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## CONCLUSIONS AND IMPLICATIONS FOR FURTHER RESEARCH

THIS INVESTIGATION confirms the principal finding of Meiselman—that a relationship exists between expectations of future short-term rates and the term structure of interest rates. The fact that forward rates incorporate predictions of future short-term rates, with an appreciable accuracy in a statistical sense, demonstrates, by an a fortiori argument, that forward rates are a function of expected future spot rates.

Previous investigators, Hickman and Meiselman, have interpreted the difference between forward and subsequently observed spot rates as forecasting errors of the market. (Culbertson found the difference between holding period yields of different terms to maturity to be so large that he rejected the view that the market forecasts, since he found it difficult to believe that the market could forecast as badly as his interpretation of his findings suggests.) Their interpretations can be questioned because it is unreasonable to expect the market to err asymmetrically. The mean error in a long series of observations should be zero. If the work of these investigators is extended or examined closely, it can be shown that what they regarded as forecasting errors were in large part attributable to liquidity premiums, and that the errors of the market were indeed much smaller.

It is the thesis of this study that a forward rate should be viewed, not as an expected rate, but as an expected rate plus a liquidity premium. If forward rates are so interpreted, then the forecasts and forecasting errors of the market can be detected. These forecasts are, within the maturity spectrum studied, accurate to a degree that cannot be rationalized as the workings of chance. The finding that forward rates constitute high estimates of future spot rates is

consistent with the Keynesian theory of "normal backwardation."<sup>1</sup> The implications of this theory for the money and capital markets have been developed by Hicks in *Value and Capital*.<sup>1</sup> Hence these results support the Hicksian view that forward rates are equal to expected spot rates plus a liquidity premium.

The existence of liquidity premiums indicates that short and long maturities are not perfect substitutes for one another in the market as the proponents of the pure expectations hypothesis, such as Lutz and Meiselman, have argued. In particular, short and long maturities differ with respect to their value as money substitutes; short maturities are much better money substitutes than long maturities. Consequently, the greater liquidity yield of short maturities leads to a persistent pecuniary yield differential in favor of long maturities. This differential offsets the greater liquidity yield of short maturities. Therefore, the expected value of holding period yields, (with yield defined as total, as distinguished from pecuniary only), is equal for all terms to maturity.

The existence of liquidity premiums has been explained as a consequence of risk avoidance and positive costs for the speculative services required to convert long- into short-term securities. The market is willing to take a lower yield in exchange for a lower variance in the price of governments. The implications of this rationalization are consistent with the observed behavior of relative yields of low- and high-grade bonds, both secularly and cyclically.

Liquidity premiums have moved with the cycle in recent years. Since interest rates also increase during expansions and decrease during contractions, this raises the question: are liquidity premiums a function of the stage of the cycle or the level of interest rates? The upward trend in liquidity premiums over the three latest cycles, when interest rates have also shown an upward trend, indicates that it is the level of interest rates and not the stage of the cycle that determines the magnitude of liquidity premiums.

This finding does not support the theory that liquidity premiums are a development of the Great Depression. It is difficult to understand why evidence of the existence of liquidity premiums was so sparse before the 1930's and so abundant afterwards. If one argues

<sup>1</sup> In particular, see p. 147.

that the emergence of liquidity premiums was a consequence of risk aversion caused by the financial losses of the early 1930's, then one ought to observe that liquidity premiums have been declining secularly since that time. The foregoing evidence does not support this view. However, possibly more refined analysis, when the level of rates is held constant, would show that there has been a downward trend in liquidity premiums over time.

The joining of liquidity preference to expectations explains the lack of symmetry in the movement of short- and long-term rates over the cycle. It explains why short-term rates do not exceed long-term rates at peaks by as much as they fall below long-term rates at troughs; why yield curves are positively sloped during most of the cycle; and why yield curves, when short-term rates are unusually high, never seem to be negatively sloped throughout their full length, but show humps near the short end.

