, in particular, are often "humped", although, by construction, they are "smooth", i.e. continuous and continuously differentiable. This, of course, underlines the need of adopting a reliable estimating procedure and, more specifically, a theoretically justified rule by which it is decided whether to accept humps or reject them as spurious or random (29). In fact, as has been shown, oversmoothed yield curves tend to generate "well behaved" forward rates (30), and are therefore implicitly biased in favour of expectational models of the term structure (in particular in favour of the Meiselman model of revision of expectations).

From a general point of view, the yield curves obtained are consistent with the normal patterns which have been observed both for the U.S. and the U.K.:

1. Descending yield curves (or at least yield curves with negatively sloped segments) are typical of periods when both long and short rates are relatively high, while ascending curves characterize periods when interest rates are relatively low. This is most easily seen by means of Chart 2. In the upper part we have the difference between R_9 and R_1 ; in the lower R_1 and its mean value over the whole period. As we can easily see, when R_1 is above its mean value, which may roughly be interpreted as an indication of high interest rates, R_9 tends to lie below R_1 ; conversely, when R_1 is below its mean value, the interest rate spread is usually positive, with a remarkable similarity in the opposite movements of the two curves (31).

(28) The numerical data obtained are reported in Appendix A.7; the time series of estimated redemption yields on bonds of the same maturity have been plotted on graphs in Appendix A.8, together with the average yield, for each term to maturity, during the 11 years considered: 1957-1967 (132 monthly observations).

(29) For the procedure adopted in this study see below Section A.5 of the Appendix.

(30) See A. BUSE, "Interest Rates, the Meiselman model and Random Numbers", *Journal of Political Economy*, February 1967. On these points, however, see also N. WALLACE, "Buse on Meiselman - a Comment", *Journal of Political Economy*, July-August 1969.

(31) This is quantitatively confirmed by the fact that the correlation coefficient between $(R_9 - R_1)$ and $(R_1 - \bar{R}_1)$ is equal to -0.917 . This, incidentally, should serve as a warning of the need of great caution in interpreting high correlations in equations which explain the interest rate spread in terms of present and past values of short-term interest rates. On this point see also below pp. 367-370.

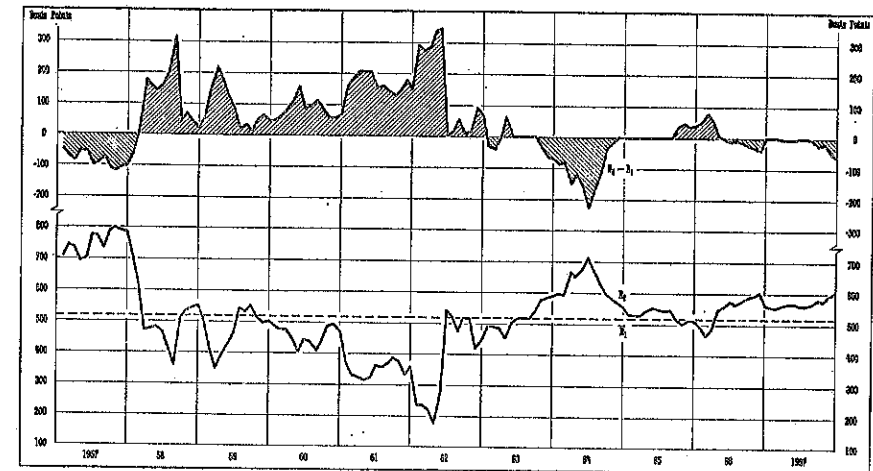


Chart 2 - $R_9 - R_1$, and R_1 : 1957-1967

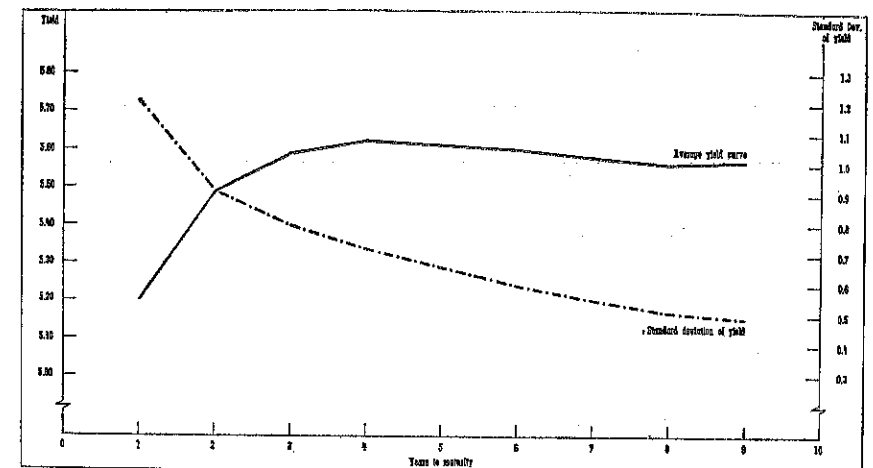


Chart 3 - Average Yield and Standard Deviation of Yield as a Function of Term to Maturity, Italian B.T.P., 1957-1967

