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THE TERM STRUCTURE OF INTEREST RATES

IN SOUTH AFRICA

Thesis

Submitted in fulfilment of the requirements

for the degree

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by

BRIAN EDWARD DOLLERY

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E R R A T A

	FOR	READ
p. 6 line 2	Irwing Fisher	Irving Fisher
p. 9 line 7	$(1 + t R_n)$	$(1 + t R_n)^n$
p. 9 line 10	r_2, r_3, \dots, r_n	$2^{r_1}, 3^{r_1}, \dots, n^{r_1}$
p. 9 line 13	R_1, R_1, \dots, R_n	R_1, R_2, \dots, R_n
p.10 line 16	use	rise
p.16 line 18	$\Delta t + n^{r_{1,t}}$	$t + n^{r_{1,t}}$
p.16 line 26	expectational	expectation
p.20 line 1	, the face	, P the face
p.22 line 27	6	σ
p.31 line 19	dedicate	devote
p.32 line 24	seasonal	seasonally
p.40 footnote 5	Internal	Interest
p.49 line 30	Hicks'	Hick's
p.50 line 13	ex poste	ex post
p.52 line 13	ex poste	ex post
p.55 line 18	concomitant	concomitant
p.55 line 22	synonomous with	equivalent to
p.58 line 8	equivalent of	equivalent to
p.62 line 7	budgetory	budgetary
p.69 line 17	on the behalf of	on the part of
p.70 footnote 3	Franszen	Franzsen
p.71 line 4	attacting	attracting
p.80 footnote 8	Rosseas	Rousseas
p.84 line 9	Due to the paucity	Owing to the paucity
p.84 footnote 2	Franszen	Franzsen
p.96 TABLE 4.3.2	r^2	R^2
p.98 line 24	briefly discuss	discuss briefly
p.99 footnote 3	Quasional	Occasional

On the following pages the symbols t, a, b, and d should be underlined where they occur in the text: pp. 46, 47, 92, 93, 96, 97 and 98.

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I N T R O D U C T I O N

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Since the late 'fifties the term structure of interest rates has attracted considerable attention from both theoretical and empirical economists. While potentially a very fruitful area for the application of the traditional methods of economic enquiry, the term structure has proved itself to be a potent testing ground for these tools, and consequently a wide range of sophisticated analytic devices have been introduced. Despite this, no general agreement has yet been reached and a number of crucial questions remain unanswered. It is our task in this dissertation to extend the enquiry into the South African context in an attempt to shed some light on the determination of the term structure of interest rates.

Theoreticians have isolated a number of factors which operate in a complex pattern of inter-relationships to determine the rate of return on financial assets. Some of the more prominent of these are the risk of default in promised payment, the coupon or nominal rate, the degree of marketability, call provisions, tax features, the degree of acceptability as collateral, convertability and so on. In order to allow for systematic theoretical investigation of the pattern of returns on securities, economists have abstracted from these factors so that only term to maturity, or the life of the bond, remains as the determinant of the yield on such a security. In this way, the various theories on the term structure are able to focus on the differences in yields on financial assets which are equal in every respect except for their term to maturity. Usually this implies an examination of the market for government bonds where the ceteris paribus clause is generally relevant.

Conventionally the value of a bond is believed to be determined by the interaction of four basic elements. Firstly, the face value of a bond or the principal amount to be repaid on the termination of the bond designated by F . Secondly, the nominal rate of interest or coupon, C , accruing to the investor. Thirdly, the number of years to maturity denoted by n , and finally, the internal rate of return i , or the annual net return known as the yield to maturity. This yield to maturity is therefore simply that discount rate which makes the sum of the present values of all the coupons accruing as interest and the principal to be paid at maturity equal to the purchase price.

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

which can be transformed into a geometric progression and simplified to

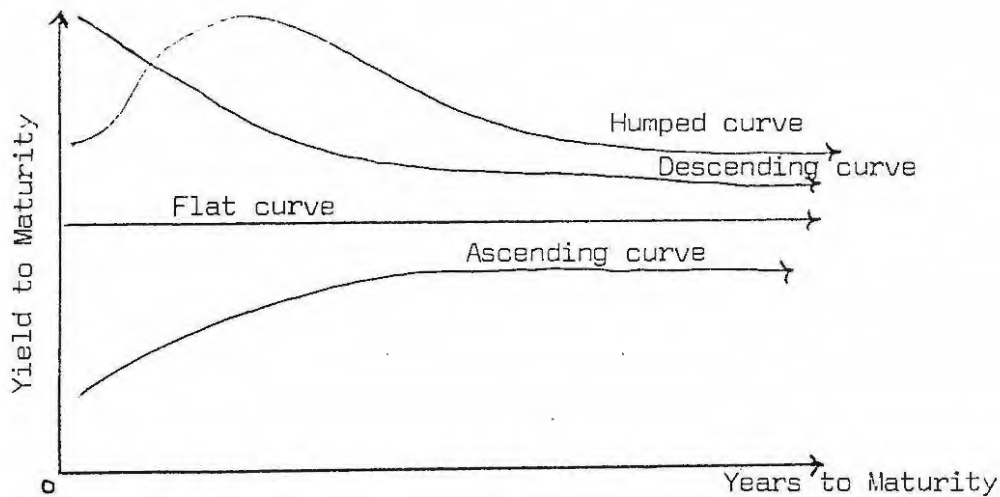
$$P = \frac{C}{i} \left\{ I - \frac{I}{(I+i)^n} \right\} + \frac{F}{(I+i)^n}$$

Clearly, as n approximates infinity, so the equation nears the limit $\frac{C}{i}$.

Therefore, for a consol or bond with $n = \infty$ which receives one rand annually, the market value equals the reciprocal of the market rate of interest. If we define the nominal yield as I , where $I = \frac{C}{F}$, and compare it to the market yield i , where $i = \frac{C}{P}$, then several important relationships can be deduced. Firstly, when i equals I , then $\frac{C}{i} = F$ and the discounted value of the bond equals the face value, or $P = F$. When the nominal yield I exceeds i , $\frac{C}{i} > F$ and $P > F$, and finally when $i > I$, then $\frac{C}{i} < F$, and the face value exceeds the discounted value or the bond sells below its par value.

The relationship between the yield to maturity and the term to maturity of comparable financial obligations has customarily been depicted graphically by means of so-called yield curves. Years to maturity are measured along the abscissa and the vertical axis measures yield to maturity. Although in the real world only a finite number of yields can be observed from the series of different maturities, a smooth and continuous yield curve is normally constructed by connecting all the separate observations. Several alternative smoothing techniques exist which vary in terms of both their accuracy and sophistication. Often the method employed can be of vital importance in an empirical investigation, for as we shall see in Chapter II, different results may be due only to the different methods employed to fit the curve. In practice, the curves are usually based on yearly, quarterly or monthly data, and may be represented over a period of time by ways of a three dimensional chart.

While an infinite diversity of shapes is possible, four general forms have been found to be predominant in reality. Yields may be lowest on short term securities and rise at a diminishing rate to produce what is known as an ascending yield curve. The opposite form may be apparent with yields highest in short range and decreasing until they level out, to form a descending curve. Yields on longs and shorts may be equal, causing a horizontal or flat yield curve. Finally, the least frequent form is known as the humped curve where the peak of the curve is found in the early maturity range. These four types are illustrated in the following diagram:-



The theory of the term structure of interest rates concerns itself with the elucidation of these various relationships between yields on different maturities, where term to maturity is the only differentiating factor. The level of the rate structure is assumed to be exogenously determined by the general equilibrium of the system.

A number of theories have been put forward to explain the term structure of interest rates. It is our concern in this thesis to examine the most important and widely known of these. The starting point will be the traditional or fundamental expectations Hypothesis which will form the basis of the discussion on the more modern approaches of New Expectations Theory, Malkiel's Alternative Reformulation of Expectations Theory, the Hicksian Liquidity Preference Hypothesis, and Market Segmentation Theory. The next step will be an analysis of the empirical evidence available on the theories so as to gain insight into both the problems associated with the operationality of the hypotheses and their potential explanatory power in the South African context. In order to establish institutional and other features peculiar to South Africa which may have an impact on the performance of the hypotheses in their application here, we shall then examine the institutional framework and interest rate determination in this country. The ultimate goal of the dissertation is reached in Chapter IV when we apply empirical content to the theories. Our aim here is to establish which hypothesis, if any, is best able to explain the South African experience and to this end we employ econometric and other quantitative methods. To facilitate comparability a specific time period has been chosen, namely from 1964 to 1974. This particular set of dates has been singled out for no other reason than the availability of consistent time series data.

In sum then, our aim is to test the major theories on the term structure of interest rates against the South African data in order to determine whether meaningful conclusions can be drawn on the relevance of the theory to the South African experience.

It may be useful at this stage to very briefly anticipate some of the major conclusions of this dissertation. After a systematic evaluation of the theories on the term structure in Chapter I, we concluded that no a priori deductions were possible without specific reference to the empirical evidence. It emerged from the empirical review of Chapter II that only the Malkiel Hypothesis was favourably, if scantily, supported, while the traditional theory performed badly and the remaining three hypotheses produced indifferent results. Chapter III established that although the South African financial sector is relatively well developed and possesses a not insignificant degree of flexibility, it is nonetheless subject to powerful legislative constraints. We further concluded that while specific interest rates are determined via a complex interplay of economic, institutional and legal factors and that the market is rather rigidly controlled, it is apparent that generally market forces do seem predominant in the sense of movements in controlled rates approximating those of more freely determined interest rates. Chapter IV exposed the enormous difficulties inherent in testing the various theories. The experience of overseas investigators was confirmed insofar as it was found that no model could completely explain the South African yield structure. It did emerge, however, that the theory espoused by Malkiel performed well in the circumstances.

CHAPTER I

THEORIES OF THE TERM STRUCTURE OF INTEREST RATES

1.0 INTRODUCTION

Our concern in the present chapter lies in initially evaluating the various theories purporting to explain the term structure of interest rates. After briefly surveying the development of theories on the rate structure, the discussion moves on to the "traditional" expectations theory which is examined in some detail, for it will form the basis of our deliberations. The other, more modern theories are then arranged in accordance with their similarity to the orthodox approach. Essentially this implies a classification based on risk aversion, the traditional view being that investors are indifferent to maturity. We conclude the chapter by making certain generalisations on the various hypotheses.

1.1 Historical Overview

Until the late 1920's it was customary amongst economic theoreticians to talk of "the rate of interest". Despite the recognition that this involved a drastic simplification of the real world it was not considered a weakness, since the complex of interest rates on different maturities was believed to move simultaneously. Furthermore, it was proposed that the "family" of interest rates characteristically possessed a tendency toward the equalisation of different rates.

However, specific attempts to reduce the rate of interest to a structural composite of interest rates dates back long before the era of the 'twenties. J.B. Say's¹ publication in 1853 represents the earliest theoretical endeavour aimed at explaining the term structure of interest rates. Some thirty years later Henry Sidgwick² made a similar attempt. Nonetheless, both works received scant attention from the mainstream of economic analysis on the theory of interest.

Towards the end of the 1920's however, there appeared several important works dealing with the term structure of interest rates. Karin Koch³ pointed out the significance of the behaviour of the rate structure for monetary policy/

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1. Say, J.B. Treatise on Political Economy, Lippincot, Philadelphia, 1853.
 2. Sidgwick, H. Principles of Political Economy, Macmillan, London, 1882
 3. Koch, K. A Study of Interest Rates, Macmillan, London, 1929

and analysed in depth institutional and theoretical considerations affecting the structure of rates. Irwing Fisher⁴ developed the relationship between short-term and long-term rates of interest under conditions of perfect foresight⁵, which heralded the beginnings of an expectationally based explanation of the term structure of interest rates. Fisher's work later became crystallised in the theorising of both Friederich Lutz⁶ and Sir John Hicks⁷, who, writing independently, formulated what has become known as Expectations Theory or simply, the Hicks-Lutz Theory. It has been suggested that in some respects it is not correct to group the Hicks and Lutz approaches together since they assess expected rates of interest differently, and the Hicksian theory becomes eventually the Liquidity Preference or Risk Premium Theory of the term structure⁸. Two more modern variants of the traditional theory have been developed since 1960 by Meiselman⁹ vis-a-vis his Error-learning Model, and by Burton Malkiel¹ using his "mathematics of bond prices".

Sir Ralph Hawtrey² had earlier opened up a new perspective on the rate structure. Fundamentally, he argued that changes in short-term rates caused by the central bank, had little effect upon long-term rates. This represented a unique line of thought significantly different from that underlying expectations theory³. Seizing upon Hawtrey's central theme, Culbertson⁴ refined it into what has become known as Hedging Pressure or Market Segmentation Theory which today exemplifies the centre of opposition amongst theoreticians to theories based on expectations.

-
4. Fisher, I. The Theory of Interest, Macmillan, New York, 1930. See pp 313-14 and Chapter ix especially pp 209-210 on these points.
 5. However, Fisher was very explicit about his abstraction from institutional factors and the consequent inapplicability of any precise theoretical formulation.
 6. Lutz, F.A. "The Structure of Interest Rates" Quarterly Journal of Economics, November, 1940, p.36.
 7. Hicks, J.R. Value and Capital, Clarendon Press, London, 1939, pp 144f.
 8. This view has been expressed by, among others, D.G. Lockett "Professor Lutz and the Structure of Interest Rates" Quarterly Journal of Economics, Feb.1959, pp 131f and Ford, J.L. and Stark, T. Long and Short-Term Interest Rates, Blackwells, Oxford, 1967.
 9. Meiselman, D. The Term Structure of Interest Rates, Prentice-Hall, Englewood Cliffs, 1962.
 1. Malkiel, B.G. The Term Structure of Interest Rates: Expectations and Behaviour Patterns, Princeton University Press, Princeton, 1966.
 2. Hawtrey, R. A Century of Bank Rates, Oxford University Press, London, 1936, pp 184-95.
 3. Kessel, R. The Cyclical Behaviour of the Term Structure of Interest Rates National Bureau of Economic Research, New York, 1965, p 11 points out that Hawtrey was the first to formulate a segmented markets theory, long before Culbertson.
 4. Culbertson, J.M. "The Term Structure of Interest Rates" Quarterly Journal of Economics, Nov. 1957 pp 485-517.

1.2 The Traditional Expectations Theory

Amongst professional economists, the traditional expectations theory represents by far the most widely accepted explanation of the term structure of interest rates. Predictably, it has formed the methodological basis for almost all the discussion centering on the question of the rate structure. The theory rests primarily on three assumptions, detailed at the outset of Lutz's classic paper⁵:

- " (i) everybody concerned knows what the future short-term interest rates will be i.e. there is accurate forecasting in the market;
- (ii) there are no costs of investment, either for lenders or borrowers;
- (iii) there is complete shiftability for lenders as well as for borrowers. The lender who wants to invest, for say, ten years is equally well prepared to buy a ten-year bond or to lend on a one-year contract and to re-lend ten times. Similarly, a lender who wants to invest for only one year is in principle prepared to buy a ten-year bond or a bond of any other maturity and sell it again after the first year. The same shiftability is assumed for the borrower."

Given profit maximisation, these assumptions will ensure that each investor will arrange his security portfolio in such a way as to maximise his return for the period in which his funds are available. In addition, we will show that these circumstances lead to a unique set of equilibrium relationships between securities of different maturity.

The fundamental notions underlying the expectational theory of the term structure follow from the fact that these assumptions are sufficient to equalise the expected holding period yield⁶ on an investment in any combination of maturities. For example, an investor wishing to have a holding or investment period of one unit length will get the same return regardless of whether he places his resources in an asset of one unit length to maturity, or one which has two unit lengths to maturity. Formally, this proposition has become known as the Equalisation Theorem.

5. Lutz, F.A. op.cit; P.37

6. Ibid, p.40, Lutz provides a definitional equation for the holding-period yield as follows:-

$$\text{holding period yield} = \frac{\text{coupon interest} + \text{capital gain (loss)}}{\text{purchase price}}$$

The rationale for the equalisation of holding period yields can be shown in many ways. The crucial point is, though, that under the assumptions made above, the only variable that influences the investment behaviour of the market is the expected yields of an investment in any maturity range. Because expectations are uniform for all market participants, we can describe the modus operandi of the market in the following way. Assume that we begin in a situation where yield differentials exist between securities of varying maturity. Thus, for instance, an investor with a long holding period would not invest in longs if he expected a higher yield from purchasing a successive array of short-term securities. Since he operates under the postulate of rational economic behaviour, he would obviously desire that combination of securities which would ensure the largest expected holding period yield. It follows then, that by attempting to maximise holding period returns, the market as a whole through the process of arbitrage, would act to eliminate any differentials in yields. Consequently, long rates must be an average of present and expected (future) short-term rates of interest, which is no more than a statement of the Equalisation Theorem.

The term structure is conceptually viewed as determined in the market for loans of different maturities. It is seen as useful to deal with this market as analogous to the commodity futures market, an analogy first used by Hicks in his analysis of interest rates in Value and Capital⁷. The rate structure at any point in time is argued to contain an implicit set of forward or "futures" interest rates. The rate of interest for a two-year loan therefore, is conceived as being compounded out of the "spot" rate for loans of one-year, and the expected "forward" rate of interest for one year loans to be executed at the beginning of the second year.

In formalising the theory⁸, we can write the "long" or two-year rate as ${}_tR_2$, the "spot" or current one-year "short" rate as ${}_tR_1$, and the "futures" one-year short rate as ${}_{t+1}r_1$. If a lender purchases a two-year bond, at the end of his holding period the investment will be worth $(1 + {}_tR_2)^2$. Had he invested in two successive one-year loans instead, the result would be given as $(1 + {}_tR_1)(1 + {}_{t+1}r_1)$. Since we have established from the Equalisation Theorem that/

7. See Hicks, J.R. op.cit; Chapters 11 to 13. For example, on p.146 Hicks states, "... these ... are strictly analogous to the futures prices we discussed in the last Chapter, and are determined in almost exactly the same way."

8. We utilise the notation developed by Meiselman, D. op.cit; p.19. Capital R's represent actual market yields, while lower case r's indicate expected interest. The prescripts represent the time period at which the rates are applicable, and the subscripts stand for the maturity of the bonds.

in equilibrium both investment strategies must be equal in terms of their holding period yields, we can write;

$$(1 + {}_t R_2)^2 = (1 + {}_t R_1) (1 + {}_{t+1} r_1)$$

$$(1 + {}_t R_2) = \sqrt{(1 + {}_t R_1) (1 + {}_{t+1} r_1)} \quad (1.2.1)$$

If we generalise this relationship to the whole spectrum of long-term and short-term rates, we get;

$$(1 + {}_t R_n) = \left[(1 + {}_t R_1) (1 + {}_{t+1} r_1) \dots (1 + {}_{t+n-1} r_1) \right]$$

$$(1 + {}_t R_n) = \left[(1 + {}_t R_1) (1 + {}_{t+1} r_1) \dots (1 + {}_{t+n-1} r_1) \right]^{1/n} \quad (1.2.2)$$

$$(1 + {}_t R_n) = \left[(1 + {}_t R_{n-1})^{n-1} (1 + {}_{t+n-1} r_1) \right]^{1/n} \quad (1.2.3)$$

where r_2, r_3, \dots, r_n are the implicit forward rates at the beginning of period 1 for one period loans during the periods 2,3, \dots, n respectively. These "short-term" forward rates, which can be calculated from the observed term structure R_1, R_1, \dots, R_n represent the current market rates for one period in each of the future periods 2,3, \dots, n when all payments are made at the end of the loan.⁹ Conversely, each observed "long-term" rate R_2, R_3, \dots, R_n can be calculated from the current one period rate and the relevant number of successive forward one period rates. In this way, the system of market rates for various maturities can be reduced to a function of the current short rate and a series of relevant forward short rates.

It should be stressed, however, that this relationship does not express a statement of economic behaviour. Rather it is, as Meiselman has pointed out, only a tautology. He goes on in the same breath;

"The relationship between a given term structure of rates and the implied forward short-term rates is analogous to the well-known relationship between average and marginal quantities. Any long-term rate is an average of forward rates spanning the same period, and forward rates are measures of the incremental costs or returns."¹

9. We assume that all funds are retained in the investment until maturity, i.e. the coupon carried by the bond is zero. Lutz, F.A. op.cit; p.37, rationalises this method of using the arithmetic average rather than compounding interest as follows: "The arithmetic average can, however, be used as a sufficiently close approximation for most purposes."

1. Meiselman, D. op.cit; p.4

The pure expectations theory does produce a proposition about forward rates that is an assertion about economic behaviour. It maintains that the forward rates which can be derived from the term structure are unbiased estimates of expected interest rates.

1.2.1 Implications of the Theory for the Term Structure

The traditional or Hicks-Lutz variant of the expectations theory, as we have seen, produces a relatively straightforward and easily managed framework of analysis. It is to the implications of this analysis for the term structure that we now focus our attention.

Equation (1.2.2) contains several well-established propositions concerning the rate structure. These can be separated into two distinct categories, namely; propositions dealing with the term structure of yields at a moment of time t , and those which concern the movement of rates over time.

Consider firstly the rate structure at a moment of time t .

The following four propositions can be derived:-

- (1) If the market expects short rates to rise monotonically in future, then at t the rate on longs will exceed that on shorts, i.e. the yield curve will slope continuously upward to the right.
- (2) If the market expects short rates to fall monotonically in future, then at time t the short rate will exceed the long rate i.e. the yield curve will be continuously downward sloping to the right.
- (3) If the market expects that the current spot rate will equal all future short rates, then the yield curve will be horizontal since expectations are static.
- (4) If the market holds divergent expectations of future short rates, then almost any yield curve is possible. Lutz himself has pointed this out:²

"In principle, with sufficiently differentiated expectations, any structure of interest rates is possible. The rates might /

2. Lutz, F.A. The Theory of Interest, D. Reidel Publishing Company, Amsterdam, 1963, Chapter 17, p.213.

initially rise with term to maturity and then fall from a certain maturity on, or vice versa, or they might first rise, then fall, then rise again, and so on."

Three propositions dealing with the movement of rates over time may be deduced from equation (1.2.2).

- (1) Long-term rates will be less volatile than short rates. This follows from the fact that all future changes in the short rate are already reflected in the long rate. Therefore, with the passage of time, changes in the short rate affect the long rate only to the extent that the average of short rates is altered.³
- (2) When the market expects all short rates will be higher in the future than they are in the present period, long rates will rise i.e. any given long rate will be higher than that it was at $t-1$.
- (3) Conversely, when the market expects that all short rates will be lower in the future than they are at present, any given long rate will be lower at t than it was at $t-1$.

It should be stressed, though, that this by no means exhausts the deductions that can be made from the traditional expectations theory. J.W. Conard, for instance, has argued:⁴

"In the first place, since this theory does not describe how expectations are formed, there is room for any influence that may change them to alter the value of any or all future short rates, and hence produce a wholly new term structure. Thus, it is possible to make any pattern of change in the structure of rates compatible with the (expectational) theory by merely assuming the appropriate changes in the sets of expected short rates."

The Hicks-Lutz approach clearly offers a rich fund of ideas on the yield structure, and the predictions which follow from the approach have direct/

3. This can be proved mathematically. See Lutz, *ibid*, p.214

4. Conard, J.W. An Introduction to the Theory of Interest, University of California Press, Benkley, 1959, Chapter XIV, p.301.

relevance to real-world situations. We shall see in the following chapter however, that this fund is somewhat illusory when it is tested against empirical data.

1.2.2 Criticisms of Expectations Theory

The traditional expectations theory has been subjected to a prolonged and vigorous attack by a variety of critics on a number of counts.

Perhaps the most compelling assaults have come from those cynical of the basic behavioural postulates assumed by the theory.⁵ These largely concern the Lutzian assumption that all investors hold uniform expectations, and that it is expected (future) short-term interest rates that determine the yield structure.

D.G. Lockett has argued that the existence of diverse expectations may "warp" the term structure, and that then "the rate pattern is based on what everyone thinks everyone else thinks ... long rates have no relevance to short rates."⁶ However, as Meiselman and others have suggested, the existence of diverse expectations need pose no real threat provided that the market is dominated by investors who hold the same expectations and who act on them.

It is on the second count, though, that the attacks of critics have been much more telling. Lockett again spearheaded the assault on the assumption that expected (future) short-term rates govern the term structure. He petulantly sketches his reasoning:

"We are thus treated to the spectacle of an individual standing on the eve of World War II, atomic bombs, the Cold War, the postwar inflations, the Employment Act of 1946, et hoc genus omne, trying to decide what short-term interest rates will be fifteen to twenty years in the future."⁷

Joan Robinson in her famous article on the rate of interest proved to be an equally scathing opponent:

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5. This method of evaluating theories has, however, not met with universal acceptance. Milton Friedman for one has come out strongly against such methodology in his Essays in Positive Economics, Chicago University Press, Chicago, 1965.
 6. Lockett, D.G. "Professor Lutz and the Structure of Interest Rates" Quarterly Journal of Economics, February, 1959, p.139.
 7. Lockett, D.G. Ibid. p.141

" The view that the long rate can be determined solely from expectations about the short rate is untenable it certainly does not detach the rate of interest from dependence on its bootstraps for, in such a world, the only reason for a difference between long and short rates is the expectation of a change in the long rate In real life it would be perfectly rational for a man, to think that he knows exactly what the rates of interest will be every day from today till Kingdom Come."⁸

Robinson is questioning the premise that investors form expectations of interest rates for indefinite periods ahead by implying that rational expectations can encompass only the near future. She argues that expectations of the short rate do not solely determine the long rate, but independent expectations concerning the long rate itself may also exist.

This contention is reinforced by the assertion advanced by Lockett that while investors are not able to rationally formulate expectations much beyond the immediate short-term, neither do they believe themselves capable of this. Expectations therefore cannot be self-fulfilling nor can the well-known "as if" assumption be made.⁹

This line of criticism is clearly aimed at the very core of the expectations theory. For the theory to be meaningful in any way, investors must be able to predict short rates for a considerable number of years into the future.

At present very few economists would accept the original Hicks-Lutz variant of expectations theory without some reservation. Depending on the nature of their criticisms, various "schools" of thought have developed emphasising one or another aspect of investor behaviour. We shall systematically examine their points of departure from the "traditional" view beginning with the theory nearest to the Hicks-Lutz formulation, namely Meiselman's so-called New Expectations Theory.

1.3 Meiselman's New Expectations Theory

New Expectations Theory or the Error-learning Model put forward in 1962 by David Meiselman, should be viewed as constituting a brilliant defence of the/

8. Robinson, Joan "The Rate of Interest" Econometrica, April, 1951, p.102.

9. It is often justifiably argued in Economics that individuals behave "as if" they are aware of the variables at play in any given context.

expectational explanation of the term. While believing expectations theory to be fundamentally sound and rejecting prior empirical tests of it, he accepted the criticism that some investors, because of risk aversion or other impediments to mobility, may be rigidly committed to specific maturity ranges. But in aggregate, he argued, market excess demand schedules for securities of each maturity would still tend to be infinitely interest elastic. In this vein he contends:-

"As a matter of descriptive reality, individual transactors may still speculate or hedge on the basis of risk aversion, but speculators who are indifferent to uncertainty will bulk sufficiently large to determine market rates on the basis of their mathematical expectations alone."¹

The New Expectations hypothesis, then, embodies an attempt both to debase earlier criticism and to provide operational content to Expectations Theory.

