AN EMPIRICAL STUDY OF THE DETERMINANTS OF THE LIQUIDITY PREMIUM

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INTRODUCTION

Assuming that investors are risk averse (i.e. prefer lower variability of return) and that security prices as well as the holding period rates of return for longer-term securities are more variable, we can assume that investors will require higher yields to maturity on longer-term securities to compensate them for higher risk. This difference in yield, or premium, on long relative to short-term securities of comparable quality may be due to transaction costs, errors in expectations, or the greater "liquidity" of short-term securities. In this study, I have assumed no transaction costs and that the errors in expectations tend to cancel out over a given period. An important study by Kessel also shows that U.S. long-term bond yields usually exceed bill rates by more than the difference in transaction costs plus any errors in expectations.

The premium apparently reflects the greater liquidity of shorter-term securities, that is, their fairly stable prices and ease of marketability, which is a characteristic not as prominent in longer-term securities. This premium on a longer-term security, according to Cagan [1], measures the marginal advantage of holding the more liquid security.

The first section of this study deals with the term structure of interest rates, i.e. why similar securities of different maturity have different interest rates, and the three prominent theories that analyze the term structure. A review of the spot and forward rate relationship is included in this section. Any discussion of the term structure involves the yield curve, which shows the relationship between interest rates and maturity. The three theories are also at times referred to as yield curve theories.

In the second section relevant literature is reviewed. Most important for this study are the investigations of Kessel [4] and Cagan, of which the latter will be more thoroughly examined.

In the third section the methodology for this study will be presented. Cagan determines the liquidity premium by measuring the difference between one-week holding period yields of two securities of different maturity. This paper will use a similar technique in determining the premium. To aid in the elimination of risk, the data used in this study will be U.S. Treasury-bills.

Similar to Cagan's study, this thesis is an empirical analysis of the determinants of the liquidity premium. These determinants will be examined, using linear regression analysis, as to their degree of influence on the liquidity premium relative to the level of interest rates. These empirical results will be presented in the fourth section.

The question of how liquidity premiums fluctuate as interest rates change is not settled. Two leading theories, the money substitute theory and the "normal" level of interest rates theory, have opposing conclusion addressing this issue. This study will attempt to produce results supportive of one of these theories. The fifth section will offer conclusions and implications regarding the regression analysis results.

Current research has not yet been successful in measuring the liquidity premium and it fluctuations. Improvements in the technique of measuring, analyzed and used in this study, may prove helpful in further analysis of this problem.

THREE THEORIES OF THE TERM STRUCTURE OF INTEREST RATES

Before analyzing the three theories, a discussion of the properties of the term structure and characteristics of the yield curve may prove helpful.

The term structure of interest rates primarily concerns the question of why like-securities of different maturities have different interest rates. In other words, it deals with the relationship between yield and maturity on instruments that are similar except for the length of time to maturity. An understanding of the spot and forward rates and their relationship is essential in our consideration.

The spot interest rate is a rate determined today for a security issued today. The spot market, or cash market, is the market for immediate delivery,

$$PV_o = \frac{FV_1}{(1 + {}_oSR_1)^1} \qquad (1)$$

where

PV_o = present value of security today (time 0),
FV_1 = future value in one period, and
${}_oSR_1$ = spot rate determined today (time 0) for period one.

Most transactions in the financial market are in the spot market. For example, if a security is exchanged in this market for immediate purchase, it is paid for and earns interest immediately. However, forward transactions do occur, in which the parties agree at time 0 on the yield and price of a security that will be exchanged on a set date in the future. The interest rate agreed upon in this forward market is called the forward rate of interest. It is the rate set at time zero for funds exchanged at some future date,

$$PV_t = \frac{FV_{t+1}}{(1 + {}_oFR_1)^1} \qquad (2)$$

where

PV_t = present value of security at some future time t,
FV_{t+1} = future value of security at time t+1, and
${}_oFR_1$ = forward rate determined at time 0 for one period.

Livingston [5] attempts to demonstrate that there must be a precise relationship between the forward and spot rates of interest. He gives a two period example,

$$(1 + SR_2)^2 = (1 + SR_1)(1 + FR_2) \qquad (3)$$

where

SR_2 = two period spot rate,
SR_1 = one period spot rate, and
FR_2 = period two forward rate.

This indicates that the two period spot rate is the geometric mean of the one period spot rate and the period two forward rate. In other words, the yield on a security for two periods at the two period spot rate is the same as the yield earned at the one period spot rate plus the yield earned at the period two forward rate.

Following equation (3), we can say that the yield earned on one security at the two period spot rate would be equivalent to the yield earned on two securities, on at the one period spot rate, and the next at the period two forward rate. This direct relationship between spot and forward rates is important in the following discussion of the yield curve theories, primarily in the discussion of the expectations theory.