2. As is clear from the charts of Appendix A.8, long rates have shown much lower fluctuations than short rates. This is quantified in cols. 1 and 2 of Table 7, where I reported the standard deviation and the coefficient of variation for the B.T.P. yields by maturity. It is, in particular, evident that the observed interest-rate-

variability is a monotonically decreasing function of term to maturity (see also Chart 3), with a substantial drop from the figures for the one-year rate (st. dev. = 1.215, coeff. of var. = 23.286) to those of the nine-year rate (st. dev. = 0.490, coeff. of var. = 8.787).

In particular, with reference to these data, it is interesting to show explicitly the differences between the one-year rate on the B.O.T. (32) and the one-year rate on the B.T.P. (see Chart 4). It is

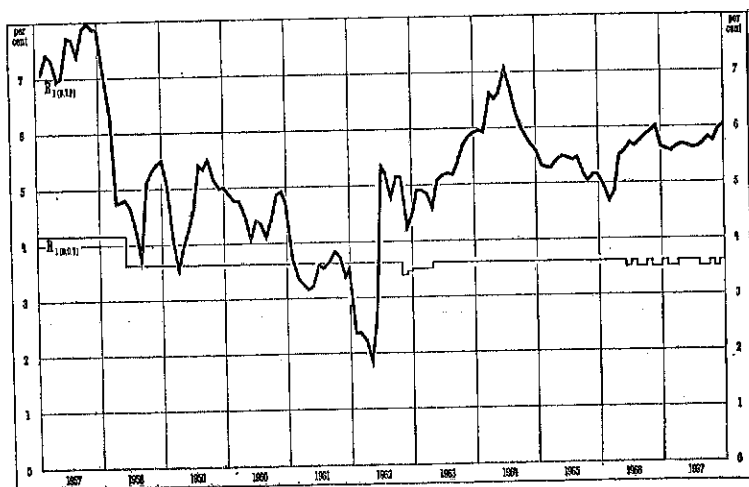


Chart 4 - One-Year Rate on the B.T.P. [$R_1(B.T.P.)$] and on the B.O.T. [$R_1(B.O.T.)$]: 1957-1967

clear from this chart that the B.O.T. rate has a limited economic significance with respect to free market short-term interest rates; this being also true from November 1962 onwards (33).

3. Finally, when we come to analyze the average yield curve, we find (see Chart 3) that this curve after a steep increase, especially in the maturity range from 1 to 2 years, reaches a maximum at 4 years to maturity, then is gently downward sloping until 8 years

(32) See above pp. 354-355.

(33) As will be recalled, since November 1962 monthly auctions for free-investment Treasury bills have taken place; the B.O.T. rate of Chart 4 is, from this date, the auction rate. For reasons already pointed out this rate has never differed in any significant way from the fixed 3.63 rate paid on bills used to meet reserve requirements.

to maturity, with the average nine-year rate slightly above the eight-year one (the figures are reported in col. 3 of Table 7). The lack of any significant trend in interest rates during the period considered (34), and the approximate balance of cycles should, therefore,

TABLE 7
STANDARD DEVIATION, COEFFICIENT OF VARIATION, AND MEAN OF B.T.P.
REDEMPTION YIELDS FOR THE ONE- TO NINE-YEAR MATURITY
RANGE: MONTHLY OBSERVATIONS, 1957-1967

Years to Maturity	Standard Deviation (1)	Coefficient of Variation (2)	Mean (per cent) (3)
1	1.215	23.286	5.20
2	0.907	16.535	5.49
3	0.795	14.218	5.59
4	0.720	12.803	5.62
5	0.656	11.692	5.61
6	0.599	10.707	5.60
7	0.548	9.835	5.58
8	0.506	9.096	5.56
9	0.490	8.787	5.57

tend to show the existence of "liquidity" or "risk" premia in the determination of the term structure in Italy, at least in relation to the period considered.

Conclusions

The relative imperfections of the secondary market for short-term securities in Italy, together with the fact that this market has been on the whole free from official controls during the period considered (35) makes one expect on *a priori* grounds: (a) strong fluctuations in market-clearing short-term rates and (b) a great sensitivity not only to general economic conditions but also to policy

(34) I have tried many different trend and trend-seasonal models to the time series of interest rates for the same maturities, but they all gave very poor results.