Drawing upon the experience of Cagan², who successfully explained the demand for money during hyperinflations using a model of price expectation formation, and the subsequent success with which Milton Friedman³ explained consumption behaviour with a model of permanent income, Meiselman proposed an hypothesis of how expectations are revised for interest rates. Like his predecessors, Meiselman posited that market expectations are revised according to the size of the error between what was anticipated and what actually occurred.

The basic premise in any error-learning model is that the agents in the model learn from experience, and this information will automatically and mechanically be acted upon regardless of the circumstances surrounding the error in forecasting. To be specific; if forecasts are too high, expectations will be revised downwards, or if they are too low, they are revised upwards. The market, therefore, cannot make any judgement that the circumstances which caused it to err at any given time were of an ephemeral nature, and having disappeared will leave other forecasts correct.

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1. Meiselman, D. op cit. p.10
 2. Cagan, P. "The Monetary Dynamics of Hyperinflation", in Friedman, M. Studies in the Quantity Theory of Money, University of Chicago Press, Chicago, 1956.
 3. Friedman, M. A Theory of the Consumption Function, Princeton University Press, Princeton, 1957.

Meiselman begins his analysis by assuming that forward rates are unbiased estimates of future spot rates, which implies that the yield structure is determined in accordance with equation (1.2.2). While this is true, Meiselman argues, predictions of forward rates need not necessarily be correct. Instead, expectations will constantly be revised via the error-learning process.

The substantive assumptions underlying the model are essentially similar to those of the traditional theory. Securities of different maturities are assumed to be perfect substitutes, the market is seen as dominated by investors attempting to maximise present value on the basis of their homogeneous expectations, transactions costs are non-existent, and expected holding yields are assumed equal for all maturities.

It is crucial to recognise that Meiselman is concerned with explaining not the level of interest rates but rather how expectations change over time. He argues:-

"Instead, changes in, rather than levels of interest rates can be related to factors which systematically cause revisions of expectations Recent research in a wide variety of behavioural contexts has indicated that hypotheses which assert that expectations tend to be related to past experience, often a weighted average of past experience, are consistent with the data. Further, these hypotheses state that expectations tend to be systematically altered on the basis of new experience whenever unfolding events differ from what had been anticipated."⁴

Thus, although the Meiselman model belongs to the same family of adaptive expectations as the Cagan and Friedman models, he introduces a new feature which exploits the special fact of the market revealing its expectations in forward rates. He goes on:-

"The same view of expectations can be applied to expectations of interest rates. In some respects the task of estimating expectations is made easier because, according to the theory we seek to test, expectations are already impounded and discounted in the term structure."⁵

4. Meiselman, D. op cit, p.18

5. Ibid, p.19

It follows then that the essence of New Expectations Theory is to observe how these implied short rates change over time with the receipt of new information.

The Hicksian view of the term structure as a series of unit period loans extending into the future is applied by Meiselman. Using equation (1.2.2) he derives the forward rate on a one-year loan during the period $t+1$ to be:

$${}_{t+1}r_{1,t} = \frac{(1 + {}_tR_{2,t})^2}{(1 + {}_tR_{1,t})} - 1 \quad (1.3.1)$$

Here ${}_{t+1}r_{1,t}$ is the yield on one-year securities that is expected at time t to prevail at $t+1$. In analogous fashion, at time t investors can recall one-year rates in existence at $t-1$, and derive the rate expected at $t-1$ to exist at time t . The expected rate can then be compared to the actual rate on one-year loans at the beginning of period t . If actual rates are higher than had been contemplated, the market would systematically raise its expectations of future yields. This implies, in effect, the operation of an automatic error-learning mechanism i.e. forward short term rates change on the basis of errors made in forecasting the current short-term rate. This can be stated algebraically in the form of a behavioural hypothesis

$$\Delta {}_{t+n}r_{1,t} - {}_{t+n}r_{1,t-1} = f ({}_tR_{1,t} - {}_t r_{1,t-1}) \quad (1.3.2)$$

which, alternatively, can be written as:

$$\Delta {}_{t+n}r_{1,t} = g (E_t) \quad (1.3.3)$$

where E_t is the forecasting error (${}_tR_{1,t} - {}_t r_{1,t-1}$), or the difference between actual and expected rates on one-year loans. Assuming the functional relationship to be at least approximately linear, Meiselman proposes the equation:

$$\Delta {}_{t+n}r_{1,t} = a + b E_t \quad (1.3.4)$$

Because, in terms of expectational theory, the long rate is an average of the current spot rate and forward (expected) short rates, Meiselman generalises equation (1.3.2) and postulates that changes in the long rate are also based on errors made in anticipating short-term rates:

$${}_{t+n}R_{j,t} - {}_{t+n}R_{j,t-1} = n ({}_tR_{1,t} - {}_t r_{1,t-1}) \quad (1.3.5)$$

which can be transposed into the abbreviated form of (1.3.3) to produce:

$$t + n R_{j,t} = R(E_t) \quad (1.3.6)$$

where $n = 0, 1, 2, 3 \dots$ years and $j = 1, 2, 3 \dots$ years.

On the "first difference" form equation (1.3.4) Meiselman hypothesises a priori two behavioural conditions likely to hold; that is $a = 0$, and secondly $b > 0$. Both follow unambiguously from the core of the theory.

A constant term a significantly different from zero would indicate that investors, even when their expectations proved correct, revise their expectations either upward (if $a > 0$) or downwards (if $a < 0$). A constant term equal to zero, posited by Meiselman, means that investors leave their expectations unrevised when the expectations of the previous period are realised. Since $b > 0$, if and only if $E_t \neq 0$ will expectations be revised.

New Expectations Theory differs then in one fundamental respect from the traditional theory of Section 1.2. It does not rely on the market correctly predicting future rates of interest. However, it does depend on yield curve data as well as the supposition that the implied forward one-year rates of interest are the market's expected rates.

In common with the traditional theory though, the Meiselman model can explain almost any conceivable shape of the yield curve because it explains changes in the rate structure and the determination of the level of interest rates. As L.G. Telser⁶ has pointed out:-

"Since Meiselman's model gives no information about the level of rates, it is consistent with any shaped yield curve."

In particular, it is able to handle the observed greater volatility of short rates in much the same fashion as the older theory. Meiselman argues that since investors are likely to take their short-term forecasts more seriously than their long-term forecasts, they will revise the former to a greater degree when their expectations of the previous period prove to be incorrect.

6. Telser, L.G. "A Critique of some Recent Empirical Research on the Explanation of the Term Structure of Interest Rates" Journal of Political Economy, Dec., 1967 p.553

call 'the interest rate'. "¹

Obviously, speculators are seldom concerned with the underlying variables, but rather manage their portfolios on the basis of readily observable changes in security prices.

1.4 Malkiel's Alternative Formulation of Expectations Theory

The Malkiel theory should be viewed as an extension of the traditional explanation in much the same fashion as the Meiselman model. In essence, Malkiel accepts the overbearing importance of expectations in determining the rate structure, and makes this his fundamental standpoint:-

"This study takes the position that the traditional expectational approach is, in principle, correct and of substantial importance in understanding the actual behaviour of market interest rates of securities with different terms to maturity."²

Acknowledging the relevance of the criticism advanced by Robinson and Lockett regarding the irrationality of a long planning horizon, Malkiel makes it quite explicit that the "reformulated" theory will be cast in terms of a short time horizon.

"Moreover, a short planning period will be substituted for the long-run horizon implicit in the received analysis."³

In his exposition, Malkiel introduces and elaborates what he calls "three building blocks" namely; the mathematics of bond price movements, the assumption that investors hold a notion of a "normal" range of expected interest rates, and "expectations proper" or the belief by investors that a specific course of future interest rates is likely.

Noting that economists have typically calibrated their explanations of the rate structure in terms of bond yields, Malkiel argues for the introduction of bond prices per se since investors are much more likely to be responsive to readily observable movements in bond prices rather than yield differentials.

1. Meiselman, D. op. cit, p.31
 2. Malkiel, B.G. op. cit, p.50
 3. Ibid. p.50

Four basic elements are proposed as determinants of bond prices, the face value of the bond F , the coupon carried by the bond C , the internal rate of return i , and the term to maturity N . By assuming that all securities carry the same coupon, and that the spot rate equals expected future short rates, Malkiel writes the equation:-

$$P = \frac{C}{(1+i)} + \frac{C}{(1+i)^2} + \dots + \frac{C}{(1+i)^n} + \frac{F}{(1+i)^n} \quad (1.4.1)$$

which, summed and simplified, reduces to:

$$P = \frac{C}{i} \left\{ 1 - \frac{1}{(1+i)^n} \right\} + \frac{F}{(1+i)^n} \quad (1.4.2)$$

Five theorems are deduced from equations (1.4.1) and (1.4.2). We shall not derive the mathematical proofs, but merely state the theorems as succinctly as possible;⁴

Theorem I: bond prices move inversely to bond yields.

Theorem II: for a given change in yield from the nominal yield, changes in bond prices are greater, the longer the term to maturity.

Theorem III: the percentage price changes described in Theorem II increase at a diminishing rate as N increases.

Theorem IV: price movements resulting from equal absolute increases and decreases in yield are asymmetric i.e. a decrease in yields raises bond prices more than the same increase in yields lowers prices.

Theorem V: the higher the coupon carried by the bond, the smaller will be the percentage price fluctuation for a given percentage change in yield, except for one-year securities and consols.

The second "building block" employed by Malkiel constitutes the centre-piece of the theory. While the idea of normal interest rates is not new, the formal use of such a range to explain the long-short spread certainly is. This, together with the postulated existence of a short planning period for investors, allows Malkiel to deduce his term structure hypothesis. He clarifies his concept of a normal range:

"This range will be defined in terms of the level rather than the structure of rates As a first approximation the aggregate of individuals comprising the 'market' will be assumed to believe that the historical level of interest rates will prevail in future."⁵

4. Ibid, p.54

5. Ibid, p.59

Malkiel argues that given the existence of a normal range and the fact that investors seek to equalise the gain they obtain from investing in any of the available securities whose coupons are assumed to be equal, if interest rates are near the upper bound of the normal range "investors will have more to hope than fear in terms of capital gains and losses"⁶. But if interest rates are near the lower bound of the normal range, then in terms of probabilities, "investors will have more to fear than hope"⁷.

The former situation, where interest rates tend towards the upper limit, implies that longs are more attractive than shorts in terms of gain, since future rates are anticipated to fall. The resultant yield curve will, of course, have a descending shape. In the latter case, where interest rates tend towards the lower limit of the normal range, short loans will be valued higher than longs because the market believes that rates will rise in future. The yield curve will therefore be ascending.

These two deductions about the shape of the yield curve, and hence about the rate structure at a point in time, follow partly from the application of bond price theorems. It can be shown, for instance, that as interest rates⁸ fall towards the lower limit of the normal range, with percentage and absolute changes equal for longs and shorts, the prices on longs will fluctuate more than those on shorts i.e. Theorem IV. In these circumstances, a given investment in long bonds will produce a higher capital gain than an equivalent investment in shorts.

Malkiel stresses that it is the choice of investors themselves to invest in one maturity range or another that determines the rate structure in the model. Plainly, the choice itself will depend on how speculators view the future course of interest rates. Malkiel approaches this by assuming that investors base their strategy on the likelihood of rates actually being at the lower or upper limit of the normal range. The probability of either limit being attained is set at 0,5, which allows a specific rate structure to be predicted.

Thus, the third building block, that of "expectations proper" is explicitly introduced into the analysis, illustrating that expectations play a well-defined role within the notion of the normal range. In the above argument, however, /

6. Ibid, p.65

7. Ibid, p.65

8. Remember that by assumption Malkiel deals with the same rate of interest on longs as on shorts.

expectations proper played a neutral role. But it is possible to argue, and Malkiel does, that if the current rate approaches the upper limit, investors may still expect rates to rise. Instead of a descending yield curve, the result will be an ascending curve.

Given the assumption of a short planning period for investors, the introduction of bond-price movements, and the concept of a normal range of interest rates, with or without the existence of expectations in the Malkiel sense, we have seen that deductions can be made concerning the term structure of interest rates. Since investors are assumed, as in the traditional theory, to maximise returns on their holding periods, a set of forward interest rates can be generated by the model.

Taking the long rate R as a surrogate for the general level of interest rates, Malkiel's basic hypothesis on the term structure can be given by:

$$(R - S)_t = f \left\{ \frac{R - R_{Ln}}{RN_R} \right\}_t \tag{1.4.3}$$

Where S is the short rate, RN_R the normal range of R, and R_{Ln} is the lower limit of the normal range of the long rate R. Malkiel specified RN_R :

"We suggest further that investors form their expectations of the limits of the normal range as if they took the average of rates over some period in the immediate past and added a specific number of standard deviations to either side of the average."⁹

He is thus able to write the upper and lower limits of the normal range as:

$$\begin{aligned} R_{Ln} &= (R_A - K\sigma) \\ R_{un} &= (R_A + K\sigma) \end{aligned} \tag{1.4.4}$$

Where R_A is defined as the moving average of long-term interest rates over a prescribed period of years in the past. Thus, for example, the lower bound of the range is equal to "the average" R_A plus a constant K times σ the standard deviation. Equation (1.4.3) now becomes:

9. Ibid, p.84

$$(R - S)_t = f \left\{ \frac{R - R_A + K \sigma}{2 K \sigma} \right\}_t \quad (1.4.5)$$

Under the assumption of a constant σ , we can derive an equivalent equation which takes the form:

$$(R - S) = F (R - R_A)_t$$

Where f and F are related by linear transformation. If F itself is written in linear form, we get:

$$(R - S)_t = a + b (R - R_A)_t \quad (1.4.6)$$

This forms Malkiel's basic behavioural equation, with the a priori expectation that $a > 0$ and $b < 0$.

Despite the fact that the behavioural mechanism employed by Malkiel is essentially different from that of the Hicks-Lutz theory the implications are very similar to the traditional theory.¹ Malkiel himself was the first to realise this, and he gave it explicit recognition by noting ".... despite these differences the alternative model gives precisely the same implications as does the traditional analysis."² In addition, Dudley Lockett has pointed out that the Malkiel theory contains within it the Meiselman hypothesis:

"Thus Meiselman's (theory is) equally consistent with either the Hicks-Lutz or Malkiel theories."³

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1. The salient differences between Malkiel's approach and the traditional theory can be summed up as follows. Firstly, instead of requiring definite and explicit expectations about the course of future rates, the Malkiel model substitutes the less demanding assumption of a normal range of interest rates and a short planning period over which alternative strategies can be compared. Secondly, the Malkiel version deals with fluctuations in the long rate during the short-run rather than the short rates behaviour over the long-run. Thirdly, it deals with bond prices rather than yields. Finally, Malkiel shows how investors arrive at the normal range while the traditional approach takes expectations as given.
 2. Ibid, p.74
 3. Lockett, D. op.cit, p.77

1.5 The Liquidity Preference Hypothesis

Thus far the theories which we have considered have all been structured on the assumption that the majority of investors are not basically risk averse. All bonds, regardless of their term to maturity, are essentially viewed as substitutes. The fact that the market exhibited complete shiftability between different maturities culminated in an equalisation of holding-period yields. Further, even in the case of Meiselman, estimates of future expected rates have been unbiased. In sum, the securities market has been assumed to operate in a perfect manner.

Hicks⁴ was the first to argue that the basic expectations theory required modification. The Liquidity Preference or Risk Premium Hypothesis postulates that investors are primarily risk averse, and that this aversion introduces an institutional weakness into the market for capital:

"It is not normal to think of the market for long-term loans in terms of hedgers and speculators; but that distinction does in fact continue to be relevant here. Other things being equal, a person engaging in a long-term contract puts himself into a more risky position than he would be in if he refrained from making it."⁵

Consequently, innate hedging against risk will cause expectations of future interest rates to be biased.

Using the analogy of the commodity futures market, and making explicit use of the Keynesian notion of "normal backwardisation",⁶ Hicks argued that the basis of the traditional expectations hypothesis had to be altered. Given the existence of strong and dominant risk aversion, the demand side of the market would be characterised by borrowers who have a propensity to borrow long to ensure a steady availability of funds. In contrast, the supply side of the market will be dominated by lenders who have exactly the opposite propensity, i.e. they have a preference for short-term lending. This leaves an imbalance or institutional weakness in the pattern of supply and demand for capital. The payment of "risk premiums" therefore becomes necessary to counterbalance the reluctance of lenders to make longer term loans. Hence it is through the existence of risk premiums that imperfections are removed from the structure of rates.

4. Hicks, J.R. op. cit, Chapter XI

5. Ibid, p.146

6. Keynes, J.M. A Treatise on Money. Vol.II, Macmillan, London, 1930, expounds this concept on pp.142 to 144.

According to this analysis, in equilibrium implicit or forward rates must exceed the expected rates by the amount of the risk premium. It follows that the normal relationship prevailing between long and short rates will be that where long rates, which are averages of current and forward short rates, exceed short rates. Hicks argues:

"The forward short rate will thus exceed the expected short rate by a risk premium which corresponds exactly to the normal backward-ation of the commodity markets. If short rates are not expected to change in future, the forward rate will exceed the current short rate by the extent of this premium; if short rates are expected to rise the excess will be greater than this normal level; it is only if short rates are expected to fall that the forward rate can be below the current rate The same rules must apply to long rates themselves, which are effectively an average of forward rates. If short rates are not expected to change the long-rate will exceed the short-rate by a normal risk premium; if the current short rate is regarded as abnormally low, the long-rate will be decidedly above it; the short-rate can only exceed the long-rate if the current short-rate is regarded as abnormally high."⁷

Naturally, if the payment of liquidity premiums is not necessary to bring about equilibrium between the long and short markets, then the same equilibrium condition will hold as in the case of the traditional expectations hypothesis. This can be expressed, as we have seen in section 1.2, in the algebraic form:

$$(1 + {}_t R_n) = \left[(1 + {}_t R_1) (1 + {}_{t+1} r_1) \dots (1 + {}_{t+n-1} r_1) \right]^{\frac{1}{n}} \quad (1.5.1)$$

If we now introduce the Hicksian liquidity premium, and express it as the amount by which the forward rate implied by the term structure is higher than the corresponding expected rate, the equation (1.5.1) becomes:

$$(1 + {}_t R_n) = \left[(1 + {}_t R_1) (1 + {}_{t+1} r_1 + L_2) \dots (1 + {}_{t+n-1} r_1 + L_n) \right]^{\frac{1}{n}} \quad (1.5.2)$$

Where $L_1 = 0$, since the liquidity premium on the current short rate of interest must be zero. L_2, L_3, \dots, L_n the Hicksian liquidity premiums for the periods 2, 3, n. Therefore, the forward short rates implicit in the term/

7. Hicks, J.R. op. cit; p.147

structure will be an upward-biased estimate of expected future short-term rates. Hicks himself posited that this relationship would take the following form:

$$L_1 = 0 \text{ and } L_2 < L_3 \dots\dots\dots < L_n$$

Accepting this as generally valid, Kessel⁸ argued that "since the risk of capital losses attributable to holding securities is directly related to term to maturity, security yields ought also to vary directly with maturity." In other words, the risk premiums $L_2, L_3 \dots L_n$ must increase monotonically with n .

If there is a Hicksian-type market in existence what will the implications be for the term structure of interest rates? The theory of normal backwardisation implies, as we have seen, that liquidity premiums will be a monotonically increasing function of n . The yield curve will therefore be smoothly ascending if the short rate is expected to remain unchanged in future. In much the same way as the traditional theory, however, the existence of risk premiums combined with various patterns of expected future short rates can explain virtually any yield curve. But what should be stressed though, is that in the Hicksian hypothesis liquidity premiums form the primary determinant of the term structure of interest rates.

1.6 The Segmented Markets or Institutional Hypothesis

Throughout this chapter we have gradually progressed further and further away from traditional expectations theory. The limit of that progression has now been reached, for the theory of segmented capital markets stands in almost complete opposition to the traditional view. J.M. Culbertson, the leading modern exponent of Market Segmentation Theory contemptuously dismisses Expectations Theory as "inconsistent with all we know about the way people behave in the debt market."⁹

In a sense, the institutional view can be regarded as an extreme variant of the Liquidity Premium hypothesis since it sees the market as completely dominated by risk aversion. However, two crucial differences separate the/

8. Kessel, R.A. op. cit; p.45

9. Culbertson, J.M. "Discussion: Econometric Studies in Money Markets II" a paper delivered at the annual meeting of the Econometric Society, Pittsburgh, Dec. 1962. Unpublished. Cited in Dodds, J.C. and Ford, J.L. Expectations, Uncertainty and the Term Structure of Interest Rates, Martin Robertson, London, 1974.

theories. Firstly, segmentation theory does not accept that risk aversion will necessarily produce normal backwardisation, in contrast to Hicks, and secondly, expectations are argued to play only a minor role in the determination of the rate structure.¹

Culbertson rejects any expectationally based explanation at the outset of his argument:

"However, the behaviour of most borrowers is not ordinarily governed by such expectations. The effect upon the rate structure of those patterns of speculative (i.e. expectationally governed) behaviour that do exist depends upon the nature of their planning periods and other such details..... Thus both the relative importance as a price determining factor and the characteristic effect of speculative activity are matters that finally must be settled by reference to the facts regarding the particular market during the particular period. In general, however, in debt markets such behaviour is more prominent in the market for debt that is more unstable in price, that is, long-term debt, and is predominantly based upon near-term expectations, rather than upon those related to the more distant future. These considerations do not support the view that long-term rates should tend to equal the average of short-term rates"²

Culbertson clearly holds the position that expectations at most can only influence the behaviour of relatively few investors in the very short term, and then only in a transitory fashion. Therefore, no significant role is granted to expectations in the determination of the rate structure.

The major premise underlying Market Segmentation Theory is that investors, and specifically investing institutions, hedge against risk by matching their liabilities against the maturity structure of their assets. Thus, unlike the traditional theory, securities of different maturities are not presumed to be perfect substitutes for either the individual investor or in aggregate.

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1. The basic exposition of Segmentation Theory can be found in two articles by Culbertson, J.M. "The Term Structure of Interest Rates", Quarterly Journal of Economics, Nov. 1957, p.485 f and "The Interest Rate Structure: Toward a Completion of the Classical System" in Hahn, F.H. and Brechling, F.P.R. The Theory of Interest Rates, Macmillan, London, 1965.
 2. Culbertson, J.M. op.cit; p.490

The institutionalists have no trouble producing real world examples in support of this allegation. Commercial banks, for instance, may often be in search of highly liquid assets in which to invest a temporary excess of resources while life insurance companies, on the other hand, will not consider liquidity when investing an inflow of funds from the sale of annuity contracts. Rather, the risk averse insurance company will attempt to match its long-term annuity finance by purchasing long paper in the capital market. This will, in fact, guarantee a profit regardless of the movement of interest rates over the life of the annuity contracts. Growth funds, building societies, pension and provident funds, etc. find themselves in an entirely analogous situation.

On the other side of the coin, borrowers will also attempt to link the time span of their liabilities with that of their assets, thereby conforming to the assumptions of the Segmentation hypothesis. For instance, consumers normally finance the purchase of houses with long-term mortgages and conversely, use short-term hire purchase contracts to purchase less durable consumer goods. Similarly, firms purchase inventories with short-term loans and finance plant and equipment by borrowing long.

It follows from both the assumption of universal risk aversion and its concomitant hedging behaviour, and the assumption that the participants on the supply and demand sides of the market have distinct preferences for financial assets of various maturities, that the total market is effectively split into smaller sub-markets. In the strict version of the theory³, Culbertson allows for no economic overlap to exist between markets whatsoever, effectively assuming away the importance of expectations.

Given the existence of a range of sub-markets across the maturity spectrum, Culbertson argues that it is the demand and supply conditions within each market that determine bond prices, and ultimately the structure of yields. Expectations of interest rates in one market will not influence interest rates in any other market, nor will changes in the supply of debt instruments, implying that actual interest rate determination in any sub-market is virtually independent of all other markets.

3. Note that Culbertson proposed the stricter version of the theory not so much because of his implicit faith in it, but rather as a distinct platform from which to attack the traditional expectations theory which he regarded as an "academic curiosium".

A less extreme version of the institutional theory known as Preferred Market Habitat Theory has been advanced by Modigliani and Sutch. This hypothesis accepts the fundamental notion of a segmented capital market eschewed by Culbertson, but in addition introduces an element of mobility into the analysis. Participants on both sides of the market are assumed to have a range of maturities in which they prefer to operate, but will move outside their usual bounds if a substantial rate differential is present.⁴ Preferred maturity ranges, or habitats, are posited as overlapping to some extent so that a continuum of excess demands for funds will exist across the maturity spectrum. Despite this, however, supply and demand conditions will still predominate in determining the actual yield in any habitat.⁵

The eclectic view of Preferred Habitat Theory, which in essence derives from the more strict Market Segmentation Theory, would seem more theoretically appealing, since while acknowledging the overwhelming strength of hedging motives in the market, it nonetheless allows some degree of speculative behaviour to exist.

1.7 Some Concluding Remarks

Having concluded our survey of the various theories purporting to explain the term structure of interest rates, we are now in a position to make certain generalisations concerning these hypotheses. First we will very briefly discuss the nature of explanations of the rate structure in a general way, and then attempt some form of categorisation so as to draw out and highlight significant features of the theories in a systematised manner.

Any theory dealing with human behaviour operates in an extremely complex universe and we must make certain simplifying assumptions to reduce this complex reality to manageable proportions. Certain variables must be isolated as prime determinants of behaviour in a given situation, and their inter-relationships closely scrutinised.

Theories put forward to explain the term structure of interest rates deal with bonds or financial claims which are intrinsically bound up with time.

4. Modigliani, F. and Sutch, R. "Innovations in Interest Rate Policy", American Economic Review, May, 1966, p.178 following.

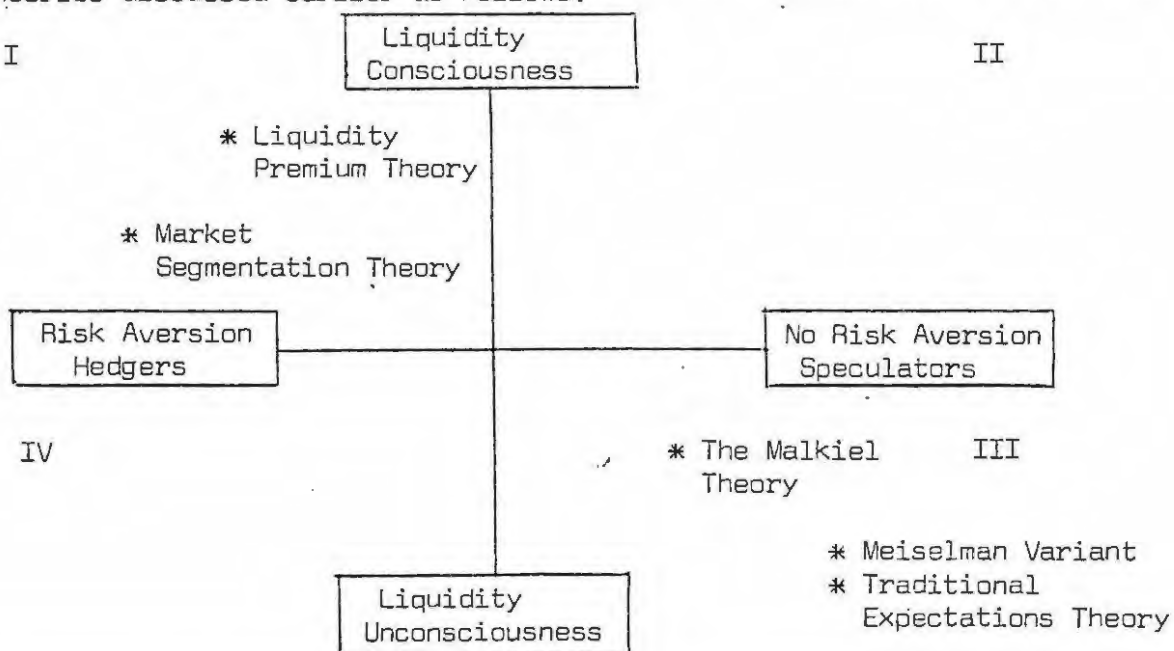
5. Modigliani, F. and Sutch, R. "Debt Management and the Term Structure of Interest Rates" Journal of Political Economy, August, 1967, p.569 following.