The common belief that short-term rates fluctuate more than long-term rates is, in general, correct.<sup>2</sup> However, this generalization conceals an important observation—as term to maturity increases, yield variance first increases, and then decreases. This observation is inconsistent with a pure expectations hypothesis, but is consistent with a hypothesis that combines expectations and liquidity forces.

At any instant of time, the power of the market to predict future spot rates decreases the longer the time span between the moment a forward rate is inferred from the term structure of interest rates and the corresponding spot rate is observed. Clearly it is more difficult to see one year than one week into the future. Hence, as the span of time between the moment a forward rate is inferred and the relevant spot rate is observed increases, the correlations between forward and spot rates ought to decrease. The observations for three- and six-month bills and one- and two-year governments are consistent with this implication of the expectations hypothesis. Other tests for this same period of time, but for different time spans, between forward and spot rates ought to yield results consistent with the foregoing. Indeed, this argument implies that a

<sup>2</sup> This is only arithmetic in a world of perfect certainty. Long-term rates can fluctuate more than short-term rates. The fact that they do not fluctuate as much as short-term rates implies that the market has some powers to recognize when short-term rates are transitorily high or low.

correlation between forward and two-year spot rates that is greater than the correlation between forward and one-year spot rates would contradict the expectations hypothesis.

The data used to show that the expectations hypothesis has predictive content is primarily drawn from one business cycle, 1958-61. Possibly using this particular cycle has produced freakish results and comparable findings could not be obtained for other cycles. Clearly much more work can and should be undertaken to find out just how well the market can predict. In particular, an effort should be made to determine how much of the market's ability to predict is attributable to predicting seasonal changes in rates. The results obtained using one- and two-year maturities indicate that the market can do more than predict seasonal changes in rates.<sup>3</sup>

The explanation of liquidity preference presented here is based on the postulate that the risk of capital loss associated with holding short-term securities is smaller than it is for long-term securities. This implies that in a period free of trends in interest rates, price variance ought to increase with term to maturity. (It should be noted that this implication is not arithmetic. The variance in prices of three-month bills could, in principle, be greater than that of six-month bills.) If variance increases with term to maturity, then mean yields should also increase. Direct evidence of a relationship between means, price variances, and terms to maturity should be sought.

Yield curves published in the *Treasury Bulletin* constitute data that can be used to determine whether or not these propositions about variance in yields, at least to the nine-to-twelve-month range, are correct. These same data can also be used to determine what maturity constitutes the line of demarcation between increasing and decreasing variances as term to maturity increases. Finally, these data could reveal how this boundary line changes from cycle to cycle and whether these changes are correlated with differences in interest rate levels.

Although these results support the view that securities of different

<sup>3</sup> Insofar as the market can predict, one should be able to observe that underwriters' spreads increase during expansions, reach a peak at the business cycle peak, and decrease during contractions.

maturities are not perfect substitutes for one another at identical, pecuniary, holding period yields, they do not support the view that it is the time span between maturities that explains less than infinite cross elasticities. Both liquidity preference and expectations imply that the cross elasticity of demand between fifteen- and twenty-year maturities will exceed the corresponding cross elasticity for five- and ten-year maturities. In addition, the expectations hypothesis implies, for coupon bearing securities with fixed maturities, the higher the absolute level of rates, the earlier the maturity at which yield curves will flatten out. This later implication has not been tested.

Durand's findings show that negatively sloped yield curves occurred more frequently before the decade of the 1930's than they have since. This leads to the questions, do his yield curves correctly depict what, in fact, was true, and if so, why this change? Furthermore, it appears that before 1914, long-term yields frequently lagged behind cyclical turns in short-term rates, a result that does not seem consistent with either the recent behavior of these rates or with the implications of the expectations-liquidity preference hypothesis. These questions deserve a fuller investigation than this study has attempted.