(35) The policy followed by the Bank of Italy has concentrated mainly on the control of the money supply and on dampening fluctuations of long-term interest rates, while leaving essentially free the market-clearing short-term interest rates (according to the Italian official definitions short-term interest rates refer to loans maturing within 18 months; intermediate-term rates refer to loans with between 18 and 60 months to maturity; while long-term rates refer to the yields on securities maturing in 60 months or more). However, starting from the second quarter of 1966 the Bank of Italy has been increasingly engaged in a policy of actual control of all interest rates, with continuous interventions across the whole maturity spectrum.

measures taken by monetary authorities. These points appear in fact to be confirmed by the short-term rates obtained from the yield curves constructed in this study.

The lack of a well-developed short-term market may, however, imply some more general and important differences in the explanation of the term structure of interest rates in Italy with respect to, say, the U.K. or the U.S., which are perhaps worth pointing out. On the basis of purely theoretical considerations the analysis of the term structure seems to lead to the conclusion of a simultaneous determination of long and short rates (36). This, however, does not necessarily imply that actual term structures are in fact to be explained by means of highly sophisticated simultaneous models. Two opposite views have been proposed: according to the first one the long rate is mainly determined by real forces and sets the level around which the short rate can fluctuate (37). The second approach views, on the contrary, the short rate as essentially determined by monetary forces, and, in particular, by the level of the official discount rate and, say, some banking-reserve variable, while the long rate is determined by expectations on future short rates (38). The two different approaches would imply in terms of an econometric model of the term structure that: (a) in the first case we tend to take the long rate as exogenously determined and therefore we try to explain the current level of the short rate essentially in terms of present and past values of the long rate (39); while (b) in the second

(36) The theoretical arguments in favour of a simultaneous determination of short and long rates appear more clearly in the context of expectational models of the term structure which assume explicitly short-term expectations of all future rates. On these points see, for example, my "The Term Structure of Interest Rates in Italy", (mimeographed) D. Phil. dissertation, University of Oxford, 1969, Chapter 2.

(37) This point of view is usually associated with Marshall (see A. MARSHALL, *Money, Credit and Commerce*, London, MacMillan, 1923, p. 255) and, more recently, with followers of the so-called segmentations approach to the term structure (see, for example, J. CULBERTSON, "The Interest Rate Structure: Towards Completion of the Classical System", Chapter 10 in F. HAHN and F. BRECHLING (eds.), *The Theory of Interest Rates*, London, MacMillan, 1965).

(38) Normally this approach is taken to be implied by the expectations approach to the term structure, and in fact the first who expressed it explicitly seems to be Kaldor (see N. KALDOR, "Speculation and Economic Stability", *Review of Economic Studies*, October 1939, reprinted in *Id.*, *Essays on Economic Stability and Growth*, London, Duckworth, 1960, pp. 38 ff.).

(39) It should be pointed out that this approach may be consistent with an expectational approach to the explanation of the term structure; in other words, it should not be necessarily identified with the one proposed by supporters of the segmentations hypothesis. On this point see my paper, "La struttura dei saggi d'interesse secondo la scadenza: teorie e implicazioni di politica economica", *Bancaria*, December 1968, pp. 1527-1528.

case we proceed in the opposite way: we explain the current level of the long rate in terms of present and past values of the short rates.

The second approach has clearly been the most widely adopted in the literature. The rationale for this approach lies essentially in the fact that we may assume a close and quick connection between the official discount rate and free money-market rates, either due to direct market links, or simply because of immediate expectational "announcement effects". Although one would like all this to be effectively shown, and not only implicitly assumed, there are sound *a priori* reasons supporting the validity of this approach in relation to the U.S. or the U.K. These reasons, however, do not seem to apply to the Italian market, where the "thin" market is essentially the short one, and where open-market operations during the period considered in this study have been mainly focused on intermediate- and long-term securities (40).

A priori it would therefore seem impossible to escape the complications of a simultaneous approach to the explanation of the term structure, i.e. to explain the *levels* of short- and long-term rates, in relation to the Italian experience. But, clearly, an essential prerequisite for the construction of a sophisticated simultaneous model is the understanding of how the links between short and long rates are formed and, more specifically, if crude supply and demand models essentially based on the market segmentation hypothesis can be adopted to depict the actual market behaviour.

A full answer to this problem is beyond the scope of this paper. However, it may be relevant to point out that the data presented in this study are consistent with a model of revisions of expectations based on the assumption of short-term forecasts of *all* future rates (41), thus supporting the arguments in favour of a simultaneous explanation.