Because knowledge and time are inseparable, the questions of expectations and uncertainty are central to any explanation of the rate structure.. It follows that hypotheses must make certain assumptions as to the behaviour of investors when confronted by the uncertain conditions of the financial market-place. As we have seen over the preceding sections, each theory has chosen some unique aspect of investor behaviour under these circumstances, although clearly there are only marginal differences between some of the hypotheses. It is the interaction of these particular conjectures made by a theory that produces a specific view of the financial market, and hence a particular hypothesis on how any stated relationship between long and short bonds can materialise, and can change through time.

It is our task now to isolate the method adopted by each of the theories to tackle the dual problem of time and uncertainty. We shall use the system suggested by J.A.G. Grant⁶ to delineate the various theories according to their behavioural treatment of these market characteristics. Grant argued:

" 'Term structure' theories of interest rate determination can conveniently be classified as if they fall into four quadrants in a two-dimensional diagram. One axis divides those which describe speculative behaviour from those which insist that markets are dominated by 'hedging'. The other axis, independent of the first, dichotomises theories with respect to the assumed liquidity-consciousness of the marginal investor or borrower."⁷

By employing the scheme outlined above, we can diagrammatically represent the theories discussed earlier as follows:-



6. Grant, J.A.G. "Meiselman on the Structure of Interest Rates", Economica, Feb. 1964.

Quadrant III contains the three theories which are expectationally based. By effectively assuming time sway, the traditional theory allows uncertainty to vanish and perfect knowledge to replace it. All bonds, regardless of their maturity, are seen as perfect substitutes, relegating liquidity consciousness to be unimportant. The Meiselman hypothesis does much the same, Malkiel's alternative formulation, by introducing a normal range of interest rates, and a probability of a movement of rates within this range, raises the importance of liquidity consciousness and explicitly allows for risk to enter into the picture. This places it above and to the left of the other two theories.

By contrast, both Market Segmentation Theory and the Hicksian Liquidity Premium Hypothesis lie in the first quadrant. Since the former is more extreme in its belief of the dominance of risk aversion it is to the left of the latter, but will be below it as a result of its rejection of normal backwardation.

A priori very little can be said on the validity of these differing views and the behavioural assumptions that they adhere to. In order to make any sort of evaluative statement we must examine the available empirical evidence, and it is to this task that we shall dedicate the next chapter. A degree of caution should be stressed however, since an empirical refutation of an hypothesis is not necessarily a refutation of the underlying theory of behaviour as we shall argue in Section 2.6.

CHAPTER IIA REVIEW OF THE EMPIRICAL EVIDENCE2.0 INTRODUCTION

Our aim in this chapter is to review and analyse the empirical evidence available on the term structure of interest rates in order to both evaluate the competing hypotheses of the previous chapter, and to prepare the ground for our own investigation in Chapter IV. To facilitate lucid exposition the material will be outlined in much the same order as before. The evidence on each theory will first be briefly discussed in historical sequence, and then critically examined. In the final section we shall draw upon this discussion and arrive at various conclusions about both the evidence under review, and the theories to which this evidence is relevant.

2.1 Evidence on the Traditional Expectations Hypothesis

The majority of empirical investigations into the Hicks-Lutz theory have been based on the premise that if expectations do determine the rate structure, there must be an observable correspondence between the forward rates implicit in the yield curve and the actual rates which materialise. In other words, unless expectations are fulfilled then the traditional explanation must necessarily be erroneous.

Among the earliest to research the predictive accuracy of forward interest rates was Frederick Macaulay¹ in 1938. Before the establishment of the Federal Reserve, there existed a pronounced and well-known annual trend in call money rates. Reasoning that the rate on time deposits should be able to anticipate this seasonal, Macaulay discovered that this did, in fact, occur. However, beyond this he was unable to find any further evidence of successful forecasting. He concluded that evidence of successful forecasting is rare because successful forecasting is also rare.

Hickman², in an unpublished but nonetheless widely cited manuscript, compared actual or observed yield curves with those predicted one year or more ahead by the term structure of interest rates, for the period 1935 to 1942. If the expectations hypothesis is valid, he argued, then there should be a high /

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1. Macaulay, F.R. Movements of Interest rates, Bond Yields and Stock Prices in the U.S. since 1856, National Bureau of Economic Research, New York, 1938.
 2. Hickman, W.B. "The Term Structure of Interest Rates: An Exploratory Analysis", National Bureau of Economic Research, New York, 1942, mimeographed.

correlation between expected and observed yield curves. By simply assuming that the yield curve at time t will be equal to that in $t + 1$, he obtained better predictions of subsequently observed yield curves than those provided by expectations theory. He inferred that the evidence in no way supported the traditional hypothesis.

A survey conducted in 1943 by Donald Woodward³ for the Mutual Life Insurance Company of New York, does provide more active support for the theory. A population of two hundred active participants in the financial markets were questioned on the future rate they expected to prevail on U.S. Treasury securities for two decades ahead. While the model forecast was that yields would not differ from the then current Treasury long yield of 2,5 per cent, there was a substantial difference of opinion and the mean expected rate was 2,78 per cent. Since the 1943 yield curve was rising, the expectations of higher rates apparent in the survey suggest a degree of successful foresight.

In the manner of Macaulay and Hickman, Charls Walker's⁴ test of expectations theory was based on the assumption that the market could predict accurately. Walker's study analyses U.S. interest rate policy during World War II. Early in the war, the Federal Reserve and Treasury pursued a policy of stabilising the existing level of rates on government securities vis-a-vis open market operations. At that time the yield curve was rising rather sharply. Given this, Walker argued that if expectations theory was correct, the pre-stabilisation term structure implied that future short rates would be higher than existing rates. In contrast, the stabilisation policy implied that future short-term rates would be the same as current rates. Therefore, a shift should occur from shorts into longs since investors expected long rates to fall. Walker found a massive switch and regarded this as supportive of the expectations hypothesis.

The empirical research of Culbertson⁵ similarly was founded on the notion that forward rates must be accurate predictions of future spot rates. He examined the yields on short and long government bonds for identical periods of time, reasoning that if expectations theory is valid, then given holding-period yields should equalise regardless of whether short or long-term/

3. Ibid, p.23 following.

4. Walker, C.E. "Federal Reserve Policy and the Structure of Rates on Government Securities", Quarterly Journal of Economics, February, 1954, p.19.

5. Culbertson, J.M. "The Term Structure of Interest Rates", Quarterly Journal of Economics, November, 1957, p.502.

securities are held. Marked differences in returns were uncovered. Since Culbertson found it difficult to believe that speculators would operate in the government securities markets and predict as badly as his results suggested, he rejected the expectations hypothesis.

A test for the diversity of expectations undertaken by Burton Malkiel⁶ has definite significance for the traditional expectations theory. The investigation involved an examination of the advisory letters of four prominent investment advisors over the period 1958 to 1965. Malkiel assumed these widely read letters to act as a valid surrogate for the expectations of market participants themselves, but conceded that the opinions expressed in these letters may often express the trading position of a particular institution. Using the categorisations "bullish", "bearish" and "neutral" to classify expectations, Malkiel found that even when the various opinions were most concurrent, the bond market was still characterised by a considerable dispersion of opinion.

A direct survey by Kane and Malkiel⁷, resembling that of Woodward provides a more comprehensive test of the opinions of a sample of portfolio managers. During 1965 a questionnaire surveying interest rate expectations was despatched to two hundred financial institutions which were important dealers in the gilt-edged market. The results indicated that the expectations of the major investors in the bond market were not uniform, even when predictions of the Treasury bill rate were made only three months in advance.

The most recent evidence on the traditional expectations hypothesis comes from an investigation undertaken by Reuben Kessel⁸. Kessel argued that because spot rates have been positive since World War II, it would be irrational for the market to hold expectations of negative interest rates. Therefore, if negative forward rates are observed, this would constitute evidence against the expectations hypothesis. Kessel found that the behaviour of the term structure of bill yields contradicted the expectations hypothesis. For nine of the twenty-one trading days in September, 1960, negative forward rates for one-week money were observed. Since this was unreasonable, Kessel concluded that forward rates were not expected spot rates.

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6. Malkiel, B.J. The Term Structure of Interest Rates: Expectations and Behaviour Patterns, Princeton University Press, Princeton, 1966, Chapter 6.
 7. Kane, E.J. and Malkiel, B.G. "The Term Structure of Interest Rates: An Analysis of a Survey of Interest-Rate Expectations" Review of Economics and Statistics, 1966, p.343.
 8. Kessel, R.A. The Cyclical Behaviour of the Term Structure of Interest Rates Prentice-Hall, Englewood Cliffs, 1962.

2.1.1 Analysis of the Evidence

The interpretation of the evidence on the traditional expectations hypothesis has become the centre of a controversy amongst theorists of the term structure. Two antithetical positions have been taken in the literature.

Meiselman⁹ has argued that, with the exception of Macaulay and Woodward, no independent evidence exists on expectations theory. Rejecting the notion that expectations must be proved correct, Meiselman accuses all the researchers of having examined propositions not implied by expectations theory, and hence having rejected the hypothesis on inappropriate grounds. The view that the market must be seen to predict accurately is invalid. Expectations theory, critics posit, deals with ex ante interest rates whereas empirical tests have all been applied to ex poste data.¹ Anticipated and realised holding period yields will not be equal except in a world of perfect certainty. Meiselman categorically states that "anticipations may not be realised yet still determine the structure of rates in the manner asserted by the theory"². The crux of this position seems to be that as long as expectations actually influence the term structure, it is immaterial whether they have been optimistic or pessimistic.

Other writers have been more sympathetic to the approach of the empirical investigations. Generally there is agreement with Meiselman, that these tests do not necessarily imply that the traditional expectations theory is not an accurate description of investor behaviour, but argue that they do show that investors have done an unbelievably bad job of predicting future rates. Given this, it is proposed that market participants would hardly continue to forecast and act on their forecasts. The position of this school of thought has been aptly summarised by Conard as follows: "I, for one, would accept the view that it is unreasonable to presume the market is so consistently and grossly wrong in its expectations that poor foresight could wholly explain these observations."³

In terms of these two conflicting views, how should we interpret the empirical evidence? Clearly, on balance, most studies indicate that accurate forecasting has most definitely not occurred. Even those which do manifest some degree of accuracy, such as the work of Macaulay and Walker, show that at/

9. Meiselman, O. The Term Structure of Interest Rates, Prentice-Hall, Englewood Cliffs, 1962.

1. Note that Meiselman's work was published before that of Kane and Malkiel which he would have to regard as "independent evidence".

2. Ibid, p.12

3. Conard, J.W. An Introduction to the Theory of Interest, University of California Press, Berkeley, 1966, p.339.

best forecasting is hazardous. The independent evidence, in the sense of not testing whether expected and observed yields coincide, has come from the three opinion surveys. Since we can discount the Malkiel survey on grounds of both the sample size and the subjective method of interpretation, we are reduced to two conflicting findings, namely the Woodward Study and that of Kane and Malkiel. This, in itself, illustrates the highly unsatisfactory nature of opinion surveys as a means of quantitative research.⁴

Given that surveys cannot suffice as evidence for traditional expectations theory, the only alternative is to compare actual and expected yields. It is here that the crux of the matter lies. Since the expectations hypothesis can generate no other testable hypothesis, we must conclude that it has little operational content. Only within the framework of more loosely defined assumptions, in particular that of uncertainty, do alternative propositions arise for testing.

The controversy surrounding the empirical evidence then seems to boil down to differing views on expectations theory itself. Meiselman et al do not believe that the expectations hypothesis need be verified by comparing future yields with those predicted, and in so doing they in fact adopt a "softer" version of the theory which we distinguished as New Expectations Theory in the previous chapter. The other view, characterised by Conard, accept a "hard" version of expectations theory, namely that expectations must coincide with observed data. This is in line with Lutz's original formulation of the theory, and thus would appear to be the more acceptable view.

Bearing this in mind we can make some evaluative statements. That expectations need not be correct to determine the term structure is, of course, correct. But, given free entry and competition in the financial markets, should there not be a relationship between expectations implicit in the rate structure and subsequently observed actual rates? There should be some advantage attached to the expectations hypothesis as a predictor of future forward rates. If not, why would the market expend time and energy, both scarce resources, in trying to predict future rates.

4. The two most fundamental difficulties normally associated with opinion surveys can be summarised, i/ the environmental influences and decision criteria which condition one's response to a questionnaire may be quite different from those which operate in the evaluation of variables at the time of investment; ii/ the individuals completing the questionnaires may not have been able to report the expectations of those who actually manage their firms portfolios. For additional problems see Morgan, E.V. Monetary Policy for Stable Growth, Hobart Paper 27, Institute of Economic Affairs, 3rd Edition, 1969, p.48 and 49.

Further, in the sense of producing other testable hypotheses, the traditional variant of expectations theory has proved illusory despite the promise it held in section 1.2.1.

2.2 Evidence on New Expectations Theory

To recapitulate section 1.3 of the previous chapter, we saw that in an attempt to provide operational content to the traditional explanation of the term structure, David Meiselman⁸ placed his analysis within the framework of an error-learning model and in so doing moved significantly away from the original hypothesis. One of the consequences of New Expectations Theory has been that in empirical research, observed rates do not any longer have to equal expected future interest rates to validate the theory. Instead, it merely has to be proved that market participants hold expectations concerning the future course of interest rates, and change these expectations on the basis of errors made in prior forecasts. In sum, New Expectations Theory does not attempt to explain the level of interest rates per se, but rather how changes in the level of interest rates come about.

Not surprisingly, the first empirical investigation into the New Expectations Hypothesis was undertaken by Meiselman himself. By employing annual Durand yield data for the period 1901 to 1954, and introducing a random error term U_t into equation (1.3.4), he estimated the equation:

$$\Delta_{t+n} r_{1,t} = a + b E_t + U_t \quad (2.2.1)$$

Three principal results emerged. All regression co-efficients were significantly positive. The regression and correlation co-efficients declined as the time period spanned by the equation increased, and the constant terms a did not differ significantly from zero. Meiselman interpreted these results, particularly the positive b co-efficients, as supporting his substantive hypothesis and therefore as indirectly supportive of the traditional expectations theory as well. That investors held forecasts of the nearer term with a greater degree of confidence than those of the more distant future explained, Meiselman believed, the fact that the regression and correlation co-efficients/

8. Meiselman, D. op.cit; Chapter II

9. Durand, D. Basic Yields of Corporate Bonds 1900-1942, National Bureau of Economic Research, Technical Paper No.3, New York, 1942.

fell with time. The small or zero constant terms were, in his view, of particular significance since if these were significantly different from zero it would mean that even when no forecast error occurred, expectations would still be revised. We shall return to this question of interpretation in the next section.

In an attempt to duplicate the results of Meiselman, J.A.G. Grant¹ carried out an independent test of New Expectations Theory using British data. Grant argued that the Durand data applied by Meiselman possessed several highly undesirable characteristics, especially the uncertainty concerning the overall error involved in their calculation, and could have been responsible to some degree for the results obtained. Accordingly, Grant constructed a time-series of yields for the U.K., and tested them for the period 1924 to 1962. First he regressed four forward one-year rates against the forecasting error and later in non-linear form for the first eight forward rates. He found that the New Expectations hypothesis did not achieve a high degree of explanatory power in respect of the British data, but cautiously noted that "..... this does not refute it as an explanation of investor behaviour."²

In the same year Neil Wallace³, in an unpublished doctoral dissertation, calculated equation (2.2.1) for U.S. Treasury bond rates using quarterly data for the period 1946 to 1962. A novel feature of his analysis was the inclusion of a dummy variable to account for the alliance between the U.S. Treasury and the Federal Reserve in 1951. Although Wallace found that the error term $b E_t$ satisfactorily explained the revision of expectations, he discovered the constant terms a to be positive and significantly different from zero. In addition, a large measure of autocorrelation was apparent.

Chronologically, the next test of New Expectations Theory was performed by James van Horne⁴. Using published monthly Treasury yield data, Van Horne covered the period January 1954 to September 1963. He found that an important part of the movement in forward interest rates could be explained by errors in past forecasting. In contrast to Meiselman's results, however, the values of the constant term were consistently positive and significant. To account for/

1. Grant, J.A.G. op.cit;

2. Ibid, p.62

3. Wallace, N. "The Term Structure of Interest Rates and the Maturity Composition of the Federal Debt". unpublished Ph.d. dissertation, University of Chicago, 1964.

4. Van Horne, J. "Interest-Rate Rest and the Term Structure of Interest Rates" Journal of Political Economy, August, 1965, p.344 following.

this Van Horne argued for the introduction of a risk variable, but Richard Roll⁵ correctly nullified this by pointing out that the presence of a common term on both sides would impart a statistical bias into the equation.

Arising out of his 1965 researches into Liquidity Premium Theory, Kessel⁶ also provided a test of the Meiselman hypothesis. The data employed by Kessel consisted of U.S. Treasury bill yields with less than six months to maturity, and he examined them for the period 1958 to 1961. A peculiarity of the study lay in his derivation of forward rates by means of an arithmetic average, rather than the more commonly used Hicksian geometric average formula. Of the five regressions run by Kessel only one of the multiple correlation coefficients was high (around 0,85). It has subsequently been agreed upon in the literature that this evidence supports Meiselman less strongly than Kessel felt it did.

The apparent deficiencies in the data compiled by Grant prompted Douglas Fisher to construct his own set of data for government bonds in the U.K. on a quarterly basis for the period 1951 to 1963. Arguing that Grant had made no allowance for the "coupon effect", Fisher was critical of the estimates he had obtained.⁷ After an examination of the estimates obtained using his own data, he reported that "these results compare quite favourably with those reported by Meiselman."⁸

In a similar investigation on the British experience, Buse⁹ found evidence less favourable to the Meiselman hypothesis. Rejecting Grant's results as a "statistical artifact", Buse posited that "the source of this divergence can easily be traced to the method of estimating the successive maturities which make up the term structure"¹. In analogous fashion, Buse discounted Fisher's/

5. For details of this discussion see Roll, R. "Interest-Rate Risk and the Term Structure of Interest Rates: Comment", Journal of Political Economy Dec. 1966, p.629-32, and Van Horne J. "Interest-Rate Risk and the Term Structure of Interest Rates: Reply", Journal of Political Economy, March, 1967, p.533-34.

6. Kessel, R. op.cit;

7. Fisher, D. "The Structure of Interest Rates: A Comment" Economica, Nov, 1964 p.413-419 and "A Reply" by Grant, J.A.G. attached to this p.419-422.

8. Fisher, D. "Expectations, the Term Structure of Interest Rates and Recent British Experience" Economica, August, 1966, p.310-329

9. Buse, A. "Interest Rates, the Meiselman Model, and Random Numbers", Journal of Political Economy, 75, 1967, p.49-62.

1. Ibid, p.53.

findings by arguing "that Fisher has failed to provide a suitable theoretical basis to justify the claims made for his method of yield observation"². Using an independent set of British data covering January averages of yields on government securities for the period 1933 - 1963, Buse reported results consistent with the Meiselman model. Suspicious that this could be a feature of the data, he randomly ordered two sets of yield curves³, and used these random orderings as a basis for a test of the Meiselman model. The regressions consistently generated Meiselman-type results, and Buse concluded that such results are implied by any set of smoothed yield curves in which short-term interest rates have shown a greater volatility than long-term rates.

In 1969 Buse⁴ re-estimated the Meiselman model with the same data as before, but employed the Lutzian rather than Hicksian formula to derive forward rates. All prior investigations had utilised the Hicksian formula exclusively. After an examination of the properties of both formulae, Buse was able to show via sample calculations that the Lutzian method gave the more accurate forward rates. After re-estimating the Meiselman hypothesis, it was found that while the coefficients of the model remained basically unchanged, its overall explanatory power was substantially reduced. In some cases previously statistically significant regressions now became insignificant.

R.S. Masera⁵ in his investigation of the Italian bond market, applied the Meiselman model to the Italian experience. Using monthly observations covering the period 1958 to 1967, Masera regressed changes in one-year expected rates against the forecasting error. The resultant estimations did not provide support for New Expectations Theory, the explanatory power of which was found to be very low with the exception of the first equation where only one period ahead was considered. Masera concluded that the Meiselman model could not satisfactorily explain the Italian market, since "given the relative imperfection of the Italian bond market, expectations do not really matter and therefore do not have an important explanatory power."⁶

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2. Buse, A. "The Structure of Interest Rates and Recent British Experience: a Comment", Economica, August 1967, p.298-308 and "Reply" by Fisher, D. attached to this on p.308 following.
 3. The two sets of yield curves so ordered by Buse were those of Durand (1942) and Durand and Winn (1947), and his own series on British securities.
 4. Buse, A. "Hicks, Lutz, Meiselman and the Expectations Theory" Review of Economic Studies, 1969, p.395-406.
 5. Masera, R.S. The Term Structure of Internal Rates, Clarendon University Press, Oxford, 1972.
 6. Ibid, p. 134.

The most recent and most comprehensive investigation of New Expectations Theory was undertaken by Dodds and Ford⁷ working in partnership at Sheffield University. Three sets of data were employed in the project; the British data compiled by Grant, Masera's Italian bond yields, and U.K. data constructed by Dodds and Ford themselves consisting of weighted, unweighted and smoothed annual observations. For each set of data two sets of forward expected interest rates were calculated vis-a-vis the Hicksian and Lutzian formulas.

Regressions run on the Grant data provided no evidence favourable to the Meiselman hypothesis. Of the two sets of forward rates, the Hicksian rates proved slightly more fruitful. Similarly, Masera's Italian data produced findings which were meaningless for both the Hicksian and Lutzian formulae. Dodds' and Ford's own data gave results only slightly more encouraging. The estimates provided by the weighted and unweighted data in no instance indicated systematic or coherent support for New Expectations Theory. However, as we would have expected in the light of Buse's findings, the tests involving smoothed data produced dramatically different results. Here the Meiselman hypothesis performed relatively well and was satisfactorily able to explain the market for the period reviewed.

Dodds and Ford concluded that the Meiselman hypothesis was "highly susceptible" to the nature of the data employed. In general, they believed their results to indicate that New Expectations Theory may have little to offer as an explanation of the term structure of interest rates.

2.2.1 Analysis of the Evidence

The preceding review of the empirical evidence indicates that great care should be taken in the interpretation of econometric results in studies of the term structure based on a Meiselman-type approach. These results, quite apart from any other complications, are subject to the cumulation of at least three types of errors. Firstly, some errors are inevitably introduced in the process of estimation of the yield curves. Secondly, errors are committed in deriving forward rates from the yield data, and finally, the interpretation of forward rates as expected rates appears to be the cause of further errors.

7. Dodds, J.C. and Ford, J.L. Expectations, Uncertainty and the Term Structure of Interest Rates, Martin Robertson & Co. Ltd., London, 1974.

Despite these problems, however, available data and techniques do seem to offer the possibility of obtaining discriminating evidence. Nonetheless, the controversy of interpretation plaguing New Expectations Theory has revolved in the main around questions concerning these three sources of error.

Meiselman's own investigation has been strongly attacked, particularly on the first count. We recall that he employed the so-called Durand data which has been heavily criticised. Grant⁸ argued that the "artificiality" of this yield data is suspect as a result of the smoothing technique used by Durand. Generally, this contention is well supported in the literature. Durand⁹ himself, writing in 1958, pointed out that "... as constructed basic yield curves are designed to create a quick and crude impression of the term structure of high-grade bond yields at a moment of time and for this they are adequate."

Meiselman's interpretation of his findings per se has been subjected to a good deal of criticism as we indicated earlier. Specifically, his reasoning that if liquidity premiums were in existence, then the constant terms would be significantly positive, has been sharply rejected. Both Kessel¹ and Wood² showed successfully that if liquidity premiums increase as the periods to which they are applicable recede into the future, the constant term may still be zero.

Despite the imperfect data used by Meiselman, and some faulty inferences drawn by him, there is little doubt that his empirical test does provide some evidence for New Expectations Theory. This becomes clearer if we acknowledge the rather qualified support stemming from the work of Fisher, van Horne and Wallace. However, we cannot accept this evidence as supporting in addition the traditional variant of expectations theory, and must concur with Michaelson³ when he posits that "the tests Meiselman conducted were tests of this error-learning mechanism rather than tests of the expectations hypothesis directly."

8. Grant, J.A.G. op.cit; p.58

9. Durand, D. "Quarterly Series of Corporate Basic Yields, 1952-57 and Some Attendant Reservations" Journal of Finance, 1958, p.348-350.

1. Kessel, R.A. op.cit; Chapter 2.

2. Wood, J.H. "Expectations, Errors and the Term Structure of Interest Rates" Journal of Political Economy, 1963, p.160-171.

3. Michaelson, J.B. The Term Structure of Interest Rates, Intext Educational Publishers, New York, 1973, p.85.

By far the most serious allegation made against the Meiselman-type empirical investigation comes from Buse⁴ who has the support of both Grant and Ford and Dodds. We recall that Buse argued that the processing of raw interest data to produce smoothed yield curves by itself gave rise to the regression results obtained in empirical tests of New Expectations Theory, or put differently, the regressions simply summarise the imposed smooth shape of the yield curves. It should be noted though, that the methodology employed by Buse has been vigorously attacked by Wallace⁵ who argued that it was both "irrelevant and incorrect".

In sum, Meiselman has produced a highly operational model which is not dependent in the manner of the traditional theory on so-called independent evidence. To date the empirical investigations, with a few notable exceptions, have not produced sufficient evidence to verify the behavioural hypothesis underlying New Expectations Theory and some very disturbing features have been unearthed. Nonetheless, there can be no doubt that the model represents an important and stimulating breakthrough into the empirical researching of the term structure of interest rates.

2.3 Evidence on Malkiel's Reformulation of Expectations Theory

It was emphasised in the previous chapter that although the mechanics of his "alternative reformulation of expectations theory" are unique, Malkiel nonetheless accepts the traditional expectations hypothesis as an accurate description of investor behaviour. Furthermore, we saw that contained in his theory are all the essential components of New Expectations Theory. As we review the empirical evidence below therefore, it should be constantly remembered that the Malkiel theory is, in essence, a variant of the traditional explanation with fundamentally similar implications for the term structure.

Unfortunately, only two independent investigations into the Malkiel theory are in existence; that of Malkiel himself and a comparative study undertaken by Dodds and Ford.⁷ We shall review initially the work of Malkiel since this was done chronologically before that of Dodds and Ford.

4. Buse, A. op.cit; p.49-62

5. Wallace, N. "Buse on Meiselman: Comment" Journal of Political Economy, 1969 p.524-527.

6. Malkiel, B.G. op.cit; Chapter 3.

7. Dodds, J.C. and Ford, J.L. op.cit; Chapter 4.

Taking his basic behavioural hypothesis which we examined in Section 1.4, Malkiel estimated this for the United States, initially using annual Durand data from 1900 to 1942 and employing the ordinary least squares regression technique.

$$(R - S)_t = a + b (R - R_A)_t \quad (1.4.6)$$

The results were not satisfactory due to the inherent statistical bias caused by the existence of the long rate R on both sides of the equation. In order to remove this bias, Malkiel transposed R from the left hand side and produced an equation which explained the rate when multiplied through by minus unity:

$$S_t = -a + (1 - b) R_t + b R_{At} \quad (2.3.1.1)$$

The regression coefficient $(1 - b)$ was held unrestricted. Since fifteen-year data was used to calculate R_{At} , estimations of (2.3.1.1) were based on twenty-seven annual observations. The method of calculating R_A was varied and the historic range of the long rate R_t . The consequent results proved to be surprisingly good. The signs of the coefficients met a priori expectations and the goodness of fit in every equation was so high as to rule out comparisons made between them on this basis.

Besides employing fifteen-year averages for R_{At} , as indicated above, Malkiel ran his basic regressions against Durand data by calculating a series of R_{At} 's based on ten-year averages. He used the 1900 to 1942 data integrated with that for 1951 to 1965. The overall results were similar to those above, although marginally inferior.

To test the sensitivity of his hypothesis to the nature of the data employed, Malkiel ran regressions against data of varying lengths, namely Grant U.K. data and U.S. Treasury yields from 1951 to 1965. The resultant estimates signified that as the number of observations inherent in R_{At} is reduced, so the explanatory value of the hypothesis declines. However, no systematic relationship could be discerned here. Malkiel concluded "that the data does not contradict our hypothesis" and ventured more positively that "these tests, utilising three different sets of interest-rate time series and several alternative time periods, offer independent evidence corroborating the findings/

of Meiselman that expectations play a major role in determining the rate structure."⁸

Dodds and Ford, in their study, empirically investigated various forms of the Malkiel hypothesis against three different sets of data, i.e. Masera's Italian data, Grant's U.K. data, and their own British data. They introduced a random error term U_t , making (2.3.1.1):

$$S_t = -a + (1 - b) R_t + b R_{A_t} + U_t \quad (2.3.1.2)$$

and then employed a series of distributed lag forms in place of Malkiel's average R_{A_t} .⁹ This gave, in effect, predominant influence to the more recent values of interest rates.

The results obtained from the Italian data were of no significance regardless of the particular distributed lag scheme used. Dodds and Ford attributed this mainly to the fact that Masera's data contains no true long-term securities since the longest available maturity range in the Italian market is only nine years.

For the Grant data from 1953 to 1962, the best estimates were achieved via the Koyck lag scheme, and the values here were not significantly different from those of Malkiel although the overall explanatory power of the equation was reduced.

Dodds and Ford's own data for the U.K. from 1953 to 1971 produced results of the same quality as Malkiel, except that in this instance reduced-form equations were used. The best estimations came from the unweighted data and the worst from the smoothed yield data.

The final conclusion provided by Dodds and Ford is somewhat eclectic. While acknowledging that on the whole the Malkiel hypothesis had performed reasonably well, they suggested that "the question of the choice of the data period and possibly the cyclical/trend structure of the data themselves might be important in influencing the outcome of the Malkiel hypothesis."¹

8. Malkiel, B.G. op.cit; p.101

9. Specifically Koyck, Pascal and Almon distributed lag schemes.

1. Dodds, J.C. and Ford, J.L. op. cit; p.156

2.3.1. Analysis of the Evidence

Despite the relatively small amount of empirical work performed on it, the Malkiel hypothesis has accumulated a substantial weight of evidence in support of it. Both his own study, and that of Dodds and Ford, provide positive evidence.

As an operational theory, the Malkiel hypothesis has some very distinct advantages over the other models we have examined up to this point. Above all it is a market-view theory, enabling us to look at the term structure at any moment t by means of a single equation. By incorporating the Keynesian notion of a normal range of interest rates, the whole spread of interest rates across the spectrum can be highlighted by concentration on just one yield differential.

Most of the problems congenital to the hypothesis seem to be those in proxying the different variables. This is particularly true of the normal range, and one wonders how correct Malkiel was to employ the difference between the long and short rates. Deciding on the width of the normal range per se itself allows an important subjective factor to creep into the analysis. The data requirements imposed by the model are severe. It is no easy matter to find comparable sets of time series data which remain consistent over considerable periods of time, and as Dodds and Ford suggested, the nature of the data itself could have considerable influence on the estimates obtained.

We conclude that despite the problems accompanying it, and the small amount of empirical investigations undertaken on it, the Malkiel hypothesis represents a highly successful operational model. It is of interest to note, however, that the bulk of the evidence available indicates that the constant term a is significantly different from zero, which, while completely compatible with the model, could be construed as denoting the existence of liquidity premiums.

2.4 Evidence on Liquidity Premium Theory

Thus far the evidence we have examined has been drawn exclusively from theories which propose that expectations, and expectations only, determine the term structure of interest rates. In contrast, as we saw in the previous chapter, the Hicksian Liquidity Premium hypothesis postulates that investors are fundamentally risk-averse, and therefore must be paid a premium to hold long-term/

securities which are more liable to capital loss than shorts. In other words, long bonds can no longer be regarded as perfect substitutes for short paper.

The first attempt to provide an empirical test of the Liquidity Premium Theory was made by Meiselman² in his path-breaking 1962 Study. We recall from Section 2.2.1 Meiselman's argument that since the constant term a was statistically equal to zero, liquidity premiums were not present in his estimates. We recall further that this notion was strongly and correctly rejected by Kessel and Wood. It follows, then, that Meiselman's conclusion cannot be accepted as ruling out the existence of liquidity premiums. Conversely, of course, his results do not "prove" the hypothesis either. Therefore, we must reject the investigation as an appropriate test of the Hicksian model.

A more direct analysis of liquidity premiums was undertaken by Neil Wallace³ in 1964. Wallace related forward rates on U.S. government securities to the composition of the Federal debt, arguing that the latter one exogenously determined affecting the term structure of rates without being in turn affected by it. Empirical examination of this proposition showed that a shift in the maturity composition had only a small effect on the rate structure in the direction predicted by the Liquidity Preference hypothesis.

During 1965 Reuben Kessel⁴ conducted what is almost certainly the most important and widely discussed empirical investigation into the existence of liquidity premiums. His aim was to allow for the presence of liquidity premiums in the markets forward rates derived from yield data, and hence obtain a "truer" estimate of the rate expected by the market. These "pure" expected or forward rates cleansed of all influences except the expectations held by investors, were then employed in the main test procedure adopted by Kessel. Here he attempted to assess the accuracy of these rates, and to see how the resultant predictions compared with the predictions made on the basis of forward rates per se. A unique feature of Kessel's methodology lay in the fact that he used neither the conventional Lutzian nor Hicksian formula to derive forward rates, but rather the arithmetic average of the Hicksian version. We shall return to this point in Chapter IV.

2. Meiselman, D. op.cit; p.45 to 47

3. Wallace, N. op.cit;

4. Kessel, R.A. op.cit;

Kessel ran his tests over three business cycles, namely, from October 1949 to February 1961 which provided 137 monthly observations on 28 day Treasury Bills, and for 138 weekly observations on 28 day Treasury Bills and 91 day bills for the period January 1959 to February 1961. Kessel argued that the estimates he obtained, supported two interdependent points. Firstly, the results indicated clearly that liquidity premiums definitely do exist. Secondly, when expected forward rates are cleansed of these premiums, the traditional expectations theory performs well. Both conclusions as well as numerous aspects of his methodology have been severely criticised, but we will deal with this in the subsequent section. In an exhaustive study for the National Bureau of Economic Research, J.W. Conard and J. Freudenthal⁵ replicated Kessel's test for the measurement of liquidity premiums on short-term government stock with a longer term-to-maturity than the Treasury Bills used by Kessel. While their results did establish some evidence for the existence of liquidity premiums on shorter stock, there was nothing to suggest the same for longer securities. Conard concluded:

"(Our) studies raise some questions about the generality of the view that risk premiums are positive functions of the level of interest rates, though they do not contradict Kessel's findings with respect to Treasury Bills."⁶

Masera⁷ adapted Kessel's approach to the Italian bond market, despite a theoretical disagreement on the simple relationship between risk premiums and the level of interest rates posited by Kessel. After investigating average holding-period yields on a monthly basis from 1957 to 1967, Masera concluded that the evidence accumulated gave strong support to the existence of positive risk premiums. He softened this conclusion however, by cautiously noting that aversion to capital risk did not appear to be the only type of risk aversion influencing market behaviour. After indicating additional computational and other difficulties involved, Masera summed up his feelings by arguing that "... the joint presence of all these complications makes it very difficult to obtain reliable econometric evidence on the points at issue."⁸

5. Conard, J.W. The Behaviour of Interest Rates, National Bureau of Economic Research, New York, 1966, Chapter 7.

6. Ibid, p.84

7. Masera, R.S. op.cit; Chapter 5

8. Ibid, p.160

Disregarding entirely the methodological framework developed by Kessel, Burman and White⁹ adopted a completely different approach to the measurement of liquidity premiums. Essentially, this involved the compilation of an index gauging the interest elasticity of bond prices, or the percentage change in the price of a security caused by a one per cent change in the yield. The Burman White liquidity premium index thus represents an attempt to measure, or at least proxy, the degree of risk inherent in stock of a given maturity. However, the index proved unsuccessful in an effort to estimate U.K. yield curves that allowed for risk premiums, despite allowances for complications such as tax rebates, coupon effects, etc. In assessing their results, Burman and White conceded ".... that the estimates of expected yields and returns over the period cannot be considered as wholly reliable."¹

The most recent empirical investigation into the Hicksian Liquidity Premium Theory was undertaken by Dodds and Ford² in 1974. Overall three test methods were employed, none of which produced convincing results.

Kessel's liquidity premium equation in conjunction with the three sets of data developed by Dodds and Ford themselves for the U.K. covering the period 1953 to 1971 produced results which were, statistically speaking, zero. Grant's data however, revealed rather more respectable evidence. The coefficients were found to be statistically significant from zero at a 95 per cent level of confidence.

For their own data, Dodds and Ford estimated two equations based on forward one-year rates set two years ahead. For the unweighted, weighted and smoothed data the results were identical, insofar as no support at all was established for the existence of liquidity premiums.

The third test method involved the use of the so-called Robertsonian notion of the long rate as the rate par excellence. Here Grant's quarterly data for the U.K. did proffer some evidence in favour of the Hicksian hypothesis. However, Dodds and Ford qualify this by noting that the method employed intrinsically assumed liquidity premiums to be constant, contrary to Hicks' belief.

9. Burman, J.P. and White, W.R. "Yield Curves for Gilf-edged Stocks" Bank of England Quarterly Bulletin, December, 1972.

1. Ibid, p.479

2. Dodds, J.C. and Ford J.L. op cit; Chapter 5.

In their concluding comments, Dodds and Ford adopt a dismal view not only of their own evidence, but also of the validity of the econometric investigation of Liquidity Premium Theory generally. Specifically they argue that "... these findings, if anything, confirm the doubts we had about the quantitative assessment of liquidity premiums"³

2.4.1 Analysis of the Evidence

It is often argued that the existence of liquidity premiums is self-evident from the observed fact that during this century long rates have consistently exceeded short rates. A positive average differential between long and short term interest rates, however, does not necessarily represent a differential between realised rates of return, because as Nelson⁴ has shown, the realised increment to capital invested in a sequence of short-term bonds depends on the ex post product of uncertain future rates. In any event, the evidence we have reviewed here must certainly be taken as casting doubt not only on the Hicksian assertion of a "congenital weakness" in the capital market, but also on the operationality of the Liquidity Premium Theory itself.

The empirical evidence can be conveniently, though perhaps superficially, sorted into three separate categories for our purposes. The first such category could be classified as "agnostic". Here we would include the work of Meiselman and Burman and White, both of which can be construed as evidence neither for nor against the Liquidity Premium Theory. Meiselman's belief that his results undermined the hypothesis was, as we have seen, unjustified. But then clearly this cannot be taken as positive evidence either. The Burman and White liquidity premium index, while apparently a useful theoretical innovation, seems so beset with computational difficulties that even they put no great faith in its efficacy.

The second category, numerically by far the largest, is that containing negative evidence against Liquidity Premium Theory. The investigations of Wallace, Conard and Freudenthal, Masera, Dodds and Ford, all indicate either no evidence at all for the theory, or at best, very weak evidence. While Wallace approaches the problem by examining the relation between the structure of interest rates and the maturity composition of the debt, all the others offer evidence suggested by the bias of forward rates as forecasts of spot rates.

3. Ibid, p.205

4. Nelson, C.R. The Term Structure of Interest Rates, Basic Books, New York, 1972, Chapter 2.

Even the admittedly very weak findings produced by Wallace have been found by L.G. Telser⁵ to be equally consistent with the traditional expectations hypothesis. The second approach, employed by the other researchers, has been singularly ineffective as a means of revealing the existence of liquidity premiums. None of these studies found any significant and coherent support for Liquidity Premium Theory. In every case, the authors acknowledge severe and limiting drawbacks implicit in the method.

Kessel's work stands suspiciously alone in our third category as the only finding in favour of the Hicksian theory. However, this should perhaps not be too surprising given his rather unique methodology. In particular, as Kessel himself admits, his tests rely on the assumption that forecast errors are themselves independent of liquidity premiums, and are therefore not tests of actual liquidity premiums. The replication of Kessel's work by Conard and Freudenthal raises some troublesome questions. Why do they find no evidence on longs? A similar query is raised by Dodds and Ford's use of Kessel's equation with U.K. data.

We are thus forced to a somewhat reserved conclusion. Clearly, the majority view seems to be that liquidity, or at least some form premium probably does exist. The rather limited evidence is neither strong in its denial or assertion of liquidity premiums. What is definite though, is the tremendous difficulty in making Liquidity Premium Theory operational. This will be emphasised in our own attempts at detecting premiums for South Africa in Chapter IV. At present no precise quantitative method exists for the measurement of liquidity premiums, and until data sources other than those derived from spot rates are uncovered, it seems unlikely that such a method is possible.

2.5 Evidence on Market Segmentation Theory

Like Liquidity Premium Theory, the hypothesis of segmented capital markets is based on the premise of universal risk aversion, the essential difference being that here normal backwardisation need not necessarily occur. While the existence of expectations is not denied, it is argued that market participants are likely to hold such diverse opinions of the future that the /

5. Telser, L.G. "A Critique of Some Recent Empirical Research on the Explanation of the Term Structure of Interest Rates" Journal of Political Economy, December, 1967, p.546-61.



observable term structure of interest rates cannot be meaningfully analysed along the lines of an expectational model. Therefore, the argument runs, the best approach is to examine the loan market as if it were dominated by hedgers and segmented into compartments according to their maturities. The term structure can then be explained with reference to the supply and demand conditions prevailing in the various sub-markets.

Chronologically, the earliest empirical investigation into Market Segmentation Theory was undertaken in 1957 by its chief proponent J.M. Culbertson.⁶ We recall from Section 2.1. that Culbertson compared yields for identical holding periods on short and long gilts, and found marked differences. He concluded that this indicated speculation to be unimportant as a determinant of the rate structure. However, this conclusion was challenged by Michaelsen⁷ who posited that Culbertson had confused ex poste and ex ante interest rates in his investigation. In fact, Michaelsen went so far as to express the belief that the results supported the uncertainty variant of the traditional hypothesis. General consensus in the literature has subsequently rejected this argument, but accepted his argument that the results do not disprove the importance of expectations despite strong protests from Culbertson.⁸ In any event, the results cannot be taken as supporting Market Segmentation Theory.

The next study was performed by Meiselman in his 1962 investigations.⁹ He examined changes in the maturity composition of the debt to changes in the relationship between short and long rates for two separate time intervals, namely 1917 to 1956 inclusive and 1930 to 1956. No statistically significant estimates were obtained in either case after first difference form equations were applied to eliminate serial correlation. In addition, Meiselman attached several important reservations to his findings, particularly regarding the inadequacy of the data at his disposal.

6. Culbertson, J.M. op.cit; p.502
7. Michaelsen, J.B. "The Term Structure of Interest Rates: Comment" Quarterly Journal of Economics, February, 1963, p.166-174
8. Culbertson, J.M. "The Term Structure of Interest Rates: Reply" Quarterly Journal of Economics, November, 1963, p.691-696.
9. Meiselman, D. op.cit; p.48 to 52 and Appendix B.

The first truly comprehensive investigation into Market Segmentation Theory came in 1963 in the form of Arthur Okun's¹ study for the Commission on Money and Credit. Okun tried to measure the alternative effects of changes in the supply of long and short gilts on long and short government yields. Using quarterly observations for the 1946 to 1959 period, he estimated an equation for the short rate and one for the long rate. In both equations the debt supply variables had positive signs, and all coefficients were significantly different from zero. Nonetheless, Okun concluded that a shift in the maturity structure would have little effect on the term structure.

A different approach to testing the influence of supply variables on the rate structure was adopted by Wallace². Wallace broke down each long bond into its component short-period parts, so that all bonds maturing in over one year were translated into one-period loans and interpreted in part as a supply of one year securities. Hypothesising that if relative supplies influence the rate structure, Wallace reasoned that an exogenous increase in the quantity of one-period forward loans beginning at time $t + j$ should affect only the forward rate $t + j$ r_1 . For quarterly observations from 1946 to 1962, his results indicated the term structure of interest rates is only slightly affected even by substantial changes in the maturity composition of the debt.

John Wood³ constructed a simultaneous equation model aimed at isolating the effects of relative supplies of securities on the rate structure. Wood postulated that the differentials between interest rates of various maturities would be dependent upon two factors. Firstly, variables related to expectations of future interest rate changes, and secondly, the quantities of securities in the various maturity sub-markets. A first difference form of the model revealed that variables centering on expectations performed far better in explaining relative interest rates than those incorporating security supplies. Wood concluded that an analysis of the supply of debt instruments could not satisfactorily explain the term structure.

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1. Okun, A.M. "Monetary Policy, Debt Management, and Interest Rates: A Quantitative Appraisal" in Stabilisation Policies, a series of research studies prepared for the Commission on Money and Credit, Prentice-Hall, Englewood Cliffs, 1963 p.331-380.
 2. Wallace, N. op.cit; Chapter 3.
 3. Wood, J. "An Econometric Model of the Term Structure of Interest Rates", a paper presented to the Econometric Society, Pittsburgh, December, 1962 and revised in March 1964. Unpublished. Cited in Dodds, J.C. and Ford, J.L. Expectations, Uncertainty, and the Term Structure of Interest Rates, Martin Robertson & Co. Ltd., London, 1974.

Criticising the Okun study for aggregating the semi-annual and 1-to-5 year maturity categories, Robert Scott⁴ included an average maturity variable in his investigation. He tested two equations against monthly data for 1952 to 1959, the latter being unique in containing the "average length of time to maturity of the marketable federal debt"⁵ variable. The resultant regression coefficients were significant, but the gain from adding the maturity variable was only marginal. Scott concluded that the relative supplies do have an important influence on the rate structure. This conclusion has, however, been heavily criticised in the literature⁶, and his methodology has been exposed as suspect in several areas.

A very substantial investigation into Market Segmentation Theory was undertaken by De Leeuw⁷ in 1965. De Leeuw employed a reduced form equation as part of a model of the U.S. financial structure, which aggregated over all maturity segments. Using quarterly data for the period 1952 to 1960, he found that while changes in the maturity composition do influence interest rates, in the long run this effect is almost imperceptible.

Modigliani and Sutch⁸ performed a comprehensive test of Market Segmentation Theory as a consequence of their attempt to determine the efficacy of "operation twist". Briefly, the implementation of this policy by the New York Federal Reserve Bank represented an attempt to "twist" the yield curve by raising the short rate relative to the long rate. Initially Modigliani and Sutch estimated the yield gap for 1952 to 1961 on a quarterly basis by regressing it solely on the short rate. The values predicted by this equation were then compared with the actual values for the period of "operation twist", and a close relationship was uncovered. Modigliani and Sutch did not, however, regard this as denying the efficiency of "twist" but rather as an indication of the existence of strong expectational forces. By allowing for these within a behavioural context, or the so-called Preferred Habitat Theory we looked at earlier, they concluded that the supply side of the financial market was not sufficient to explain the long-short interest differential.

4. Scott, R.H. "Liquidity and the Term Structure of Interest Rates" Quarterly Journal of Economics, February, 1965, p.135- to 145.

5. Ibid, p.136

6. See Dodds, J.C. and Ford, J.L. op.cit; p.242 to 244 for details of the criticism aimed at Scott.

7. De Leeuw, F. "A Model of Financial Behaviour" in Duesenberry, J.S.; Fromm, G; Klein, L.R. and Kuh, E. (eds) The Brookings Quarterly Econometric Model of the United States, Chicago, Rand McNally, 1965.

8. Modigliani, F. and Sutch, R "Innovations in Interest Rate Policy" American Economic Association, Papers and Proceedings, May, 1966, p.178-197.

A study by L.S. Wehrle¹ provided an entirely different perspective on the hypothesis of segmented capital markets. In contrast to all previous investigations, Wehrle conducted a very detailed micro-study of the financial behaviour of life insurance companies for the period 1947 to 1957. Using a standard portfolio choice model which explicitly accounted for the size and nature of the liabilities of life insurance companies, Wehrle attempted to explain their portfolio composition. After an intensive examination of the security trading of four companies, he found little evidence of perfect matching, but noted that in aggregate claims were set against assets.

A more comprehensive but essentially similar study was conducted by Terrel and Frazer² in 1972. Drawing their data from the U.S. Treasury's Survey of Ownership of government debt, they dealt with the period March, 1960 to June, 1969 on a quarterly basis. The portfolios of a broad range of investing institutions were examined and broken into eight distinct categories, providing both greater depth and meaning than the Wehrle study. On the basis of their evidence, Terrel and Frazer put forward two conclusions; "... (1) institutions are not indifferent about their maturity profiles, and (2) changes appear in the term structure without concomitant adjustments in the quantity of short-term relative to long-term ones."³

The only evidence gathered on the operation of capital markets outside the U.S. comes from a study by Dodds and Ford⁴ on the British experience. They employed an approach fundamentally synonymous with that of Terrel and Frazer despite distinguishing between only four types of financial institutions. Heavily constrained by limited data resources, they analysed the period March 1963 to March 1972 using annual observations. While concluding that the resultant evidence was only weakly suggestive of the existence of segmented capital markets, Dodds and Ford stressed that "... the limited division of government debt by maturity (which they were forced to use) is a serious drawback."⁵

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1. Wehrle, L.S. "Life Insurance Investment: The Experience of Four Companies" in Studies of Portfolio Behaviour, Cowles Foundation Monograph 20, John Wiley, New York, 1967.
 2. Terrel, W.T. and Frazer, W.J. "Interest Rates, Portfolio Behaviour and Marketable Government Securities" Journal of Finance, March, 1972 p.1-35.
 3. Ibid; p.11
 4. Dodds, J.C. and Ford, J.L. op.cit; Chapter 6.
 5. Ibid; p.255

2.5.1 Analysis of the Evidence

Before we analyse the implications of the weight of the evidence reviewed above, it would seem useful to briefly clarify the obstacles which appear to have consistently hindered empirical research into Market Segmentation Theory.⁶

The nature and availability of data has undoubtedly represented the most serious problem faced by researchers. Closely allied to this has been the difficulty experienced in classifying the various maturities of the total debt. The existence of call features and other institutional peculiarities embedded in the data have resulted in confusion and inconsistency in many of the investigations. The aggregate studies, such as those of Okun, De Leeuw, etc. which employed simultaneous equations, faced a rather different problem. Because the supply of debt is endogenous, and not exogenous as commonly assumed, the question of causation arises. A parallel can perhaps be drawn between this and the well-known "identification problem" in the demand for money. Even if the supply and demand schedules of the various sub-markets are identifiable, a more fundamental problem remains to be solved; should a flow, a stock, or a stock-flow approach be adopted?"⁷

The evidence, as it stands, can be subdivided into partial and aggregate studies. Significantly, different results have emerged from the two approaches.

The aggregate view studies, while perhaps more satisfactory from a theoretical viewpoint, have generally produced findings to the effect that changes in the maturity composition of the debt do not sufficiently explain the term structure of interest rates. Meiselman and Wood both believe their results to indicate no explanatory power at all on behalf of Market Segmentation Theory. More realistically, the evidence produced by Okun, Wallace, De Leeuw, and Modigliani and Sutch, shows that definite maturity preferences do exist, but account only marginally for changes in the rate structure. The only exception to this apparent consensus, is the work of Scott whose conclusions are open to considerable doubt as we have indicated.

On the other hand, the partial studies have provided sharply contrasting evidence. Wehrle, Terrel and Frazer, as well as Dodds and Ford, have all/

6. For an excellent discussion of the problems confronting empirical investigators see Malkiel, B.G. op.cit; Chapter 8, p.221 to 226

7. Klein, L.R. "Stocks and Flows in the Theory of Interest" in Hahn, F.H. and Brechling, F.P.R. The Theory of Interest Rates, Macmillan and Co., London, 1965, Chapter 7, p.136-151.

found evidence to indicate that the capital market is segmented according to maturity. In every case, though, it has been stressed that segmentation is not complete insofar as some degree of mobility from "preferred habitats" has been evident.

Once again, we must conclude by adopting a somewhat eclectic stance. The problems involved in making Market Segmentation Theory empirically operational are, as we have indicated above, enormous and extremely difficult to overcome. Unfortunately, no standardised procedure has been devised to overcome these obstacles, and consequently the many different methods employed preclude comparability between the various studies. Because, on balance, most of the evidence indicates that maturity preferences do exist, we must accept that Market Segmentation Theory has some validity as an explanation of financial behaviour. However, the rather indifferent evidence when coupled with the inherent operational problems does not inspire a great deal of confidence in the hypothesis.

2.6 Some Implications of the Evidence : A Conclusion

The most obvious point emerging from the preceding discussion is that the theoretical issues raised in Chapter I have by no means been settled by recourse to the empirical data. . On the positive side, however, the review of research has highlighted certain salient features of the theories and, albeit very slightly, has narrowed the field down.

For each of the theories we examined, it became apparent that when subjected to empirical research, four essential aspects emerged. The assumptions of a theory and their full implications become very clear, and more importantly, the hypothesis which they produce for verification or falsification. It may happen, as we saw in the case of the traditional theory, that no direct tests of the hypotheses are possible, or that alternative hypotheses may not be equivalent to the original theory. The third and fourth elements spotlighted in the studies we analysed, involve the data requirements of the theories. The methods that have been employed to quantify expected interest rates have been shown to make a significant impact on the estimates obtained. Nowhere was this more obvious than in investigations of the Meiselman model, when smoothed and unsmoothed data were used. The nature of the procedures by which the underlying data had been derived also emerged as meaningful, though/

it appears that either the Hicksian or Lutzian formulae for deriving forward rates may be employed without noticeable consequences.

On the basis of its operationality and its performance in empirical investigation, we shall now abandon the traditional explanation as a useful explanation of the term structure of interest rates but not necessarily an incorrect explanation. To take up the discussion of Section 1.7, it is widely acknowledged in the economics profession, as in the social sciences generally, that the empirical refutation of a behavioural hypothesis is not equivalent of a refutation of the underlying behavioural principles themselves. Even exponents of the so-called "black box" technique such as Milton Friedman adhere to this standpoint. Therefore, we cannot dismiss the traditional hypothesis per se, but rather reject it as a meaningful avenue of research.