(40) All this casts some doubts on the opportuneness of adopting, e.g., an approach à la Modigliani and Sutch to explain the spread between long and short rates in Italy. [See, for example, F. MODIGLIANI and R. SUTCH, "Debt Management and the Term Structure of Interest Rates: An Empirical Analysis of Recent Experience", *Journal of Political Economy*, August 1967 (Supplement). The two authors explain in fact the current level of the long rate as a distributed lag of the short-term rate].

(41) More specifically, the B.T.P. yields to maturity obtained in this study are consistent with an operational model of the process of revision of expectations based, in its first very crude formulation, on the assumption that expectations of *n*-year rates are revised according to errors in forecasting the *n*-year rate itself: the expectational horizon which is assumed to be relevant is of two years, forecasts thus being made on *all* rates one and two years hence. For the developments of this approach, and the empirical results obtained, see *The Term Structure...*, *op. cit.*, Chapter 6.

tion of long and short rates in the context of an expectational approach.

Finally, a few words might perhaps be spent considering very briefly the implications of the data presented in this study with regard to the recent attempts of the monetary authorities in Italy to prevent interest rates reaching the present very high international levels (42). The sensitivity to economic incentives of free-market rates which is shown by the yield curves obtained in this study points out the very serious difficulties of this policy. These difficulties are enhanced in view of the increasing obstacles which are encountered in achieving effective exchange controls of capital movements when yield differentials are very high, owing to the progressive financial integration of the E.E.C. countries. On the other hand, there are important factors which militate against a policy of letting rates float to higher levels, one of the major ones perhaps being that many banks in Italy have been heavily investing in fixed-income securities during the past two or three years. A heavy and uncontrolled rise in interest rates might therefore have dangerous consequences on their balance sheets, and, hence, on the whole financial system.

The prospects of the present policy of the Italian monetary authorities will of course largely depend on the international situation, and, in particular, on the effectiveness of the attempts to curb inflation in the U.S. Anyhow, taking into account the recent policy experiences of both the U.S. and the U.K., it is quite clear that the policy of control of interest rates in Italy must not be achieved at the expense of losing control of the monetary base, and, more generally, of the money supply. The arguments against the policy of central banks to "lean against rising interest rates" are by now well known, and there is no need of dwelling upon them here (43). A policy of injecting money into the system to relieve temporarily upward pres-

(42) See above footnote (19).

(43) See, for example, with reference to the British experience, A. WALTERS, *Money in Boom and Slump*, Hobart Paper 44, Institute of Economic Affairs, 1969 and for the American experience, D. FAND, "A Monetary Interpretation of the Post-1965 Inflation in the United States", this *Review*, June 1969. The general theoretical background of these arguments is essentially to be found on the lines of Friedman's works; however, the basic tenet that price expectations have a powerful influence on (nominal) interest rates is of course by no means accepted by neo-quantitativists only. Thus, e.g., Sir John Hicks has recently observed that "The high rates of interest, to which we are becoming accustomed in the nineteen-sixties, are the most obvious adjustment [to monetary inflation]". See J. Hicks, *A Theory of Economic History*, London, Oxford University Press, 1969, p. 97, n. 2.

ures in interest rates is particularly exposed to the risk of implying Pyrrhic victories in the Italian situation, where, given the large proportion of international transactions, inflationary pressures may have serious consequences on the balance of payments, and more generally on aggregate demand, even without substantial increases in price levels (44).

Thus, if the Italian monetary authorities decide that the actual level of domestic interest rates is to be essentially maintained, even in a background of continuing very high international rates, the only possible solution appears to be a recourse to adequate fiscal measures to finance the growing needs of the public sector. On the one hand, this would relieve the pressures of the huge demand for new funds in the bond market; on the other hand, a more favourable attitude towards the share market might provide a channel for the funds which are now being illegally exported (45). The Italian postwar experiences have shown the remarkable powers of monetary policy, thus offering strong support to the view that "money matters". Precisely because of this lesson, the time might have come to use in this difficult situation more sophisticated policy-mixes, without neglecting the support of fiscal measures (46).

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(44) The dangers of this policy are also enhanced in view of the pressures for wage increases which are now under discussion for a large part of the Italian labour forces.

(45) *Ad hoc* fiscal measures might of course have the immediate effect of hitting precisely the funds which contribute to form the capital outflow.

(46) At the time of reading the proofs of this paper (December 1969) the policy of preventing upward movements especially in long-term interest rates is apparently being gradually relaxed by the monetary authorities. For an analysis of the recent developments of (short-term) Italian economic policy see, for example, the (forthcoming) papers and proceedings of a meeting held in Rome (12 December 1969) at the "Consiglio Nazionale delle Ricerche" to discuss these issues.