Of the other theories whose evidence we have reviewed, we can expect the Malkiel hypothesis to perform the most satisfactorily in the South African context for two fundamental reasons. Firstly, in both previous studies undertaken on it, as we saw, it performed successfully if not outstandingly. Secondly, the data requirements of the model can be readily fulfilled by existing published statistics. No manipulations of any kind are needed.

To distinguish amongst the remaining three hypotheses on the basis of their previous empirical performances is very difficult. All are dogged by severe operational problems, although the Hicksian Liquidity Premium Theory is probably the worst off in this regard. Therefore, a priori we can say very little about them except for holding a rather pessimistic view of their explanatory power in the South African context. How they perform in actuality remains to be seen in Chapter IV.

CHAPTER IIIINSTITUTIONAL ARRANGEMENTS AND INTEREST RATE DETERMINATION
IN SOUTH AFRICA3.0 INTRODUCTION

Chapter I outlined in some detail the various theories attempting to explain the term structure of interest rates, and the evidence accumulated in support of these theories was comprehensively reviewed in Chapter II. Since our primary concern lies in examining the rate structure in South Africa, we turn now to the institutional context within which interest rates are determined in this country.

For the purposes of clarity, the discussion in this chapter will be divided into two main areas. Section 3.1 will deal with the institutional arrangements per se. Here the nature and functions of the major participants in the financial sector as well as the relevant legislation covering their activities will be examined as systematically as possible. In Section 3.2 the process of interest rate determination will be discussed in order to distinguish between those rates which are governed by market forces and those that are wholly or partly controlled by the authorities.

3.1 INSTITUTIONAL ARRANGEMENTS IN SOUTH AFRICA3.1.1 The Raison D'Être of the System

Notwithstanding the dualistic nature of the South African economy, at its centre exists a relatively developed financial system characterised by a wide variety of financial assets and liabilities. This system has evolved in the market economy of South Africa primarily due to competition between various financial institutions as well as some degree of State intervention. At present the system consists of an increasing range of specialist institutions whose functions often overlap to a considerable extent.

While different kinds of financial institutions may provide financial services of a more or less distinctive character, all have in common that they are largely financial intermediaries. This view, put forward by Gurley and Shaw¹, implies a mechanism linking the so-called surplus units in the economy, /

1. Gurley, J.G. and Shaw, E.S. Money in a Theory of Finance, the Brookings Institute, Washington, 1960.

normally individuals with a propensity to save, and deficit units, typically firms and the government sector. Therefore, while it is possible to distinguish between banks and non-bank financial intermediaries, in this sense both possess a common characteristic, and despite exterior peculiarities all are fundamentally and inextricably part of the same process. In essence, financial intermediaries must be able to reconcile the conflicting portfolio requirements of both surplus and deficit units by means of adjusting primary and indirect securities under conditions of economies of scale.

3.1.2 The Monetary Authorities

3.1.2.1 The South African Reserve Bank

The South African Reserve bank came into existence in 1920 as a consequence of the Currency and Banking Act promulgated that year. Through time a long series of legislation has bestowed more and more responsibility on the Reserve Bank, and currently it undertakes all the functions associated with central banking², with the notable exception of administering the South African government debt³.

Viewed broadly, the functions of the Reserve Bank can be classified under three general headings. Firstly, its operation as bankers' bank and banker to the State, the management of the country's gold and foreign reserves, the issue of bank notes and coin, and the arrangement of ancillary services to the banking sector generally. The second field of the bank's activities lies in the area of monetary policy. Policy objectives must be identified and pursued via specific monetary instruments. Finally, the bank also concerns itself with long-term structural developments in the financial sector. The development of new institutions should be encouraged and appropriate adjustments in financial legislation initiated whenever necessary. Since it operates at the apex of the South African financial structure, the Reserve Bank obviously represents a significant variable in every area of the monetary sector.

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2. After the 1920 Act, the Reserve Bank's powers have been successively enlarged by the following legislation; Currency and Banking Amendment Acts of 1923, 1930 and 1942, the Reserve Bank Act of 1944 amended in 1956 and 1961, the Banks Act of 1965 amended in 1969, and the Financial Institutions Amendment Act of 1972. The specific impact of this legislation is comprehensively dealt with in Kantor, B. "The Evolution of Monetary Policy in S.A." South African Journal of Economics, March, 1971.
 3. This is done by the Public Debt Commissioners.

3.1.2.2 The National Finance Corporation⁴

While the National Finance Corporation cannot be regarded as an integral part of the monetary authority, it would nonetheless seem appropriate to list it here in the sense that it is dependent on the guidelines drawn up by the Reserve Bank and co-operates closely with the Treasury. The National Finance Corporation was established as a statutory body with the purpose of pursuing three broad objectives. Firstly, to reduce the direct dependence of the Treasury on the Reserve Bank for its funding operations. Secondly, to foster a market in short money and investments so as to facilitate the efficient employment of temporarily inactive funds, and finally, to expedite the participation of overseas investors in the development of South Africa.

Although the National Finance Corporation operates functionally in the public sector, its share capital is drawn from a variety of sources, both public and private. Principally, the National Finance Corporation was designed to accept call money and invest it into Treasury Bills safeguarded in this operation by the lender of last resort facilities provided by the Reserve Bank.

The National Finance Corporation co-operates with the Treasury by accepting both call deposits and short notice funds at a fixed rate of 0,15 below the current Treasury Bill rate. The rationale underlying this process was to allow other money market institutions to offer slightly higher rates, and to limit the overall number of participants so as to promote a thriving market. Virtually all the resultant funds are channelled into the public sector, and are invested chiefly in Treasury Bills, government stock, and Land Bank Bills. Since it has become the largest purchaser of Treasury bills, the National Finance Corporation acts as a price-setter and thus determines both its lending rate, by way of the Treasury Bill tender price, and its borrowing rate at the fixed margin below the Treasury Bill rate, with very little reference to competitive forces. This has given rise to the term "captive market".

While the National Finance Corporation was originally intended to disappear with the emergence of merchant banks and discount houses, it has in fact become a very important institution occupying a central role in the money market.

4. Kantor, B. "The Evolution of Monetary Policy in South Africa"
South African Journal of Economics, March, 1971, p.42.

3.1.2.3 The Treasury

The second major institution of State Policy is the Treasury, supposedly designed to operate in close co-operation with the Reserve Bank. Since its creation in 1910, the Treasury has been responsible for budget administration in South Africa and South West Africa.

The functions of the Treasury are many and varied, and we will list only the most prominent. In essence, the Treasury is obliged to prepare budgetary policy sanctioned by Parliament in order to finance the activities of government departments, as well as provincial and sometimes local authorities. In addition, the Treasury must regulate capital expenditure on behalf of the public sector as a whole. Several financial institutions fall under Treasury control and supervision.

The most important aspect of the Treasury resides in its short and long-term financing of state expenditure. One of the relevant instruments here is the Treasury Bill. Briefly, these bills are issued weekly by tender with a term to maturity of 91 days. Each tender must be in multiples of R10 000 for a minimum amount of R100 000.⁵ While purchases of Treasury Bills are open to both private and public financial institutions, the Treasury Bill rate cannot be regarded as market determined since it is biased by both the supply offered by the Treasury, and the size of the tenders submitted by the National Finance Corporation being the largest purchaser of bills, and the Reserve Bank. Invariably the outcome of this process forces the Treasury Bill rate below competitive rates to enable the public sector to borrow cheaply. This has important and far-reaching implications for interest rate determination which we shall deal with later in this chapter.

3.1.3 Quasi-Government Financial Institutions

3.1.3.1 Provincial Administrations and Local Authorities

It is customary to link provincial administrations and local authorities in the sense that they control various administrative activities normally associated with the State.

The importance of these institutions in the overall financial system resides primarily in the fund-raising and capital expenditure programmes. Both/

5. A detailed discussion on this can be found in Barnett, M.J. "The South African Money Market: Financial Assets and Institutions" Unpublished M. Com. Thesis, UNISA, 1975.

operations fall under Parliamentary control and hence Treasury supervision. Consequent to the nature of their operations, provincial and local administrations are usually concerned with long-term finance for infra-structural projects, and therefore reside primarily in the long end of the so-called "semi-gilt-edged" market. Taken as a financial sub-sector, these bodies are usually a deficit unit in the economy despite recent concerted efforts at becoming self-financing.

3.1.3.2 Public Corporations

Public corporations currently operating in South Africa can be classified according to four basic sub-divisions. Firstly, commercial or industrial corporations like the South African Iron & Steel Industrial Corporation (ISCOR). Secondly, regulatory or supervisory corporations usually the various agricultural marketing boards. Third, commercial or industrial service corporations which operate non-competitively, for example, the Council for Scientific and Industrial Research (CSIR). Finally, a few social service corporations such as the National Housing Commission.

Public corporations are generally very widely constituted and may be self-financing in the sense of issuing loan stock, or they may be dependent on the State for funds. In this dissertation we are primarily concerned with the former, and more specifically in the amount and type of their debt.

For our purposes the most important public institutions are the Land and Agricultural Bank, and the Public Debt Commissioners (PDC) because they act directly as financial intermediaries and administer a very large volume of funds. Since the scope of their activities differs widely, we shall examine them independently.

3.1.3.3 The Land and Agricultural Bank of South Africa

The Land Bank was founded on the premise that agriculture required a unique finance pattern to satisfy its distinctive demand for funds. Consequently three independent colonial banks were combined by an Act of Parliament⁶ to provide financial assistance to farmers and their organisations. Essentially, such assistance was to be based solely on commercial viability.

6. See Kahn, E. "Public Corporations in South Africa: A Survey" South African Journal of Economics, 1959.

7. ALSO, Steyn, D.H. (ed.) Inleiding tot die Suid-Afrikaanse Staatsfinansies, J.J. van Schaik Bpk. Pretoria, 1961.

8. Act No.18 of 1912.

The Land Bank Act has subsequently been amended, and the present Act authorises advances to farmers, co-operative societies and companies, marketing boards, and statutory institutions aimed at promoting agriculture. Different kinds of loans secured by various forms of collateral are defined and permitted by the Act. Despite its relative autonomy, the Land Bank is exempt from the provisions of the Banks Act.

The Bank is funded primarily by deposits from farmers and their institutions, and by issuing debentures (some of which qualify as liquid assets) on the capital markets from 1959 onwards. A crucial aspect of the financial behaviour of the Land Bank lies in its stated aim of keeping interest rates to the agricultural sector as low as possible, usually far lower than commercial rates.⁹ A high level of interest rates on the capital market predictably creates problems, which recently have been solved by government assistance in the form of interest-adjusted funds. As a consequence of its policy, the Land Bank has become by far the largest supplier of long-term loans although its share of short-term financing is small.

3.1.3.4 The Public Debt Commissioners

The question of viewing the Public Debt Commissioners (PDC) as a separate entity in the South African financial structure is not clear-cut since they do not possess investment funds per se. However, as Steenkamp and De Swardt¹ have argued, if we emphasise their role as decision-makers rather than as asset-owners then the PDC can justifiably be regarded as a distinct financial body.

The PDC was initially created by the Public Debt Commissioners Act of 1911 to be an independent body responsible for the custody and investment of certain funds of the government sector. At present there are three members constituted in terms of the Act as amended in 1969, namely the Minister of Finance, a State President nominee, and a Railway Commissioner.

9. See van der Merwe, C. "Agricultural Policy" Chapter 5 in Lombard, J.A. Economic Policy in South Africa (Selected Essays), Citadel Press, Cape Town, 1959.

1 De Swardt, G.J. and Steenkamp, G. "The Public Debt Commissioners - Their Operations and role in the financial structure of South Africa", S.A.R.B. Quarterly Bulletin, June, 1969.

The funds administered by the P.D.C. are drawn from five basic sources. These are, broadly, the general funds of the government and provincial administrations, the funds of the South African Railways and Harbours Administration, social security and other funds stipulated by the Act, the General Sinking Fund, and the Local Loans Fund. Most of this finance is long-term, although the short-term flow of funds is not insignificant.

Given that its primary objective is to earn a high rate of interest on its investments, the P.D.C. pursues two distinctive investment policies. Short-term funds are "pooled" and invested mainly in Treasury Bills. In contrast, long term finance is invested in long-term securities, primarily public sector debt, on the basis of the statutory investment requirements of the Act.

Essentially the P.D.C.'s function is that of a public sector financial intermediary, for it recycles State funds within the public sector from surplus to deficit units. It is, therefore, not surprisingly, the largest single buyer of government debt, illustrating its important role in financing the Exchequer.

3.1.4 Private Financial Institutions

3.1.4.1 The Commercial Banks

In the literature it has become customary to define a bank in terms of its functions rather than from a formal viewpoint. In the broadest sense a bank can be described as an institution whose principal operations are concerned with attracting funds from surplus units in the economy for the purpose of advancing these funds to deficit units. A commercial bank may be distinguished from other financial intermediaries because "a substantial part of its business consists of the acceptance of deposits of money withdrawable by cheque"².

2. As defined in the Banks Act No.23 of 1965, as amended.

Since they act as financial intermediaries which accept demand deposits, commercial banks perform two basic functions. First, they act as the primary payments mechanism for the transfer of funds. Secondly, they possess the ability to create money through the extension of bank credit, or advances.³ It is the latter aspect which is closely followed and controlled by the Reserve Bank.

The structure of commercial banking in South Africa, as in many other countries, has recently developed two distinctive features.⁴ The existence of large economies of scale has led to a high degree of concentration in the industry to the extent that the resultant oligopolistic structure has limited competition exclusively to deposit attraction. The second characteristic trend has been a rapid diversification of activities since the 1950s. Rising interest rates have led depositors to reduce their demand deposits in favour of time deposits, terminating in severe competition between commercial banks and other financial institutions for interest-bearing deposits. Commercial banks were therefore forced to offer a range of financial services to compete successfully.

Control of the commercial banks by the monetary authorities in South Africa has rather a mixed record in terms of its efficacy, and is manifest in three major forms. The 1965 Banks Act, as amended, constitutes the chief controlling legislation by prescribing certain liquid asset and cash reserve requirements. In addition, the Reserve Bank can impose quantitative credit ceilings in terms of the Currency and Exchange Act of 1933, and interest rate ceilings through the Limitation on Disclosure and Finance Act of 1968.⁵

While the commercial banking sector remains a crucial institution in the money market, it is important to recognise that its role has nonetheless been a relatively declining one since the 1950s. The total assets of commercial banks expressed as a percentage of the assets of all financial intermediaries, for instance, fell from 44,3% in 1964 to 32,9% at the end of 1974.

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3. For a complete explanation of this process, see Newlyn, W.T. Theory of Money, Clarendon Press, Oxford, 1971.
 4. See Barker, H.A.F. The Principles and Practice of Banking in South Africa, (3rd Ed.), Juta, Cape Town, 1952.
 5. For an analysis of the efficacy of these controls see Strydom, P.D.F. and Koopmans, A.J.G. "Monetary Policy in South Africa", Finance and Trade Review, June, 1974 or Strydom, P.D.F. "Monetary Legislation in South Africa", South African Journal of Economics, March, 1974.

3.1.4.2 The Merchant Banks

Essentially two main features distinguish merchant banks from commercial banks. Firstly, merchant banks do not provide current and transfer payment facilities. Secondly, merchant banks are "wholesale" banks dealing mostly with institutions and large corporate clients.

In terms of the Banks Act a merchant bank is defined as "a person who carries on the business of which the acceptance of bills which are eligible for discount forms a substantial part, and who accepts deposits"⁶. However, while it is difficult to provide a precise definition, perhaps a more comprehensive description would be "a bank which specialises in financial advice and management and the arrangement rather than the provision of finance."⁷

Broadly, the basic functions of merchant banking in South Africa, like its British parent, can be separated into three chief areas. Merchant banks are primarily concerned with the lending of money by means of so-called acceptance credits. A second area involves the planning and raising of finance for clients and often the underwriting of new securities. Thirdly, merchant banks provide financial expertise in the form of investment advice and portfolio management services to their customers.

As a growth sector in the money market, the rapid development of merchant banking can be mostly attributed to the relative freedom from control it enjoyed in its formative years. Only with the 1965 Banks Act were they brought under statutory regulations in respect of capital and liquidity ratios.

Given that the demand for acceptance credit as a low-cost and sophisticated instrument is growing, merchant banking will probably continue to expand relative to the commercial banking sector. This is likely to increase the complexity of monetary control since the merchant banking system has proved to be highly adaptable to both direct and indirect policy measures.

6. Banks Act of 1965, as amended.

7. As defined in "Merchant Banking in South Africa" by the Company Finance Department of the Standard Merchant Bank Limited, Standard Bank Review Supplement, September, 1973, p.14.

3.1.4.3 The Discount Houses

The money market is customarily delineated as the market within which short-term assets are bought and sold, in contrast to the capital market where long-term assets are traded. Amongst the various participants in the former, only the discount houses and money brokers are exclusively limited to the money market in their activities.⁸

The basic function of the discount houses consists in accepting short-term deposits from certain institutions⁹ defined by the Banks Act, and in investing these funds in short-term financial assets. The purpose of restricting the range of depositors to these institutions is to confine the discount houses entirely within the financial sector, thus making them an efficient transmission mechanism for Reserve Bank policy instruments. Since deposits are at call, investing institutions may earn interest on their excess reserves while still remaining highly liquid. It is worthwhile to add that since the discount houses do not accept monies from the public, they do not fall under the provisions of the Banks Act relating to liquid assets etc.

Because the discount houses hold call money, their investment function lies in the purchasing of short-term securities, primarily Treasury Bills, negotiable certificates of deposit, bank acceptances, and other bills, and acting as "jobbers". The latter term refers to the holding by the discount houses of "gilt-edged" or government stock and "semi-gilts" or other public sector paper, both as an investment and stock-in-trade. In terms of the Banks Act, however, their portfolio is restricted to stock with a life of three years or less.

3.1.4.4 The Grey Market

Parallel to the banking system there exists a conceptually separate category of the money market which deals in money broking. Money broking firms may be defined as financial intermediaries which do not accept deposits but rather interpose between company lending and borrowing.¹ Funds ranging from call deposits to medium-term are funnelled between industrial and commercial companies as well as semi-government institutions. This intermediation takes the form/

8. See Goedhuys, D.W. "Discount houses in the Money Market" Supplement to the Standard Bank Review, June, 1974, p.3

9. Commercial banks, merchant banks, other banks, building societies, the Treasury, and the Public Debt Commissioners are the most significant of these.

of broking in commercial paper, primarily promissory notes issued by the borrowers, whose acceptability is dependent on the reputations of both the broker and the borrowing institution.¹

The economic function of money broking firms is essentially similar to that of the discount houses. Temporarily idle funds are mobilised to provide a new form of credit for borrowers. Clearly though, money brokers do not create money since they do not possess the liabilities which would allow for this.

The use of money broking should be viewed as a consequence of the interaction of three forces. Firstly, the composition of quantitative credit controls resulted in a largely unsatisfied demand for finance by firms. Second, the lending potential of firms was increased by the application of modern portfolio management techniques, and finally the persistent gap between the borrowing and lending rates of financial institutions has provided the necessary scope for the successful operation of money brokers.

The growth of the grey market² as a parallel market to the money market has led to a degree of unease on the behalf of the monetary authorities, because it falls beyond the direct reach of policy instruments and hence may frustrate their successful implementation.

3.1.4.5 Hire-Purchase, Savings and General Banks

Consequent to the high degree of similarity in the nature of their economic functions, we can logically categorise hire-purchase, savings and general banks together. Fundamentally, all three groups operate to provide credit in the form of merchandise leasing, hire-purchase and other loans. They are subject to the same statutory requirements regarding both prescribed asset holdings as well as interest and credit controls.

The most significant sources of funds for the group lie predominantly in fixed deposits, and more recently, savings deposits, although two of the general banks do offer cheque account facilities. Capital and reserves/

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1. See Goedhuys, D.W. "Money on the Wing or the Rise of Non-Bank Lenders" South African Journal of Economics, March, 1966.
 2. Apart from firms which specialise in money broking, discount houses, finance houses, trust companies, general banks and other financial institutions have added money broking to the range of services they offer.

form only a relatively small proportion of available resources.

The lending activities of the group are very widespread and constitute a complex mix of advances. However, the single most important form of credit is hire-purchase discounts and advances on consumer durables. Other loans, particularly customers liability on acceptances outstanding, are becoming relatively less important. After 1965 the discounting of merchandise leases emerged as a major new source of credit. Bill discounting itself, on the other hand, has remained at a low level.

After the passage of the 1965 Banks Act the growth of these three classes of banks has been very rapid, mainly at the expense of the building societies and commercial banks. Diversification,³ particularly on the part of the general banks, seems to have set the pace for this expansion. Among the financial services offered we even find such "exotic" features as rent collection and the payment of accounts.

3.1.4.6 The Building Societies

Building societies may be defined as institutions which accept interest-bearing deposits for the purpose of granting loans for house purchase secured by mortgages. Being mutual institutions without a dominant profit motive, they attempt to provide housing finance at the lowest cost compatible with the cost of that finance.

Permanent, as opposed to "terminating" building societies, hence perform two distinct functions. Firstly, interest-bearing deposit facilities with varying time horizons are offered to investors wishing to save. Secondly, the building society behaves as an investor by providing finance for construction, mostly private domestic housing.

The most important legislation governing this group of financial intermediaries is contained in the 1965 Building Societies Act, which placed certain curbs on their ability to attract funds.⁴ However, as a consequence of the resultant liquidity crisis in the industry, the Financial /

3. See Fiscal and Monetary Policy. Third Report of the Commission of Inquiry into Fiscal and Monetary Policy in South Africa (the Franszen Commission), Pretoria, Government Printer, 1970, AP 87/1970.

4. Specifically by means of imposing certain ratios in respect of share capital and liquid assets.

Institutions Amendment Act of 1973 relaxed some restrictions.⁵

Despite ranking second only to commercial banks as financial intermediaries, it is probable that the future of the group is limited, due to the interplay of severe statutory restrictions and the heightened competition in attracting deposits, as well as the rising cost of housing.

3.1.4.7 The Insurance Sector and Private Pension and Provident Funds

A primary distinction may be drawn in the South African insurance sector between short and long-term insurance companies. While short-term insurance intrinsically embraces risk assessment, long-term insurance and pension and provident funds concentrate mainly on investment results.

The latter group act as a very important financial intermediary. As deposit acceptors they have become the largest channel for personal savings, and as investors the chief private source of long-term funds for the public sector.⁶ The latter function has arisen as a result of legislation designed to force the group to place a proportion of the funds in government stock. Recently, however, there has been a marked trend away from fixed interest-bearing securities towards growth assets, such as equities and property, to improve the competitive position of the industry in attracting savings. Despite this structural change in the composition of their assets, their investment activities remain closely regulated by legislation, namely the Insurance Act of 1943, as amended, and the Pension Funds Act of 1956, as amended.

The importance of insurance companies, private pension and provident funds as financial intermediaries is likely to increase as a consequence of two factors. First, the application of more modern management techniques as the outcome of accelerating concentration, and secondly, the trend of diversification into the entrepreneurial field will widen the scope and size of their business.

3.1.4.8 Mutual Funds and Unit Trusts

While mutual funds and unit trusts differ in respect of their liability structures, for our purposes we may link them since they perform an essentially/

5. The most important of which are (i) they could again accept savings deposits from public and private companies ; (ii) increased the mortgage repayment period to 30 years.

6. Ibid, p.188

similar role as investors.⁷

In their function as financial intermediaries, mutual funds and unit trusts receive personal savings and channel these into a very large range of assets granting the individual investor a hedge against loss. The spread of the investment portfolio is assured since investment in any one asset is limited by the Unit Trusts Control Act to 5 per cent of the total assets.

The importance of the mutual fund industry as an investment sector in the economy has declined considerably since the "collapse" of the stock market in 1969. Furthermore, it is unlikely that they will regain their former stature given the continuing lack of public confidence in their viability.

3.1.4.9 The Johannesburg Stock Exchange

The central role of a stock exchange in a capitalist economy is usually argued to provide a market where shares and securities can be freely traded under a regulated procedure,⁸ in South Africa this being the Stock Exchange Control Act of 1947 as amended, and the internal regulations of the Johannesburg Stock Exchange itself. Theoretically, the stock exchange allows for the rapid allocation of capital towards efficient and expanding industries and away from inefficient industries.

Essentially then, the stock exchange should be viewed as performing three inter-related economic functions. First, it is a mechanism whereby savings may be converted into productive investment. Secondly, allied to this process is the means by which investment may be transformed into cash, i.e. the provision of investment liquidity. Finally, the stock market provides a method of publicly evaluating both securities and management by means of the prices of securities.

3.2 THE DETERMINATION OF INTEREST RATES IN SOUTH AFRICA

Having dealt briefly with the major participants within the institutional framework of the South African financial system, we turn now to the determination of interest rates within that system. We begin our analysis by/

7. Unit holders provide the funds for investment by mutual funds, while unit-trusts are "closed-end" trusts who receive their funds from specific shareholders. Their economic functions do not, however, differ apart from this.

8. Baumol, W.J. The Stock Market and Economic Efficiency, New York, Fordham University Press, 1965.

outlining the theoretical underpinnings of interest rate determination, before examining the relevant rates making up the short and long markets respectively.

3.2.1 The General Theory of Interest Rate Determination

Essentially four main theories have been expounded to explain the nature and determination of interest rates; the classical theory, the loanable funds theory, the liquidity preference theory, and the neo-keynesian or "modern" theory. Our interest lies only with the widely accepted neo-keynesian theory.

Hansen⁹, arguing the case for the modern theory, which effectively amounts to a synthesis of the classical and Keynesian theories, listed four fundamental determinants of the rate of interest; namely the investment demand schedule or the productivity of capital, the consumption function representative of thrift, the liquidity preference schedule or the demand for money, and the money supply. The equilibrium condition of these four variables, together simultaneously determines a rate of interest, which Hansen sketches as follows:-

"An equilibrium condition is reached when the desired volume of cash balances equals the quantity of money, when the marginal efficiency of capital is equal to the rate of interest, and finally, when the volume of investment is equal to the normal or desired volume of saving."¹

In essence, this represents a synthesis of the loanable funds formulation and liquidity preference theory by removing the dichotomy between the real and monetary sectors vis-a-vis the well-known IS and LM schedule analysis. The IS schedule represents equilibrium in the real sector and similarly the LM illustrates equilibrium for the monetary sector of the economy. The intersection of these curves yields the equilibrium rate of interest prevalent at a specific level of income. A change in any of the variables underlying either schedule will, of course, result in a shift of that schedule and consequently a change in the equilibrium rate of interest.

9. Hansen, A.H. Monetary Theory and Fiscal Policy, McGraw-Hill, New York, 1949.

1. Ibid, p.171

In sum, therefore, the neo-keynesian analysis postulates that if productivity, thrift, liquidity preference, and the supply of money are combined, they will produce a determinate theory of interest rate determination. However, because of the very complex interplay of these variables with institutional, legal and cultural factors, this general theory is of little assistance in explaining the determination of particular rates of interest in a specific real-world situation. Given this, in the subsequent analysis we shall employ established economic principles within the South African institutional and legal system, outlined in the previous discussion, rather than examine interest rate determination using the very general theoretical framework of the neo-keynesian analysis.

3.2.2 The Market for Short-Term Interest Rates

A distinction between the short and long markets, while drawn rather arbitrarily to facilitate methodical discussion, can be justified on various grounds. The short market is primarily a money market whereas the market for longs is a market for investment capital. Legislation has tended to reinforce this difference. In addition, as we saw in Section 1.4, by their nature short rates are the more volatile of the two. This is immediately apparent from a comparison of Graphs 1 and 2.

In the following sections we shall analyse the bank rate, the Treasury Bill rate, the National Finance Corporation deposit rate, the yield on short-term government stock, the rate on negotiable certificates of deposit, and the rate on bankers' acceptances, in that order. In each case we are concerned with the ownership distribution, any legislative peculiarities, rate fluctuations, and most importantly, the extent to which the rate is freely determined.

3.2.2.1 The Bank or Discount Rate

The bank rate represents the most traditional weapon of monetary control wielded by a central bank. Essentially the bank rate is the rate at which the Reserve Bank, in order to perform its function as lender of last resort, will discount Treasury Bills, Short-dated government stock, Land Banks Bills and debentures, bank acceptances, self-liquidating commercial bills and certain types of promissory notes, or offer advances with these as surety.

A relatively fixed relationship normally prevails between the discount rate and other market rates, which arises from two conditions. First, recognition on behalf of the private banking sector of the leadership of the Reserve Bank.

TABLE 3.1

OWNERSHIP DISTRIBUTION OF MARKETABLE TREASURY BILLS FROM 1964 to 1974

YEAR	PUBLIC DEBT COMMISSIONERS		T h e B a n k i n g S e c t o r														OTHER HOLDERS		TOTAL
			RESERVE BANK		COMMERCIAL BANKS		NATIONAL FINANCE CORPORATION		DISCOUNT HOUSES		MERCHANT BANKS		OTHER MONEY MARKET INSTITUTIONS		TOTAL				
			AMT.	%	AMT.	%	AMT.	%	AMT.	%	AMT.	%	AMT.	%		AMT.			
1964	26,0	18,0	3,7	2,6	14,9	10,4	53,1	36,9	33,7	23,4	3,0	2,0	6,0	4,1	114,5	3,3	2,3	143,9	
1965	10,5	5,2	7,5	3,7	82,8	40,8	19,6	9,7	59,9	29,5	0,5	0,2	1,0	0,5	171,4	20,9	10,3	202,8	
1966	5,0	1,9	13,0	5,0	125,3	48,5	16,3	6,3	47,2	18,3	-	0	11,3	4,4	213,1	39,5	15,3	257,6	
1967	6,5	3,4	1,7	0,9	83,9	44,4	24,2	12,8	42,8	22,7	1,6	0,8	4,3	2,3	158,5	23,9	12,7	188,9	
1968	-	0	2,7	1,5	80,8	44,0	30,9	16,8	30,9	16,8	5,2	2,8	7,5	4,1	157,9	25,7	13,9	183,6	
1969	-	0	-	0	39,9	27,5	51,5	35,5	35,3	24,3	-	0	4,0	2,8	130,8	14,4	9,9	145,2	
1970	3,0	3,9	8,9	11,7	4,0	5,3	48,3	63,6	0,6	0,9	-	0	0,8	1,0	62,6	10,5	13,8	76,0	
1971	-	0	2,0	2,6	-	0	65,0	84,4	-	0	-	0	-	0	67,0	10,0	12,9	77,0	
1972	-	0	2,0	1,7	-	0	56,0	46,7	49,0	40,8	-	0	-	0	107,0	13,0	10,8	120,0	
1973	-	0	152,0	54,5	-	0	80,0	28,8	42,0	15,1	-	0	-	0	273,0	6,0	2,2	279,0	
1974	-	0	-	0	-	0	231,0	59,5	154,0	39,7	-	0	-	0	385,0	3,0	0,8	388,0	
TOTAL	51,0	2,5	193,5	9,4	431,6	20,9	676,0	32,8	495,4	24,0	10,3	0,5	34,9	1,7	-	170,2	8,2	2062,0	

Data Source: South African Reserve Bank Quarterly Bulletin, 1964 to 1974.

Second, the accommodation provided to this sector in times of credit stringencies and heavy seasonal strain.

The modus operandi of the bank rate is based on the principle underlying the theory of interest rate policy, that changes in the discount rate are generally accompanied by corresponding changes in money market rates.²

The discount policy of the Reserve Bank relies on three inter-related instruments.³ Firstly, the bank rate itself which affects both the cost and availability of credit and is linked directly to the overdraft rate and less directly to other rates. However, as graph 1 confirms, the bank rate is not often varied because it has social and political implications with regard to the cost of housing finance. Interestingly, the Reserve Bank has occasionally discounted at a rate different from its published rate so as to avoid periodic crises.

Secondly, the Reserve Bank may determine those financial assets that it will accept for discounting depending on whether it pursues a restrictive or expansionary policy. The net outcome is that the asset no longer discountable becomes more costly.

Finally, the Reserve Bank's judgement in regard to which financial institutions it will accommodate. Because of the extreme nature of this instrument, however, a penal rate above the discount rate is normally applied.

It is no easy matter to determine whether the Bank rate follows or precedes the fluctuations in money market rates. Recently though, the discount rate seems to have lagged slightly behind developments in the market. What is clear, however, is that the correspondence between the discount rate and the rates on Treasury Bills, National Finance Corporation call deposits and short stock is a good deal closer than that on negotiable certificates of deposit and acceptances, e.g. See Graph I.

3.2.2.2 The Treasury Bill Rate

The Treasury Bill must be regarded as one of the most important forms of paper in the money market. Several factors account for this. As a government security there is no default risk, it is eligible for rediscount at the/

2. For a sophisticated analysis of this process see De Kock, M.H. Central Banking, Staples Press, London.

3. Goedhuys, D.W. op.cit; p.163 following.

Reserve Bank or readily negotiable elsewhere, and it comes in regular weekly issues.

Significantly, the rate on Treasury Bills cannot be regarded as "indicating at all accurately the state of liquidity of the banking sector"⁴, despite the fact that it fluctuates widely i.e. see graph I. As we pointed out earlier in Section 3.1.2.3, the supply of bills is determined by the Treasury, and the largest tenderers are the N.F.C. and Reserve Bank. Table 3.1 confirms this, for over the period 1964 to 1974 they purchased 42,2 per cent of all bills on offer. The net result has been to depress the Treasury Bill Rate to below that on comparable N.C.Ds and acceptances, even if the greater risk of default on the latter is taken into consideration. Graph I indicates this to be the case.

Because Treasury Bills qualify as liquid assets in terms of the 1965 Banks Act obliging the banking sector to purchase them, it is probable that the Treasury made use of this "captive" market whose rates it could manipulate in order to facilitate cheap short-term finance for the government. The extent to which this was done was apparently dependent on both the need for such finance and the capacity of the market to provide it. What is clear, however, is that cognisance was taken of conditions generally in the money market since the Treasury Bill Rate follows the more freely determined rates i.e. N.C.Ds and bankers acceptances. Nonetheless, the Treasury Bill Rate must be regarded as a controlled rate.

3.2.2.3 The N.F.C. Deposit Rate

In Section 3.1.2.2 outlining the operation of the N.F.C., we indicated that demand deposits of not less than £10 000 were accepted at a rate of 0,15 percentage points below the Treasury Bill Rate. It follows, therefore, that the N.F.C. rate must consistently fall below the Treasury Bill Rate by that margin even though it need not be subject to the same economic and institutional determinants. Indeed, a comparison of Tables 3.1 and 3.2 shows that the annual trends in holdings of the two differ markedly.

Since N.F.C. deposits are liquid assets for the monetary banking sector as well as for building societies not unexpectedly both groups possessed substantial deposits over the period 1964 to 1974. A further comparison of Tables 3.1 and 3.2 indicates that the private financial sector held greater quantities of N.F.C. deposits than Treasury Bills despite the lower/

4. Ibid, p.56

TABLE 3.2 OWNERSHIP DISTRIBUTION OF CALL DEPOSITS AT THE NATIONAL FINANCE CORPORATION

DATE	COMMERCIAL BANKS		DISCOUNT HOUSES		MERCHANT BANKS		HIRE PURCHASE, SAVING AND GENERAL BANKS		OTHER FINANCIAL INSTITUTIONS		CENTRAL GOVERNMENT		S.A. RAILWAYS		LOCAL AUTHORITIES		OTHER		TOTAL
	AMT	%	AMT	%	AMT	%	AMT	%	AMT	%	AMT	%	AMT	%	AMT	%	AMT	%	
1964	31,4	27,37	0,07	0,06	1,23	1,07	3,00	2,61	2,0	1,74	-	0	20,0	17,43	12,0	10,46	45,0	39,23	114,7
1965	22,6	20,61	-	0	-	0	17,07	15,56	4,0	3,65	-	0	19,0	17,32	13,0	11,85	34,0	31,00	109,67
1966	44,1	34,67	0,08	0,06	0,07	0,05	10,94	8,60	1,0	0,79	-	0	18,0	14,15	22,0	17,29	31,0	24,37	127,19
1967	34,1	21,22	-	0	1,23	0,77	14,37	8,94	3,0	1,87	46,0	28,62	25,0	15,57	23,0	14,31	14,0	8,71	160,70
1968	42,7	30,16	0,04	0,03	3,03	2,14	17,82	12,59	9,0	6,36	4,0	2,83	18,0	12,71	17,0	12,01	30,0	21,19	141,59
1969	95,0	44,48	0,99	0,46	11,0	5,15	22,57	10,57	5,0	2,34	4,0	1,87	33,0	15,45	11,0	5,15	31,0	14,52	213,56
1970	111,2	59,88	0,15	0,08	6,26	3,37	9,10	4,9	5,0	2,69	4,0	2,15	29,0	15,62	5,0	2,69	16,0	8,62	185,71
1971	134,3	56,96	0,08	0,03	6,19	2,63	9,19	3,89	4,0	1,69	10,0	4,24	39,0	16,54	5,0	2,12	28,0	11,88	235,76
1972	178,3	53,94	-	0	14,31	4,33	31,97	9,67	7,0	2,12	9,0	2,72	38,0	11,49	10,0	3,02	42,0	12,70	330,58
1973	155,0	52,78	-	0	14,80	5,03	27,89	9,49	5,0	1,70	3,0	1,02	53,0	18,05	11,0	3,75	24,0	8,17	293,69
1974	239,6	54,25	3,6	0,82	23,79	5,39	36,69	8,31	17,0	3,85	3,0	0,68	62,0	14,04	7,0	1,58	49,0	11,07	441,68
TOTAL	1,088,3	46,22	5,01	0,21	81,91	3,58	200,61	8,52	62,0	2,63	83,0	3,52	354,0	15,03	136,0	5,78	344,0	14,61	2,354,83

Data Source: Registrar of Banks Annual Reports, 1964 to 1974.

TABLE 3.3 OWNERSHIP DISTRIBUTION OF MARKETABLE SHORT-TERM GOVERNMENT STOCK FROM 1964 TO 1974

DATE	PUBLIC DEBT COMMISSIONER		The Banking Sector												OTHER BANKING INSTITUTIONS		BUILDING SOCIETIES		INSURANCE COMPANIES & PRIVATE PENSION & PROVIDENT FUNDS		OTHER HOLDERS		TOTAL
			RESERVE BANK		COMMERCIAL BANKS		NATIONAL FINANCE CORP.		DISCOUNT HOUSES		MERCHANT BANKS		OTHER MONEY MARKET INSTITUTIONS										
	AMT	%	AMT	%	AMT	%	AMT	%	AMT	%	AMT	%	AMT	%	AMT	%	AMT	%	AMT	%	AMT	%	
1964	169,4	30,5	29,6	5,3	119,0	21,4	58,2	10,5	57,0	10,3	23,3	4,2	13,2	2,4	1,7	0,3	33,3	6,0	14,2	2,6	36,0	6,5	554,9
1965	148,1	24,4	30,1	4,9	188,3	31,1	49,9	8,2	55,0	9,1	19,7	3,2	29,0	5,0	8,2	1,3	48,0	7,9	7,0	1,2	24,2	4,1	607,5
1966	123,9	15,5	21,5	2,7	279,9	35,0	64,3	8,1	62,0	7,8	25,8	3,2	96,9	12,2	16,3	2,0	75,6	9,5	8,5	1,1	22,5	2,8	797,1
1967	135,0	15,0	45,0	5,0	316,0	35,1	64,5	7,2	62,0	6,9	24,1	2,7	115,5	12,8	21,1	2,3	80,0	8,9	11,5	1,3	24,7	2,7	899,4
1968	103,8	10,5	41,6	4,2	362,2	36,7	53,5	5,4	100,0	10,1	32,7	3,3	157,0	15,9	16,6	1,7	83,3	8,4	8,3	0,8	28,6	2,9	987,7
1969	6,2	0,7	42,8	4,8	338,8	38,0	104,8	11,8	90,0	10,1	20,0	2,2	163,9	18,4	12,4	1,4	84,9	9,5	3,7	0,4	24,1	2,7	891,4
1970	17,1	1,0	58,2	6,2	334,8	35,9	79,4	8,5	144,0	15,4	6,8	0,7	162,3	17,4	10,5	1,1	94,6	10,3	4,0	0,4	20,4	2,2	932,2
1971	29,0	2,8	64,0	6,2	362,0	35,0	84,0	8,1	147,0	14,2	6,0	0,6	182,0	17,6	9,0	0,9	98,0	9,5	6,0	0,6	45,0	4,4	1,033,0
1972	24,0	2,0	38,0	3,2	469,0	39,6	89,0	7,5	154,0	13,0	62,0	5,2	150,0	12,7	36,0	3,0	124,0	10,5	4,0	0,3	34,0	2,9	1,185,0
1973	18,0	1,3	302,0	21,9	446,0	32,3	117,0	8,5	136,0	9,9	61,0	4,4	151,0	10,9	43,0	3,0	99,0	7,0	6,0	0,4	-	0	1,379,0
1974	9,0	0,7	321,0	24,5	385,0	29,4	119,0	9,1	150,0	11,5	69,0	5,3	155,0	11,8	57,0	4,4	48,0	3,7	8,0	0,6	-	0	1,310,0
TOTALS	783,5	7,4	993,8	9,4	3601,0	34,0	883,5	8,4	1157,0	10,9	350,4	3,3	1375,8	13,0	231,8	2,2	868,7	8,2	81,2	0,8	259,5	2,6	10,577,2

Data Source: South African Reserve Bank Quarterly Bulletin, 1964 to 1974.

rate. This would seem to be the consequence of two factors. Firstly, N.F.Cs are call deposits whereas Treasury Bills are time paper, and secondly, since May 1968 the Reserve Bank has instructed the monetary banks to hold special deposits with the N.F.C. This increase in holdings of N.F.C. deposits from 1968 onwards is clearly visible in Table 3.2.

3.2.2.4 The Yield on Short-Term Government Stock

Short term gilt-edged government stock is customarily defined as having a term-to-maturity of not more than three years. The yield on this stock has been described as "freely determined in the market."⁵

Short stock would seem to reflect market conditions primarily because of its legal status.⁶ Both the 1965 Banks Act and the Building Society Act include it as a liquid asset, while in the Pension Funds Act and Unit Trust Control Act it is an approved investment. This has ensured that the holding and volume of trade in short government paper is extensive. Table 3.3 indicates that the private financial sector held 83,2 per cent of the total issue of R10 577,2 million over the period 1964 to 1974, with commercial banks as the single largest holders at 34,0 per cent. In contrast to the market for Treasury Bills, the P.D.C. and Reserve Bank together held only the remaining 16,8 per cent.

Fluctuations in the yield for short gilts show some correspondence with N.C.Ds and acceptances, although it almost always lies below them, illustrating that their greater security has outweighed their longer term-to-maturity. Obviously as the maturity of gilt-edged paper decreases, so its price must rise to reduce yield. Hence the popular investment expression of "riding the yield curve".

3.2.2.5 Negotiable Certificates of Deposit

An N.C.D. or cash deposit is "a document issued by a bank certifying that a deposit has been made with it, repayable to the holder upon surrender of the certificate at maturity"⁷ and which is negotiable by simple delivery. As distinct from Treasury Bills and N.F.C. deposits, N.C.Ds are issued solely by the private banking sector and therefore involve a switch from demand to time deposits in the system.⁸ For the issuing banks, N.C.Ds represent a valuable/

5. Ibid, p.58

6. See De Swardt, C.J. and Steenkamp, G. "An Analysis of the South African Government Debt" S.A.R.B. Quarterly Bulletin, September, 1969.

7. Wall, J.P. "Aspects of the Short-term Money Market in South Africa" The Investment Analysts Journal, No.3, Nov. 1973, p.12.

8. Rosseas, S.W. Monetary Theory, Alan A. Knopf, New York, 1972, p.213 following.

TABLE 3.4

OWNERSHIP DISTRIBUTION OF NEGOTIABLE CERTIFICATES OF DEPOSIT FROM 1964 TO 1974

DATE	COMMERCIAL BANKS		MERCHANT BANKS		DISCOUNT HOUSES		GENERAL BANKS		HIRE-PURCHASE BANKS		SAVINGS BANKS		TOTAL
	AMT.	%	AMT.	%	AMT.	%	AMT.	%	AMT.	%	AMT.	%	
1964	-	0	-	0	-	0	-	0	-	0	-	0	-
1965	-	0	-	0	-	0	-	0	-	0	-	0	-
1966	1,72	10,95	4,85	30,85	1,15	7,32	6,62	42,14	1,37	8,72	-	0	15,71
1967	4,45	21,99	3,50	17,30	5,03	24,86	2,55	12,61	4,56	22,54	0,14	0,69	20,23
1968	27,71	26,19	24,42	23,08	9,72	9,19	28,05	26,51	14,91	14,09	1,01	0,95	105,82
1969	57,49	38,80	26,61	17,96	12,28	8,29	30,53	20,60	20,05	13,53	1,21	0,82	148,17
1970	49,14	36,40	25,26	18,71	23,25	17,22	25,26	18,71	9,39	6,97	2,69	1,99	134,99
1971	54,45	37,15	29,28	19,98	25,00	17,06	29,28	19,98	6,16	4,20	2,41	1,64	146,58
1972	77,78	41,63	26,18	14,01	19,34	10,35	57,38	30,71	3,14	1,68	3,01	1,61	186,83
1973	47,69	31,78	36,24	24,12	18,34	12,22	46,04	30,68	-	0	1,75	1,17	150,06
1974	5,97	9,88	16,71	27,64	27,11	44,85	9,57	15,83	-	0	1,09	1,80	60,45
TOTAL	325,54	33,60	193,05	19,93	141,22	14,58	235,28	24,28	59,58	6,15	13,31	1,37	968,84

Data Source:

Registrar of Financial Institutions Annual Reports, 1964 to 1974.

means of raising finance enabling them to adjust their liquidity position without having to unload other assets on depressed markets, and rather disturbingly for the authorities, facilitate mutual liquidity arrangements among banks themselves. N.C.Ds, however, do not qualify as liquid assets.

The yield on N.C.Ds depends, of course, on the current rate on time deposits, but it definitely can be regarded as market determined and therefore reflective of the liquidity position in the money market. Graph I shows the rate on N.C.Ds to be far above that on equivalent Treasury Bills and N.F.C. deposits further vindicating this. Table 3.4 illustrates the rapid growth of N.C.Ds until 1973 when they declined drastically due mainly to the fall in holdings of commercial and merchant banks.

3.2.2.6 Banker's Acceptances

A banker's acceptance may be defined as "a bill or promissory note which must be self-liquidating, and linked directly with and immediately preceded by a specific merchandise transaction and the bill or promissory note must be so enclosed (to the satisfaction of the Reserve Bank) that it is possible to identify the transaction concerned."⁹

Banker's acceptances are readily discountable on the market, allowing the drawer to acquire use of the funds until the due date when the bill must be honoured. Despite the various transactions costs, acceptance credit has become preferable to overdrafts because it is the cheaper of the two and cannot be recalled.

The growth of banker's acceptances as a credit instrument has been prolific. A glance at Table 3.5 will confirm this. The volume of acceptances more than quadrupled between 1964 and 1974, despite restrictions imposed on the discount houses holdings of them. Not unexpectedly given the nature of their business outlined in Section 3.1.4.2, merchant banks were responsible for a massive 71,36 per cent of total issues during the period.

The rate on acceptances can be regarded as relatively market determined, although the so-called quota system (no more than forty percent of total assets may be bank acceptances) has prevented the rate from reflecting supply and demand conditions in the markets to the extent of the N.C.D. rate. Recently not all institutions have adhered to this informal agreement, however.

9. Government Gazette No.3683 of 20th October, 1972.

TABLE 3.5

OWNERSHIP DISTRIBUTION BY ISSUING INSTITUTIONS OF BANKERS ACCEPTANCES
FROM 1964 TO 1974.

DATE	COMMERCIAL BANKS		MERCHANT BANKS		GENERAL BANKS		HIRE-PURCHASE BANKS		SAVINGS BANKS		TOTAL
	AMT.	%	AMT.	%	AMT.	%	AMT.	%	AMT.	%	
1964	2,70	2,27	116,16	97,73	-	0	-	0	-	0	118,86
1965	4,17	2,54	159,91	97,43	0,05	0,03	-	0	-	0	164,13
1966	2,78	1,83	148,53	98,00	0,25	0,16	-	0	-	0	151,56
1967	7,13	4,49	151,30	95,39	0,18	0,11	-	0	-	0	158,61
1968	17,54	10,99	141,74	88,86	0,23	0,14	-	0	-	0	159,51
1969	45,27	21,44	151,85	71,90	7,68	3,64	6,39	3,02	-	0	211,19
1970	72,75	25,64	191,27	67,40	13,21	4,66	6,54	2,30	-	0	283,77
1971	87,23	28,20	197,08	63,72	19,02	6,15	5,85	1,89	0,11	0,04	309,29
1972	129,39	35,74	208,05	57,47	21,63	5,97	2,84	0,78	0,11	0,03	362,02
1973	153,38	33,31	285,06	61,91	21,88	4,75	-	0	0,11	0,02	460,43
1974	172,02	31,46	336,71	61,58	37,91	6,93	-	0	0,11	0,02	546,75
TOTAL	694,36	23,73	2087,66	71,35	122,04	4,17	21,53	0,74	0,44	0,015	2926,03

Data Source: Registrar of Banks Annual Reports, 1964 to 1974.

3.2.3. The Market for Long-Term Interest Rates

In contrast to the market for short-term securities, which reflect cyclical and random influences, the market for long-term paper manifests the long-run growth conditions in the economy and is closely related to the state of the international capital markets. This, together with the impact of Malkiel's Theorem, causes long rates to be more stable over time than their short counterparts.

Because our primary objective is to investigate the yield curve, we are interested only in fixed interest-bearing securities. Due to the paucity of relevant statistics, we shall examine only two rates, namely those on long-term government stock and company debentures.

3.2.3.1 The Yield on Long-Term Government Stock

Long-term government stock is customarily demarcated as that with a term-to-maturity exceeding 20 years. The rate on these long gilts must be regarded as a controlled rate since new issues are governed by the so-called pattern of rates by the Reserve Bank.

The rationale behind this procedure, according to the Governor of the Reserve Bank is "... not the maintenance of stability in the sense of rigid pegging of rates and prices, but rather of ensuring an orderly upward adjustment of market rates"¹ The historical antecedents of this policy lie in the depressed state of post-war yields on long bonds, which tended to restrict the borrowing capacity of the state. The pattern of rates was established to give investors a clear indication of the terms of new issues and hence reduce the element of uncertainty.

The most important factors influencing the choice of the rate pattern seem to be the supply and demand situation in the market, the effect of developments in the capital and current accounts on the balance of payments, and the related behaviour of long rates overseas.² The rates on long stock nonetheless tend to follow in close relation, other rates in the capital market i.e. see Graph 2, and thus can be regarded to a certain extent anyway, as indicative of conditions in this market.

1. Address by the Governor, S.A.R.B. Quarterly Bulletin, 1950.

2. Franszen, D.G. Economic Growth and Stability in a Developing Economy : Some Aspects of the Union's Post-War Experience, G.L. von Schack Ltd., Pretoria, 1960.

TABLE 3.6

OWNERSHIP DISTRIBUTION OF MARKETABLE LONG-TERM GOVERNMENT STOCK FROM 1964 TO 1974

DATE	PUBLIC DEBT COMMISSION		The Banking Sector						MUTUAL FUNDS & UNIT TRUSTS		BUILDING SOCIETIES		INSURANCE COMPANIES & PRIVATE PENSION & PROVIDENT FUNDS		OTHER HOLDERS		TOTAL
			RESERVE BANK		COMMERCIAL BANKS		OTHER MONEY MARKET INSTITUTIONS										
	AMT.	%	AMT.	%	AMT.	%	AMT.	%	AMT.	%	AMT.	%	AMT.	%	AMT.	%	
1964	1,426,0	79,0	30,1	1,7	76,4	4,3	21,5	1,2	-	0	53,4	2,9	84,1	4,7	92,4	5,2	1,783,9
1965	1,621,7	83,4	36,2	1,9	43,2	2,2	37,1	1,9	-	0	28,1	1,4	90,4	4,6	88,6	4,6	1,945,3
1966	1,755,6	79,8	60,8	2,8	57,5	2,6	26,5	1,2	2,1	0,1	22,6	1,0	154,2	7,0	118,4	5,3	2,197,6
1967	1,968,5	81,6	56,9	2,4	36,1	1,5	14,1	0,6	4,1	0,2	18,5	0,8	214,7	8,9	99,5	4,1	2,412,3
1968	2,223,8	78,5	49,8	1,8	66,6	2,4	29,5	1,0	20,4	0,7	24,4	0,9	292,9	10,3	125,4	4,4	2,832,7
1969	2,547,3	78,1	52,3	1,6	55,3	1,7	13,9	0,4	80,5	2,5	21,1	0,6	369,8	11,3	119,6	3,7	3,260,0
1970	2,722,3	79,4	73,9	2,2	22,9	0,7	8,1	0,2	54,7	1,6	17,9	0,5	417,6	12,2	109,4	3,2	3,426,7
1971	2,844,0	77,9	80,0	2,2	20,0	0,5	7,0	0,2	49,0	1,3	18,0	0,5	519,0	14,2	111,0	3,0	3,648,0
1972	2,899,0	67,9	86,0	2,0	92,0	2,1	90,0	2,1	48,0	1,1	48,0	1,1	757,0	17,8	243,0	5,7	4,264,0
1973	3,012,0	66,4	63,0	1,4	114,0	2,5	82,0	1,8	41,0	0,9	60,0	1,3	904,0	19,9	262,0	5,8	4,538,0
1974	3,242,0	67,1	70,0	1,4	79,0	1,6	97,0	2,0	34,0	0,7	49,0	1,0	1,045,0	21,6	218,0	4,5	4,835,0
TOTAL	26,262,2	74,7	659,0	1,9	663,0	1,9	426,7	1,2	333,8	0,9	361,0	1,0	4,848,7	13,8	1,587,3	4,5	35,142,60

Data Source: South African Reserve Bank Quarterly Bulletin, 1964 to 1974.

Yields, as distinct from rates, are controlled so as to approximate rates. The authorities are able to ensure this since they are by far the largest purchasers of stock, with the PDC alone holding 74,7 per cent of the total over the period 1964 to 1974 as shown in Table 3.6.

3.2.3.2 Company Stock, Debentures and Notes

The private sector counterpart of the long-term gilt-edged stock consists in company stock, debentures and notes. The yield on debentures may be viewed as freely determined in the capital market and hence reflective to some extent of the real rate of return on investment.

No marked imperfections in the trading of debentures are apparent, which generally are in line with the rates prevailing in London and New York. Direct government intervention in the market is non-existent except for the normal impact of macro-economic policy instruments on the economy of South Africa as a whole.

3.3 CONCLUSION

A Gurley and Shaw-Type³ approach classifying financial institutions as intermediaries between deficit and surplus units in the economy was adopted to analyse the South African financial structure. Essentially this structure emerged as a relatively well-developed system consisting of a number of specialist institutions which, despite powerful legislative constraints, nonetheless possesses a not insignificant degree of flexibility.

Interest rates generally are affected by a variety of institutional, legislative and other factors. The market as a whole must be regarded as rather rigidly controlled by the monetary authorities. In the money market only NCDs and short term stock are freely determined, although acceptances are also to a great degree indicative of market forces. On the other hand, while rates on Treasury Bills and NFC call deposits are manipulated, they do approximate the other rates, though at lower levels. A similar situation prevails in the long market, with debentures being entirely competitively determined and the yield on long-term stock controlled but nonetheless approximate to it.

3. Gurley, J.G. and Shaw, E.S. op.cit;

CHAPTER IVA SOUTH AFRICAN TEST OF THE THEORIES4.0 INTRODUCTION

Chapter III was concerned with the determination of interest rates within the South African institutional context. The present Chapter will draw heavily on this analysis in evaluating empirical tests of the theories introduced in Chapter I.

The discussion here will be organised in our usual manner. The traditional theory will be considered and the rationale for not submitting it to empirical verification will be examined in the light of our conclusions in Section 2.1.1. In the subsequent three sections, the results of econometric tests of New Expectations Theory, the Malkiel hypothesis, and Liquidity Premium Theory will be analysed. In each case we will draw heavily on the discussion of Chapter II. Finally, a statistical examination of the validity of Culbertson's Market Segmentation Theory will be conducted in Section 4.5. The Chapter terminates with an overall evaluation of the performances of the competing theories.

In every instance the a priori expectations emerging from the deliberations of the empirical review of Chapter II will be extracted, the data requirements will be contrasted against the data availability and any manipulations discussed, the estimations will be presented and analysed with special emphasis on any institutional peculiarities affecting them, and lastly, a brief examination of the policy implications will be provided where this is relevant.

4.1 The Traditional Expectations Hypothesis

In Chapter II, Sections 2.1 and 2.1.1, we saw that the empirical evidence available on the traditional variant of expectations theory was, to say the least, conflicting. We argued that it is not sufficient to compare expected rates implicit in the yield curve and actual observed rates since expectations can still be the prime determinant of the term structure without having to be an accurate reflection of the future.

In Section 2.1.1, we accepted the so-called "hard" version of the theory, but argued that the only acceptable method of empirical investigation lay in the/

examination of independent evidence, that is, evidence other than that derived solely from the yield-to-maturity curve. We noted that the only known means of obtaining independent empirical evidence was by way of questionnaire surveys, but indicated that at best this method possessed certain undesirable characteristics.

Given this, and the inconclusiveness of prior tests of the traditional theory, we shall not attempt an empirical study of the traditional theory. While a questionnaire survey, despite its flaws, may have been a relevant exercise, such an endeavour would lie beyond the scope of a project of this nature.

4.2 New Expectations Theory

Our review of the empirical evidence accumulated on the Meiselman model in Sections 2.2 and 2.2.1 revealed a number of notable features. Firstly, the estimations obtained did not seem to be dependent on the length of the data period employed, nor on whether quarterly or annual data was used. Secondly, however, the regressions were highly susceptible to the manipulations performed on the yield data, but even when the data had been smoothed the hypothesis did not consistently perform well. Finally, there was no indication as to whether the Lutzian or Hicksian formulae proffered better forward rates. Overall the empirical evidence on New Expectations Theory forced us to an eclectic conclusion.

The Durand data used by Meiselman has no equivalent in South Africa. While published observations on gilt-edged securities are available from three years through to twenty-five years to maturity, no commensurate official statistics exist on bonds of less than three years to maturity. Therefore, it is not possible to regress changes in one-year forward rates against the forecasting error as in the original Meiselman Study. That smoothed data is not attainable in South Africa need not necessarily be considered a disadvantage, for if we recall Buse's¹ argument in Chapter II, smoothed curves are likely to produce results which in any event are little more than statistical artifacts.

Although due to data limitations then, we cannot estimate the equation dealing in the short end of the market, we can investigate an equivalent hypothesis put forward by Meiselman:

1. Buse, A. "Interest Rates, the Meiselman Model and Random Numbers", Journal of Political Economy, 75, 1967, p.49.

"Since unanticipated changes in marginal interest rates are highly correlated with the forecasting error, it must follow that unanticipated changes in the long-term rate, an average of the marginals, are also highly correlated with the forecasting error."²

Meiselman³ himself did not test directly this hypothesis since "unfortunately, data limitations preclude giving precise empirical content to this hypothesis Durand's basic yields at one-year intervals are not available beyond ten years to maturity". However, instead of calculating the appropriate forward long-term rates he decided to proxy unanticipated interest rate changes with actual changes. Generally, the results obtained were good, particularly for 30 year bonds.

A priori we cannot expect acceptable estimates for South Africa by employing the long-rate hypothesis. In the first instance, we will not be using smoothed data, but rather actual observed market rates. Previous investigations based on similar data, such as those of Grant⁴, van Horne⁵ and Buse⁶ outlined in Chapter II, did not establish evidence supportive of the Meiselman model. Secondly, we have in some instances due to data constraints been forced to commit what Masera⁷ has termed "errors of the first kind" or "the attribution to term to maturity of bond-yield differentials which are in fact due to other determinants". Finally, the errors in forecasting short rates used to re-assess expectations of future long rates are generally based on rates which are both more freely determined and more volatile than the rate on long-term stock. In the previous chapter, we noted that although long gilts are not market determined per se, they do closely follow market trends, but fluctuate less than the shorter rates. Even corporate bonds, which must be regarded as freely determined, are greatly more stable over time than their short counterparts.

Our first estimation of equation (2.2.1) considered the difference between actual and observed yields on 3-year government stock as the error on which/

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2. Meiselman, D. The Term Structure of Interest Rates, Prentice-Hall, Englewood Cliffs, 1962, p.22.
 3. Ibid, p.23
 4. Grant, J.A.G. "Meiselman on the Structure of Interest Rates : A British Test" Economica, February 1964, p.51.
 5. Van Horne, J. "Interest-Rate Risk and the Term Structure of Interest Rates" Journal of Political Economy, August, 1965, p.344
 6. Buse, A. op.cit.
 7. Masera, R.S. The Term Structure of Interest Rates, Clarendon University Press, Oxford, 1972, p.91.

expectations of future yields on long gilt-edged stock were revised. We used quarterly data for the period 1964(I) to 1974(IV), although three years were lost as a consequence of calculating forward rates on short stock. Since the more complex Lutzian formula could offer no observable advantage over the Hicksian formula, we employed the latter method to calculate forward rates implicit in the yield curve from 1964 onwards:

$$1 + r_n = \frac{(1 + R_n)^n}{(1 + R_{n-1})^{n-1}} \quad (4.2.1)$$

We recall that for the Meiselman hypothesis to be upheld the constant term must be zero, and the regression coefficient b must be positive and significantly different from 0. For the equation

$$\Delta t + n r_{20,t} = a + b E_t \quad (2.2.1)$$

we obtained the estimates given below⁸. We quote these rather meaningless results only as an indication of the type of results obtained in identical regressions using the error on 3 year stock to revise expectations on 5 year, 12 year and 15 year bond yields respectively.

$$\begin{aligned} \Delta t + n r_{20} &= 7,2835188 - 0,2887387 E_t \\ &\quad (28,50) \quad (1,26) \\ r^2 &= 0,225 \\ D.W. &= 0,1096 \end{aligned}$$

Obviously, these results provide absolutely no support at all for the hypothesis with the a term positive and significantly different from zero, and the b term negative and not significantly different from zero. In addition, the r^2 indicates that the model has no explanatory power, and the low Durbin-Watson shows strong serial correlation.

Given that the results for government stock were so discouraging, we estimated the same equation using the forecasting error on three-month bankers acceptances against the expectations on corporate bonds for the period 1964 to 1974 employing quarterly observations. Because the term-to-maturity of acceptances is three months, only one set of observations was lost. The two rates, as we saw in/

8. All calculations were done at the Rhodes University Computer Centre, except as indicated later. The regression results are given in the usual manner, i.e. beneath the coefficients in parentheses are the Student's t -statistic. r^2 and R^2 are the simple and multiple coefficients of determination respectively. D.W. denotes the Durbin-Watson statistic.

Chapter III can be regarded as market determined and hence compatible.

The results were:

$$\Delta t + n r_{20,t} = 8,6926544 + 0,000093 E_t$$

(41,15) (0,62)

$$r^2 = 0,096$$

$$D.W = 0,1656$$

Several other attempts using the forecast error on N.C.Ds, Treasury Bills and N.F.C. deposit rates respectively, regressed against the expected rate on corporate bonds produced equally poor estimates.

We made a final attempt using the expected yield on three-year government paper as the dependent variable, and prediction errors on forecasts of bankers' acceptances as the independent variable. Again quarterly observations for the period 1964 to 1974 were employed. Once more the estimates obtained were meaningless.

$$\Delta t + n r_{3,t} = 5,1923762 + 0,2206995 E_t$$

(47,17) (0,84)

$$r^2 = 0,129$$

$$D.W = 0,2867$$

Similar regressions with short-term government stock were run using N.C.Ds, Treasury Bills and N.F.C. deposit rates. In no instance did anything like relevant results occur.

From our investigation of the equivalent Meiselman long rate hypothesis, we are forced to conclude that the results provided no support for the model whatsoever. In every case the a's were high and significantly different from zero whereas the b coefficients were not statistically different from 0. All unconnected multiple correlation coefficients showed that the model was incapable of explaining more than 30 per cent of the variations in expected long rates, which can be taken to indicate severe mis-specification. In addition, strong serial correlation was evidenced by the extremely low values produced vis-a-vis the Durbin-Watson test.

Since the South African data compares favourably with that used in other comparable tests of the long rate hypothesis, we cannot ascribe the very poor performance of New Expectations Theory to deficiencies in this regard. A more probable explanation would lie in the greater volatility of short rates relative to the long rates. However, the estimation of short stock and acceptances would tend to diminish the weight we could attach to this argument. We must conclude that the Meiselman long-rate model is not at all successful in explaining the market for securities in this country. Given the performance of the hypothesis, therefore, it would be spurious to attempt to draw policy conclusions from it.

4.3 Malkiel's Alternative Reformulation of Expectations Theory

In Chapter II, Sections 2.3 and 2.3.1, we examined and analysed the results of quantitative tests on the Malkiel hypothesis. We saw that although only two investigations had been undertaken, by Malkiel himself and Dodds and Ford respectively, the resultant evidence provided relatively strong support for the hypothesis.

We recall that Malkiel used the long-short yield differential to proxy the normal range of interest rates, a factor that has been subjected to some criticism. In addition, he assumed that investors formed their expectations of the limits of the normal range by taking an historical average of interest rates and adding a certain number of standard deviations to either side of it. Clearly, the time period used to calculate the historic average is dependent on subjective criteria and it is by no means assured that Malkiel was correct in selecting 15 years as a suitable length of time. For this reason, we decided to vary this time span between 15 years and one year in order to see how this affected the overall results.

In contrast to the Meiselman hypothesis of the previous section, the South African data are fairly well suited to testing the Malkiel theory, for both the yields on long and short stock are amongst the most consistent time-series data available in this country. A note of caution should be sounded, however, over the fact that short gilts are more freely determined than longs. As we argued before though, this need not necessarily imply that an error of the first kind is committed since long rates do appear to follow the market fairly closely.

In our tests of the theory, we followed very closely the test procedure of Malkiel, and estimated both equations of Section 2.3. The first equation to be investigated is given below:

$$(R - S)_t = a + b (R - R_A)_t \quad (1.4.6)$$

A priori we cannot expect equation (1.4.6) to perform well, even if we do not consider the poor results obtained by Malkiel. The reason for this is that R , or the long rate, appears on both sides of the equation. In essence this implies that as R increases so $(R - S)$ and $(R - R_A)$ must rise. Consequently, a strong statistical bias is imparted to the estimates obtained.

Equation (1.4.6) was estimated using quarterly yield data on short and long government securities as defined by the Reserve Bank, from 1966 (I) to 1974 (IV). The results are given below in tabular form R_A , or the moving average of past long rates, was raised by using 15 years, 10 years, 5 years, 3 years and one year respectively calculated on a quarterly basis.

TABLE 4.3.1 REGRESSION RESULTS USING DIFFERING PERIODS FOR MOVING AVERAGE R_A QUARTERLY DATA, 1966 TO 1974.

$$(R - S)_t = a + b (R - R_A)_t$$

Equation Number	Length of R_A	Intercept a	Regression Coefficient b	Degrees of Freedom	Uncorrected R^2	Durbin-Watson
1	15	0,7950654 (2,58)	0,6242858 (3,85)	34	0,551	0,3250
2	10	1,1603341 (3,97)	0,5113576 (2,79)	34	0,431	0,3078
3	5	1,8698497 (6,89)	0,476109 (1,80)	34	0,311	0,2134
4	3	1,9935714 (11,53)	-0,1334225 (0,64)	34	0,109	0,2195
5	1	1,8565950 (13,59)	0,2393771 (0,89)	34	0,151	0,2194

The estimates contained in Table 4.3.1 are not encouraging to say the least. For the Malkiel hypothesis to be at all vindicated the b coefficients must be less than zero, and this is true only for equation 4 where it is not significant in any case. However, we would have expected this since the statistical bias inherent in equation (1.4.6) is one of positive correlation, and therefore acts against the Malkiel hypothesis. For all equations the R^2 is low and declines as the length of the period used to calculate R_A is shortened, indicating mis-specification in the model. After applying the Durbin-Watson test, we found strong evidence of serial correlation since all d 's fell below their critical lower values.

Following the methodology of Malkiel⁹, who removed the statistical bias by transposing R to the left-hand side of the equality sign and multiplied through by minus unity, we estimated equation (2.3.1.1) below. Once again, the long average rate R_A was varied by using 15, 10, 5, 3 and 1 year behind moving averages calculated quarterly.

$$S_t = -a + (1 - b) R_t + b R_{At} \quad (2.3.1.1)$$

A priori we would expect (2.3.1.1) to perform more satisfactorily than (1.4.6) since the bias has been removed. The short rate now becomes the dependent variable, and the regression coefficient $(1 - b)$ is left unrestricted as in the original Malkiel investigation. For the estimations to support the hypothesis, b must again be negative and significantly different from zero. The results obtained are given in Table 4.3.2 below:

TABLE 4.3.2 REGRESSION RESULTS USING DIFFERENT PERIODS FOR THE MOVING AVERAGE R_A QUARTERLY DATA, 1966 TO 1974

$$S_t = -a + (1 - b) R_t + b R_{At}$$

Equation Number	Length of R_A	Intercept -a	Regression Coefficient (1 - b)	Regression Coefficient b	Degrees of Freedom	Uncorrected r^2	Durbin-Watson d
1 ¹	15	-5,4608742 (6,93)	1,0423858 (8,33)	-1,3762867 (5,23)	33	0,855	0,7218
2 ¹	10	-4,0818568 (6,35)	0,9166719 (7,87)	-0,9114167 (4,59)	33	0,836	0,9451
3 ¹	5	-2,7600740 (6,11)	1,0642724 (8,52)	-0,799192 (5,42)	33	0,860	0,7625
4 ¹	3	-2,4899938 (5,18)	0,8790149 (7,79)	-0,5174789 (4,43)	33	0,831	0,6278
5 ¹	1	-2,4350546 (4,00)	0,7409607 (4,34)	-0,3415769 (1,80)	33	0,743	0,4934

9. Malkiel, B.G. The Term Structure of Interest Rates : Expectations and Behaviour Patterns, Princeton University Press, Princeton, 1966, Chapter 4.

The estimates in the table above compare favourably with those of Malkiel, particularly equation 1¹ which employed a similar time period to calculate R_A . All equations have coefficients statistically significant at a 95 per cent level of confidence and higher. In every case the signs of these terms are in conformity with those predicted by the hypothesis. The multiple correlation coefficient R^2 indicates the explanatory power of the hypothesis is in excess of 80 per cent with the exception of equation 5¹. Corresponding to the results of Malkiel, however, the Durbin-Watson statistic d is disturbingly low in every instance, registering a severe degree of serial correlation, and making it difficult to draw any firm overall conclusions.

It is interesting to note in regard to the results of Table 4.3.2, that as the length of the period in which R_A is calculated is decreased, so the performance of the equation is diminished. As we would have expected, so too does the d statistic fall as R_A approaches the present observation.

In order to remove this serial correlation and raise the Durbin-Watson statistic, we estimated the first difference form of equation (2.3.1.1) and performed a separate multiple regression using the ordinary least squares method¹. Table 4.3.3 below gives the outcome of this process.

TABLE 4.3.3 REGRESSION RESULTS FOR THE FIRST DIFFERENCE FORM OF (2.3.1.1) USING DIFFERENT PERIODS FOR THE MOVING AVERAGE R_A QUARTERLY DATA 1966 TO 1974.

$$\Delta S_t = -a + (1 - b) \Delta R_t + b \Delta R_{At}$$

Equation Number	Length of R_A	Intercept -a	Regression Coefficient (1 - b)	Regression Coefficient b	Degrees of Freedom	Uncorrected R^2	Durbin-Watson d
1*	15	-0,0177	0,9308 (5,01)	-0,5230 (-0,12)	32	0,6659	1,5021
2*	10	-0,0468	0,9327 (5,04)	0,0857 (0,04)	32	0,6657	1,5086
3*	5	-0,1201	0,9462 (5,10)	1,0196 (0,54)	32	0,6694	1,5163
4*	3	-0,023	0,9148 (4,34)	-0,1795 (-0,18)	32	0,661	1,5049
5*	1	-0,0694	0,8739 (4,66)	0,4060 (1,19)	32	0,6838	1,5385

1. In contrast to all previous calculations, this regression was run at the Computing Laboratory of the University of South Africa.

As we would anticipate, the R^2 's fell by approximately 0,2 whereas the Durbin-Watson statistic rose dramatically, but in every case lay between the critical upper and lower values at a 95 per cent level of confidence. While this prohibits us from concluding that serial correlation has been removed, it nonetheless indicates that no serious degree of inter-relationship exists between the residuals of the time series employed. In any event, the first difference equations are a considerable improvement in terms of d relative to the original estimations.

The values of the constant term a lie close to zero and thus accord closely with those of Malkiel in his first difference estimations. Similarly with the regression coefficients of ΔR_t , which are positive and statistically significant. However, the b coefficients are very disappointing and exhibit no apparent trend. This is understandable in view of the fact that because they are based on the difference between averages of R_t , each calculation $e_t - e_{t-1} = V_t$ must necessarily produce a very low absolute value.

Overall, we will argue that the Malkiel hypothesis via equation (2.3.1.1) has performed relatively well. The results in Table 4.3.2 in particular can be regarded as satisfactory. Despite the low Durbin-Watson values obtained here, it can be demonstrated that the estimations of the ordinary least squares method may still be efficient since R_t and R_{A_t} increase regularly for every observation.² If we accept this then $-a$, $(1 - b)$ and b remain unbiased estimates, and the multiple correlation coefficient R^2 is not overstated.

Because the Malkiel hypothesis has performed satisfactorily in the South African context it would not be out of place to briefly discuss the policy implications of the model. Clearly, expectations are a significant factor influencing the term structure of interest rates. Therefore it follows that the most rational means of altering the term structure must lie in those policy instruments which directly affect expectations per se. Consequently, we would argue for the vigorous application of the so-called announcement effect by way of strong and frequent statements by the authorities of the direction in which they wish the rate structure to move, in other words, the introduction of what Malkiel has termed an "open-mouth" policy, rather than the use of traditional debt management policy. Open market operations, in this country at least, are all too frequently severely restricted by the financing constraints of the Treasury which hamper their effectiveness. This being so, it would appear that the former instrument is both more effective and far simpler to implement.

2. See Wonnacott, R.J. and Wonnacott, T.H. Econometrics, John Wiley and Sons, New York, 1969 p.136 following and Chapter 16 for the principles underlying this argument.

4.4 The Liquidity Preference Hypothesis

In our review of the empirical investigations conducted into the Hicksian Liquidity Premium Theory in Chapter II, it was apparent that the only study to find any really positive evidence for the existence of liquidity premiums was that of Kessel.³ At best the other investigations revealed only weak evidence in support of the hypothesis.

We recall from Sections 2.4 and 2.4.1, Kessel's argument that if the average of forward expected rates do not equal subsequently observed actual rates, then the forward rates must portray not merely expected rates, but must also incorporate some other variable, namely liquidity premiums. Given this, Kessel then designed a study which would "cleanse" the market's forward rates of liquidity premiums in order to measure the "true" expectations of the market. These "true" expectations could then be used to test the predictive power of the market, or how accurately the market predicted future interest rates. One of Kessel's central problems, therefore, lay in the assessment of the ability of "true" expectations to be an accurate forecast of actual observed future rates.

In our own investigation of the Hicksian Liquidity Preference Hypothesis, we followed one of the many procedures developed by Kessel very closely. As in our work into the Meiselman hypothesis, we could not derive expected rates for the short end of the market since data constraints did not allow this. Therefore, unlike Kessel, we did not investigate liquidity premiums for $LP=1$, but rather for longer rates. But because Kessel did not investigate further than $LP=1$, and thus did not enquire into the Hicksian assumption that $LP_1 < LP_2 < \dots < LP_n$, or the assumption of normal backwardisation, this departure is not significant in a general sense except as we shall indicate below. It is permissible, therefore, to use the liquidity premium on any forward rate as data to test his basic hypothesis.

As his fundamental premise, Kessel assumed LP_1 to be dependent on present, observed one-year spot rates. We make a similar assumption, and for example, can then regard the liquidity premium on a six-year loan to be dependent on the present observed value of six-year loans. That the level of liquidity premiums bears a positive relationship to the level of interest rates is well supported in the literature. In other words, Kessel was able to write,

3. Kessel, R.A. The Cyclical Behaviour of the Term Structure of Interest Rates, National Bureau of Economic Research, Quassional Paper 91, New York, 1965.

$$LP_{n,t} = F(R_{n,t}) \quad (4.4.1)$$

By assuming, as we pointed out above, that if forward expected rates do not equal subsequently observed spot rates then the difference must be taken as indicative of liquidity premiums, Kessel is able to measure the latter. This, together with his behavioural postulate of equation (4.4.1), enables Kessel to propose his basic operational hypothesis:

$$LP_{n,t} = F(R_{n,t}) + Z \quad (4.4.2)$$

Where Z is the error in prediction contained in the original derived forward rates. Hypothesing that the relationship explicit in (4.4.2) is linear, Kessel posited the testable equation to be:

$$LP_{n,t} = a + b R_{n,t} + Z \quad (4.4.3)$$

This equation has been criticised in the literature for containing a number of possible flaws. Firstly, equation (4.4.3) clearly contains within itself a test of (4.4.1) which was arrived at by assumption rather than explicit theorizing. Secondly, even granted the correctness of such an hypothesis, what is also being tested is the view that (4.4.3) is a linear relationship, also fundamentally arrived at by assumption rather than on a priori grounds. Finally, Kessel's belief that Z should be statistically no different from zero regardless of the time period to which (4.4.3) is applied, has been subjected to criticism. If $Z \neq 0$, it is likely to be correlated with the value of L.P, and hence affect the coefficients a and b. Kessel, aware of this difficulty, did not deal at all convincingly with it.

"The validity of these tests depends upon the absence of positive correlation between forecasting errors and spot rates. Unfortunately it is difficult to disentangle forecasting errors from liquidity premiums."⁴

In the light of these problems it is by no means certain that (4.4.3) provides a suitable framework from which to investigate the existence of liquidity premiums. Therefore, on a priori grounds we should not be too optimistic regarding the performance of the equation in the South African context. It is with this note of caution still ringing in our ears that we approached the matter of actually estimating (4.4.3).

4. Ibid; footnote p.26

We recall from Section 2.4.1, that in contrast to almost all other studies, Kessel did not employ either the Hicksian or Lutzian formulae to generate forward expected rates, but rather the arithmetic average of the Hicksian formula. For example, to calculate one-year ahead one-year expected rates, the formula would be;

$$2 R_{2,t} - R_{1,t} = r_2$$

While this formula performs very well in relation to the other two for short periods ahead, as the maturity of the data is increased, so a downward bias in the derived expected rates will become more and more apparent. It is here that we encounter the problem that our data have a minimum term-to-maturity of six years. For this reason we decided to employ the standard Hicksian geometric average formula. Having thus derived forward expected rates, we calculated liquidity premiums in exactly the same way as Kessel, i.e. by taking the difference between expected and observed rates as embodying liquidity premiums.

In our tests of Liquidity Premium Theory a la' Kessel, we employed five sets of data namely, six, nine, twelve, fifteen, and twenty year yields on South African government stock. Although we saw in Chapter III that stock with a maturity of over three years is controlled via the so-called pattern of rates, it nonetheless still corresponds with other freely determined rates. The estimates obtained with equation (4.4.3) are given in table 4.4.1 below:

TABLE 4.4.1 REGRESSION RESULTS FOR LIQUIDITY PREMIUMS AGAINST RATES ON 6,9,12,15 and 20 YEAR GOVERNMENT STOCK RESPECTIVELY QUARTERLY DATA, $LP_{n,t} = a + b R_{n,t} + Z$

Equation Number	Length of data used	Intercept a	Regression Coefficient b	Degrees of Freedom	Uncor-rected R^2	Durbin-Watson d
1	6	-0,2620891 (0,40)	0,1615683 (1,57)	22	0,317	0,4822
2	9	3,6052554 (3,40)	-0,4815308 (3,31)	22	0,615	0,5850
3	12	1,5904204 (1,68)	-0,1884951 (1,37)	22	0,294	1,2877
4	15	2,3494052 (2,19)	-0,3101755 (2,18)	22	0,447	0,2867
5	20	0,0070052 (0,01)	0,1033389 (0,72)	30	0,130	0,2650

While it is not clear from his analysis whether Kessel assumes the a intercept to exist or not, there are good grounds for arguing that it should not. Since liquidity premiums have already theoretically been removed from forward rates, we would posit that a should be equal to zero. The a priori expectations of the sign of the regression coefficient b is implicit in the foregoing discussion in that because Kessel (and others) postulate a positive correlation between the level of rates and liquidity premiums, we must anticipate a positive sign.

From Table 4.4.1 it is immediately clear that no obviously discernible pattern exists between the length to maturity of the bond rate used and the estimates obtained. Generally, the results are not favourable to Liquidity Premium Theory bearing out our earlier forecasts. All but one of the multiple correlation coefficients are below 0,50 indicating a low goodness of fit. In addition, the Durbin-Watson test reveals evidence of strong serial correlation with the exception of equation 3 where d lies above the critical upper limit. The values of a do not entirely conform to a priori expectations, with equations 2 and 4 having values significantly different from zero at a 95 per cent level of confidence. More disturbing, however, are the estimates obtained for the regression coefficient of $R_{n,t}$. In no instance was a statistically significant positive relationship in evidence, and equations 2, 3 and 4 and even gave a negative relationship!

We are brought to the conclusion, not surprisingly given the numerous theoretical and practical problems inherent in the approach, that our estimates of the South African data provide absolutely no support at all for the Hicksian Liquidity Premium Theory. Clearly, while this does not diminish the value of the hypothesis, it does show that for this particular method in conjunction with the particular data employed, no positive proof exists. As in the case of Meiselman, we will not attempt any discussion on the policy implications of the theory, since given the results obtained this would be meaningless.

4.5 Market Segmentation Theory

Our review of the evidence amassed on the Institutional or Segmented Markets hypothesis in Chapter II indicated that while the majority of studies did reveal at least some degree of segmentation in the capital market, all were/

plagued by problems in making the model operational. In the main the researchers found themselves hampered by data constraints, and even with the limited information available, difficulties were encountered in the classification of debt according to maturity. The aggregate view studies, while perhaps more theoretically appealing, suffered from an identification problem arising out of the endogenous nature of the supply of government securities. In contrast, the so-called partial studies adopting a more micro-level of analysis were able to avoid this problem and found rather more convincing evidence for the existence of maturity preferences in the market for financial paper.

Consequent to this we shall follow the latter approach or that of Wehrle⁵, Terrel and Frazer⁶ and Dodds and Ford⁷. However, in common with all the other investigations, and possibly more so, we are severely hampered by the paucity of data on the supply and holdings of government debt. Given this, all we can hope to establish is evidence only weakly suggestive of the existence of maturity preferences in South Africa on the part of investing institutions. While obviously this cannot "prove" the hypothesis of segmented capital markets, it may perhaps be able to indicate some degree of institutional imperfection in the market. In any event, there appears to be no suitable alternative to this approach.

Before we attempt our analysis it is important to stress the significance of legislation in the asset-holding of financial institutions in this country, a point which we touched on in Chapter III. While Market Segmentation Theory posits that firms will attempt to match their assets with their liabilities, it may be in the South African context at least, that rather than this being an inherent characteristic of their financial behaviour, current legislation forces this upon them. Commercial banks, for example, may not hold a preponderance of short-term assets so as to match the overwhelming short nature of their liabilities, but to comply with their mandatory requirements in respect of liquid assets and prescribed investments. This could prove a very strong drawback in our analysis. However, we will return to this at a later stage.

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5. Wehrle, L.S. "Life Insurance Investment: The Experience of Four Companies" in Studies of Portfolio Behaviour, Cowles Foundation Monograph 20, Wiley, New York, 1967.
 6. Terrel, W.T. and Frazer, W.J. "Interest Rates, Portfolio Behaviour, and Marketable Government Securities" Journal of Finance, March, 1972, p.1-36.
 7. Dodds, J.C. and Ford, J.L. Expectations, Uncertainty, and the Term Structure of Interest Rates, Martin Robertson and Co. Ltd., London, 1974.

The existence of risk aversion in the behaviour of financial institutions will, if we accept Market Segmentation Theory as valid, result in a matching of their assets with their liabilities. It follows, therefore, that for the hypothesis to be substantiated an examination of actual holdings must reveal this to be the case. We turn now to Table 4.5.1 below, dealing with long-term gilts.

TABLE 4.5.1 THE OWNERSHIP DISTRIBUTION OF MARKETABLE LONG-TERM GOVERNMENT STOCK FROM 1964 TO 1974.

PERCENTAGES

INSTITUTION	D A T E										
	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
Reserve Bank	1,7	1,9	2,8	2,4	1,8	1,6	2,2	2,2	2,0	1,4	1,4
Commercial Banks	4,3	2,2	2,6	1,5	2,4	1,7	0,7	0,5	2,1	2,5	1,6
Other Banking Institutions	1,2	1,9	1,2	0,6	1,0	0,4	0,2	0,2	2,1	1,8	2,0
TOTAL	7,2	6,0	6,6	4,5	5,2	3,7	3,1	2,9	6,2	5,7	5,0
Building Societies	2,9	1,4	1,0	0,8	0,9	0,6	0,5	0,5	1,1	1,3	1,0
Insurance, Private Pension and Provident Funds	4,7	4,6	7,0	8,9	10,3	11,3	12,2	14,2	17,8	19,9	21,6
Public Debt Commissioners	79,9	83,4	79,8	81,6	78,5	78,1	79,4	77,9	67,9	66,4	67,1
Other Holders	5,2	4,6	5,4	4,3	5,1	6,2	4,8	4,3	6,8	6,7	5,2
TOTAL	100	100	100	100	100	100	100	100	100	100	100

Data source: South African Reserve Bank Quarterly Bulletin 1964 to 1975

The monetary banking sector has liabilities principally short-term consisting mostly of demand deposits by the public. For the institutional hypothesis to hold we would therefore expect their holdings of long paper to be low, and Table 4.5.1 indeed validifies this. From 1964 to 1974 the average total holdings of this sector was 3,8 per cent, and it never rose above the 7,2 peak recorded in 1964.

Commercial banks in particular had an average of only 1,45 per cent over the same time span. In contrast, insurance and pension provided funds, whose liabilities are in general long-term, held an average of 10,6 per cent, which/

is high given the enormous holdings of the Public Debt Commissioners. We would expect the opposite to be true for short gilts, illustrated in Table 4.5.2 below.

TABLE 4.5.2 THE OWNERSHIP DISTRIBUTION OF MARKETABLE SHORT-TERM GOVERNMENT STOCK FROM 1964 TO 1974.

PERCENTAGES

INSTITUTION	DATE										
	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
Reserve Bank	5,3	4,9	2,7	5,0	4,2	4,8	6,2	6,2	3,2	21,9	24,5
Commercial Banks	21,4	31,1	35,0	35,2	36,7	38,0	35,9	35,0	39,6	32,3	29,4
Other Banking Institutions	27,7	26,4	33,4	31,9	36,4	43,9	43,1	41,4	41,4	37,1	41,1
TOTAL	54,4	62,4	71,1	72,1	77,3	86,7	85,2	82,6	84,2	91,3	95,0
Building Societies	6,0	7,9	9,5	8,9	8,4	9,5	10,3	9,5	10,5	7,0	3,7
Insurance, Private Pension and Provident Funds	2,6	1,2	1,1	1,3	0,8	0,4	0,4	0,6	0,3	0,4	0,6
Public Debt Commissioners	30,5	24,4	15,5	15,0	10,5	0,7	1,8	2,8	2,0	1,3	0,7
Other Holders	6,5	4,1	2,8	2,7	2,9	2,7	2,2	4,4	2,9	0	0
TOTAL	100	100	100	100	100	100	100	100	100	100	100

Data Source: South African Reserve Bank Quarterly Bulletin 1964 to 1975

In contrast to the previous table, here we find the monetary banking sector holding an average of 79,1 per cent, with the commercial banks alone holding an average 34,0 per cent. Further, in accordance with the predictions of Market Segmentation Theory, the composite of insurance companies, pension and provident funds held only an average of 0,77 per cent over the period in question.

In order to see what extent the holdings of government bonds by the commercial banks are reflective of their total asset holdings, let us examine Table 4.5.3 below.

TABLE 4.5.3 THE COMMERCIAL BANKS HOLDINGS OF SHORT-TERM AND LONG-TERM STOCK AS A PERCENTAGE OF THEIR TOTAL ASSETS
PERCENTAGE

MATURITY OF ASSET	D A T E										
	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
Short-term stock	5,6	8,1	11,0	11,5	11,2	9,1	8,7	8,8	10,1	7,9	5,7
Long-term stock	3,6	1,7	2,1	1,3	2,0	1,5	0,6	0,5	1,5	0,6	1,1

Data source: South African Reserve Bank Quarterly Bulletin
1964 to 1975

Holdings of short-term stock as a percentage of total assets is consistently higher than that of long gilts, and averages 7,2 per cent as opposed to 1,6 per cent for the period under consideration. Unfortunately, no similar data exist for insurance, private pension and provident funds.

The fact that the monetary banking sector in general, and the commercial banks in particular, have greater holdings of short government paper is probably primarily a consequence of the financial legislation specifically the 1965 Banks Act and the 1972 Financial Institutions Amendment Act. Therefore, the results presented here in no way form evidence for the hypothesis of segmented capital markets. But since no extensive breakdown of the holdings of gilt-edged securities by maturity is available in South Africa, we can do no more than present that in the above tables. The aggregation across maturities clearly represents as large a flaw as the existence of the legislation in this respect.

Given that this evidence can at best be regarded only as suggestive of the existence of maturity preferences in the market due to the legislative imperfections and data constraints, we cannot regard the analysis as constituting a test of Market Segmentation Theory *per se*. What it does indicate, though, is that a degree of segmentation does exist between the maturity ranges albeit owing mainly to legislative factors. That such segmentation is in existence is, in a limited sense, a vindication of the prediction of the hypothesis although the underlying causal relationships may be quite/

different. Nonetheless, we must again stress that this cannot be regarded as a suitable empirical evaluation of the theory in the South African context, and consequently we cannot evaluate the efficacy of the model as an explanation of the local financial market.

4.6 CONCLUDING REMARKS

The first and most obvious deduction that can be made from the application of the theories to the South African market is that no single hypothesis was completely able to explain the behaviour of the term structure of interest rates in the period 1964 to 1974. One theory could not be tested at all because of the lack of "independent" evidence, and two of the four which were applied produced results which were not significant in any way. A third was so severely constrained by data requirements as to be virtually inoperative, and only one was able to give fairly satisfactory results.

The traditional Expectations Theory as an explanation of the rate structure could not be applied to the South African context because no independent evidence, a necessary prerequisite for an adequate test as we argued in Chapter II, was available. The only satisfactory means of obtaining such evidence would lie in an extensive questionnaire survey such as that undertaken by Kane and Malkiel⁸. No test of this hypothesis was therefore conducted.

In contrast, a number of tests were carried out on the Meiselman hypothesis although not on the standard equation but rather on the alternative long-rate equation. In no case did the estimates produce statistically valid evidence, and generally the model performed very poorly. The two most important reasons advanced to explain this were firstly, that actual observations as opposed to artificially smoothed data were employed, and secondly, the greater volatility of short rates caused erroneous predictions to be made in the sense of expected forward rates.

The tests performed on the Malkiel hypothesis produced relatively good estimates for one equation at least. For his original equation no statistically acceptable evidence was accumulated, but for the second equivalent equation, good results were obtained. To remove serial correlation a /

8. Kane, E.J. and Malkiel, B.G. "The Term Structure of Interest Rates : An Analysis of a Survey of Interest-Rate Expectations" Review of Economics and Statistics, 1966, p.343.

first difference form was estimated, but it was argued on the basis of the analysis of Wonnacot and Wonnacot⁹ that a low d value need not necessarily imply biased estimates. By varying R_A between 15 years and 1 year, we found evidence to suggest that the explanatory power of the hypothesis was reduced by decreasing R_A . Overall we argued that the Malkiel model had performed relatively well, and therefore briefly postulated that this provided at least some grounds for the increased use of the announcement effect as a policy instrument to modify expectations.

The Liquidity Premium Hypothesis, in the form of the operational model advanced by Kessel, was not able to explain the movements of the term structure of rates in this country. As a consequence of the number of flaws in the model, which are well documented in the literature, this was not too surprising. In addition, due to data constraints we were not able to examine the very short end of the market, although in principle this should not have made a substantial difference.

The "test" carried out on Market Segmentation Theory was not conclusive. It was repeatedly stressed that owing to data constraints and the imperfections caused by the highly restrictive financial legislation, it was not possible to test the hypothesis per se. However, the analysis of the holdings of government stock which was carried out revealed that some degree of matching between assets and liabilities did indeed take place, and that this could have been indicative of the existence of maturity preferences on behalf of the financial institutions. It was posited that even if such matching was forced on the institutions by the authorities, this nonetheless indicated that segmentation between sub-markets did exist even if artificially. Despite this though, the analysis clearly does not uphold the institutional hypothesis as an explanation of investor behaviour, but rather that the authorities may have some belief in it.

A second deduction we can draw from the application of the hypothesis to the South African experience is that neither the institutional framework nor the published data are favourable. Interest rates, particularly those on government stock, are perhaps too rigidly controlled causing a distortion of the natural market forces. However, we should not forget the very mixed performances of these theories on other, less restricted, financial markets. Therefore, while only the Malkiel hypothesis produced results which were meaningful, this does not imply that the other theories are /

9. Wonnacot, R.J. and Wonnacot, T.H. op.cit;

invalid as behavioural hypotheses but rather that they are not helpful as explanations of the movements of rates in the South African market.

CONCLUSION

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In terms of the objectives set out in the introduction to this dissertation, we have now completed our analysis of the term structure of interest rates in South Africa. In this section we shall summarise the chief findings of the study, chapter by chapter, and then briefly indicate some additional relevant observations as well as further avenues in this area which could usefully be explored in future.

Chapter I was concerned with the theoretical evaluation of the various competing hypotheses on the rate structure. After an initial overview of the historical development of term structure theory, the traditional expectations hypothesis was examined at some length, and criticisms of this explanation were taken as the points of departure for the discussion of other, more recent hypotheses (specifically, New Expectations Theory, the Malkiel Theory, Liquidity Premium Theory, and Market Segmentation Theory). It was shown that a systematic analysis could be undertaken by classifying the theories with regard to the degree of risk aversion they assumed on behalf of the individual investor. Finally, the different theories were placed in the analytical framework suggested by J.A.G. Grant¹. It was argued that no a priori deductions could be drawn from the discussion without careful examination of all the available empirical evidence.

As a logical consequence of this, Chapter II concerned itself with a comprehensive evaluation of the evidence amassed on the five major theories of the term structure. The traditional expectations hypothesis did not have a great deal of positive supporting evidence, although some controversy was found to exist on the interpretation of this evidence. With no satisfactory "independent" evidence available, we argued that the so-called "hard" version of the theory espoused by Conard² et al be accepted, but noted that since no readily testable hypotheses emerged from the theory it should be regarded as virtually inoperable.

The empirical evidence on three of the hypotheses (New Expectations Theory, Liquidity Premium Theory, and Segmentation Theory) was such that no firm conclusions could be drawn as to their merit, as explanations of the term structure. While all were found to be theoretically appealing, excessive data requirements and methodological problems plagued most of the studies.

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1. Grant, J.A.G. "Meiselman on the Structure of Interest Rates", Economica, February, 1964.
 2. Conard, J.W. Introduction to the Theory of Interest, University of California Press, Berkeley, 1969.

The only model to have distinct positive backing from the empirical research performed on it was that of Malkiel. Unfortunately, however, the evidence was limited since only two studies had been undertaken. Both encountered the not insignificant problem of proxying some of the variables employed, particularly that of the normal range of interest rates.

Overall we argued that recourse to the empirical evidence had not satisfactorily settled the theoretical issues of Chapter I, but did highlight certain salient features of the theories, and in particular showed the enormous problems inherent in making the theories operational.

The focus of the analysis was narrowed down in Chapter III which concentrated its attention on the financial markets in South Africa. The discussion was subdivided into two sections. Firstly, institutional arrangements were carefully examined, and after a theoretical explanation of the reasons for the existence of different financial institutions, a Gurley and Shaw³ approach was adopted to analyse the whole range of institutions. It was shown that the South African financial sector was fairly highly developed both in terms of the number of assets traded, and the degree of flexibility it possessed despite powerful legislative constraints.

The second subdivision concerned itself with the determination of specific interest rates within the financial structure. It was argued that the widely accepted neo-Keynesian theory was unable to satisfactorily explain the level and movement of particular rates due to the complex interplay of economic, institutional and legal factors. The financial market was conceptually broken down into the money market or market for short-term investments, and that for longs or the capital market. In the short market it was shown that the only rates truly reflective of competitive forces were the rates on negotiable certificates of deposit and short government stock, although bankers' acceptances were to a large degree freely determined. While the rate on call deposits at the National Finance Corporation and the Treasury Bill rate were controlled by the monetary authorities, they nonetheless seemed to approximate closely the other rates. The examination of the market for long-term securities considered only the rate on long gilts, controlled by the so-called pattern of rates but also approximating supply and demand conditions in the market, and the rate on company debentures which was demonstrated as being determined free of imperfections.

3. Gurley, J.G. and Shaw, E.S. Money in a Theory of Finance, The Brookings Institution, 1960.

Chapter IV dealt with the actual empirical application of the hypotheses to the South African financial market. The traditional expectations hypothesis was not tested due to the lack of independent evidence, a necessary prerequisite for a satisfactory test. Meiselman's New Expectations model was comprehensively applied to various categories of data although only the long rate version of the model was employed owing to data constraints. The resultant estimates in no way supported the theory. The Malkiel model was tested using government stock time series data, and for the second equation used gave reasonably good results given the Wonnacot and Wonnacot⁴ argument that the estimates need not necessarily be biased by low Durbin-Watson values. The methodology of Kessel⁵ was adopted in the empirical testing of Liquidity Premium Theory. No positive evidence emerged in support of the hypothesis, and it was argued that this was primarily a consequence of the severe operational problems inherent in implementing the model. Finally, a "test" of the Market Segmentation Theory was undertaken, although it was stressed that due to data constraints and the existence of legislative imperfections in the market, this approach could only provide evidence at best weakly suggestive of a segmented market. This, in fact, proved to be the outcome. It was concluded that although no theory was completely able to explain the South African experience, the Malkiel hypothesis had nonetheless performed relatively well in the circumstances. Given this, it was posited that perhaps an "open-mouth" policy on behalf of the authorities might be more effective than the traditional open market approach.

Essentially, what has emerged from this study confirms the experience of researchers in the United States and Britain; no single theory can wholly explain the financial situation in South Africa, and the theoretical issues of Chapter I remain unsettled. However, the results obtained from the Malkiel model do seem to indicate that expectations play an important role in determining the differentials between the various interest rates. Nonetheless, it remains difficult to estimate to what degree risk averse behaviour dominates the securities market. Furthermore it is by no means obvious that expectations are either uniform or even normally distributed.

What has become clear, however, are the enormous difficulties inherent in testing the various models against real-world experience. Firstly, empirical verification is severely constrained by the paucity of data in South Africa, both in the sense/

4. Wonnacott, R.J. and Wonnacott, T.A. Econometrics, John Wiley and Sons, New York, 1969.

5. Kessel, R.A. The Cyclical Behaviour of the Term Structure of Interest Rates, National Bureau of Economic Research, New York, 1965.

of the amount and consistency of the time series data available. Secondly, with the possible exception of the Malkiel hypothesis, none of the models can be considered sufficiently operational and this places further demands on their data requirements. Thirdly, the existence of a complex institutional and legal framework in South Africa makes it difficult to refute a specific hypothesis on the basis of its empirical performance since many hidden factors exist to distort the operation of normal market forces.

It is evident, therefore, that much interesting and challenging work remains to be done. In the theoretical field of the term structure it would seem crucial that progress be made toward the integration of term structure theory with macro-economic theory. In particular, the objective should be a general equilibrium framework in which short and long-term rates are determined simultaneously with other endogenous variables in the system. It is also likely, and recent developments seem to reinforce this, that an important area lies in finding more sophisticated methods for simulating market forecasts than the conventional linear process models.

In the South African context there is undoubtedly scope for a great deal of research on the term of interest rates. Much more needs to be known about institutional arrangements generally, and in particular about the precise nature of the inter-relationships between various financial institutions. There is an urgent demand for micro-level studies of investor behaviour, and here large scale questionnaire surveys would appear to have much potential. Progress must be made towards transforming the available raw data into a systematic equivalent of the Durand series for the United States to facilitate further econometric work on the rate structure.

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GRAPH 1

90 DAY NCDS

3 MONTH BANKERS
ACCEPTANCES

DISCOUNT
RATE

SHORT-TERM
GOVERNMENT
DEBT

TREASURY BILL
RATE

NFC DEPOSIT
RATE

NOTE: DARK AREAS INDICATE A
DOWNWARD PHASE OF THE
BUSINESS CYCLE

PERIOD

1974

1973

1972

1971

1970

1969

1968

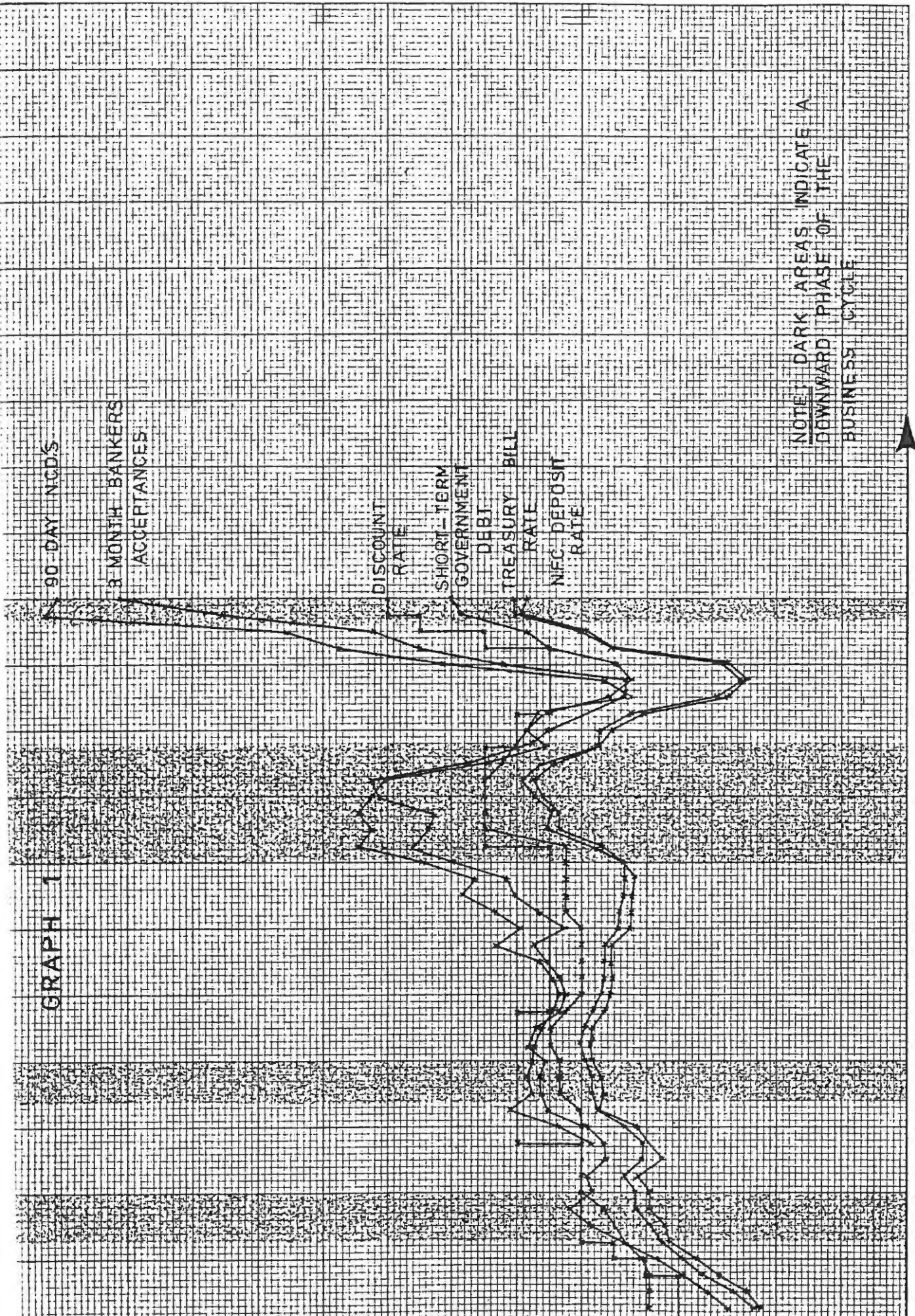
1967

1966

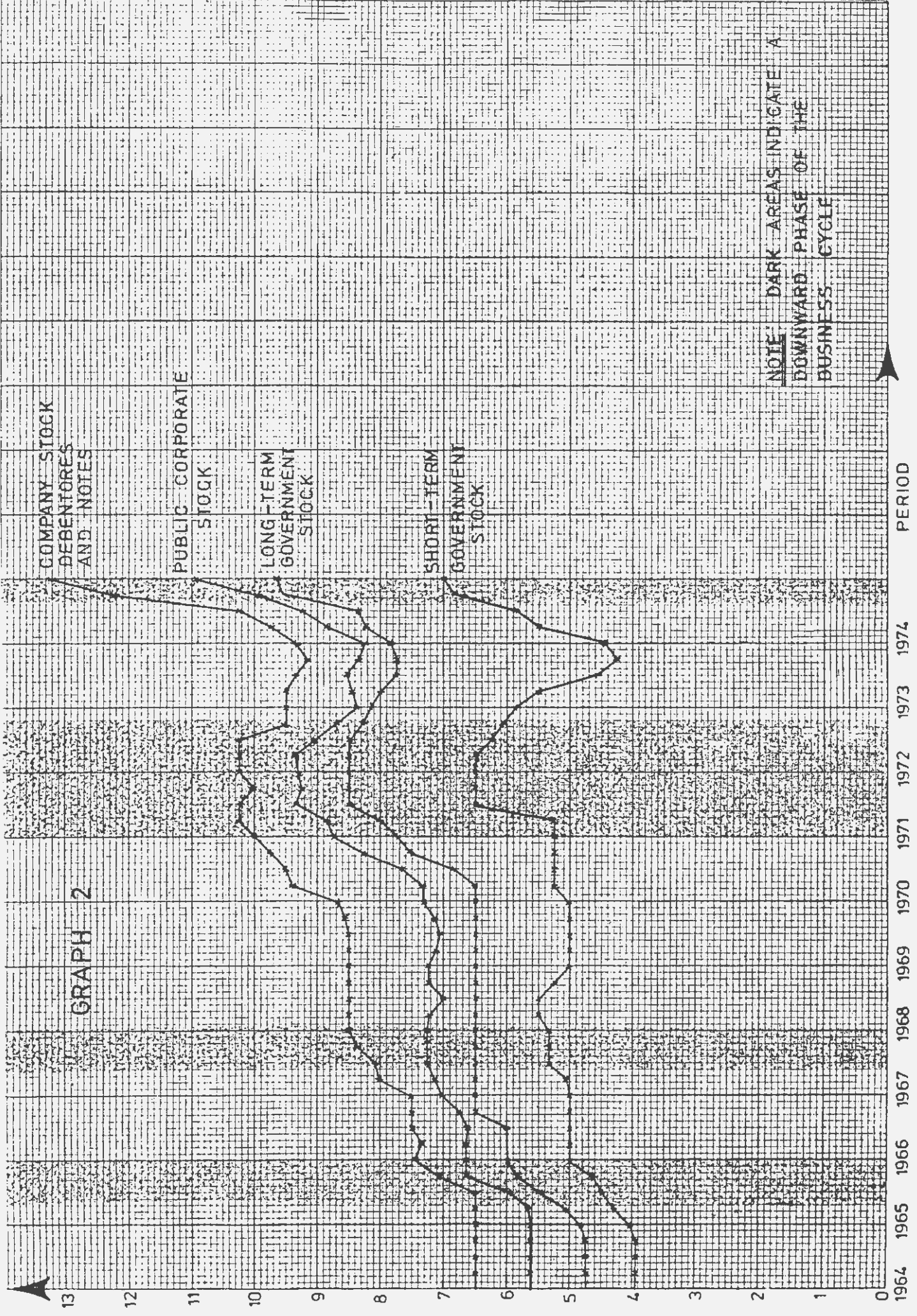
1965

1964

13
12
11
10
9
8
7
6
5
4
3
2
1
0



GRAPH 2



NOTE: DARK AREAS INDICATE A DOWNWARD PHASE OF THE BUSINESS CYCLE

PERIOD