A discussion of the yield curve and its characteristics may prove helpful in the following review of the term structure theories. The yield curve is commonly known as the graph which plots the yield against the time to maturity of homogeneous debt instruments. The homogeneous characteristic of the yield curve is best demonstrated when it displays the yield-maturity relationship of its most common securities, U.S. government securities.

Some characteristics of the yield curve are submitted by Malkiel [7] and Kessel. According to Malkiel, the most common yield curve is upward sloping, however declining yield curves have occurred when interest rates were historically high. He also holds that yield curves become flat for longer maturities. Kessel, through empirical evidence, has shown that for maturities of six months and less, the yield curve has an upward slope most of the time.

<u>Expectations Theory</u>

The expectation hypothesis is the most widely discussed theory of the term structure. This study will attempt to produce results that will assist in the analysis of this theory. The primary assertion of the theory submits that investors are indifferent about purchasing securities of different maturities. For example, if given the choice of holding a three-month T-bill for three months or a one-year T-bill for three months, the investor would be indifferent. In other words, the investor would expect the three-month holding period yields to be equivalent.

The theory goes further to claim that forward rates are unbiased predictors of spot rates. Livingston gives the example that the forward rate for period two is the unbiased estimator of the one period spot rate observed one period later, or in general terms,

$$_{0}FR_{t} = E(_{t-1}SR_{1}) \tag{4}$$

where

$_{0}FR_{t}$ = forward rate predicted in time 0 for period t.
E = expectation, and
$_{t-1}SR_{1}$ = spot rate predicted in time t-1, lasting one period.

Livingston includes the following chart that is helpful in understanding this concept:

POINTS IN TIME

RATES OBSERVED	0 to 1	1 to 2	2 to 3	3 to 4
0	$_{0}SR_{1}$	$_{0}FR_{2}$	$_{0}FR_{3}$	$_{0}FR_{4}$
1		$_{1}SR_{1}$	$_{1}FR_{3}$	$_{1}FR_{4}$
2			$_{2}SR_{1}$	$_{2}FR_{4}$

${}_0FR_2$, the forward rate predicted in time 0 for period two, should equal the spot rate ${}_1SR_1$ observed one period after, hence the forward rate equals the spot rate one period later. Furthermore, the forward rate ${}_0FR_3$ equals the spot rate ${}_2SR_1$, observed two periods hence.

Macauley [6] was one of the first to study the predictive characteristics of the forward rate. Kessel reviewed Macauley's study and supported his view. Kessel's later study gave stronger support for the predictive value of forward rates.

Many believe the expectation theory is unrealistic when predicting very distant future interest rates. Because of the high degree of uncertainty, it is difficult to support a belief that investors can predict rates 10 or 20 years into the future.

Market Segmentations Theory

One of the first supporters of this theory was Culbertson [2]. He submitted that for each maturity there is an individual market. That is, an institutional investor has its own preferred maturity range in which it chooses to invest. Furthermore, borrowers have their own preferred maturity range as well, and will borrow funds that fall into this range according to their needs. These institutions attempt to match their cash flows by lending or borrowing funds of the same maturity range.

A strict version of the segmented market theory would assert that some institutions only deal in short-term instruments, while other institutions only deal in long-term instruments. Thus, these markets would exist separately, in no way influencing each other. Fluctuations in rates on either end of the yield curve would not influence institutions to change their preference of maturity due to this strict compartmentalization [9].

Livingston gives the example of commercial banks, which invest primarily in short-term securities that do not have large price changes as interest rates change. These short term instruments are fairly liquid and can meet unexpected needs for cash. If the demand for commercial bank loans is low, banks will invest their funds in safe short-term assets, such as Treasury bills, thus increasing the price of these securities and decreasing their interest rates. The reverse scenario would occur as demand for loans increased. The demand for loans would strongly influence the short end of the yield curve, while the long end would be unaffected. Moreover, institutions that reside in the longer-maturity segment would not change their investment decisions as the short-term rates fluctuated.

This theory goes further to assume that because of market segmentation, securities of different maturities are not perfect substitutes for investors. Culbertson requires that for securities of different maturities to be perfect substitutes, they must have the same holding period yield. If they have different holding period yields, they would not be perfect substitutes, and market segmentation would exist.

This paper will attempt to show that securities of different maturities do have different holding period yields, therefore implying the existence of some form of market segmentation.

Liquidity Premium Theory

Shorter maturity instrument prices are less affected by interest rate fluctuations than are longer maturity instrument prices. Therefore, the principle risk associated with shorter-term securities is less than the principle risk associated with longer term securities.

Assuming that investors are risk averse, and that longer maturity prices are more variable, the liquidity premium theory claims that yields will increase as maturity increases. According to Hicks, investors will require a premium to persuade them to sacrifice a degree of liquidity and commit funds for a longer rather than a shorter period of time. In other words, investors will require a higher interest rate yield on long-term securities than they will require on short-term securities.

Hicks [3], along with others, believes there exists a bias on the part of investors to prefer shorter-term investments, while borrowers prefer to borrow longer-term. This causes longer rates to exceed shorter rates, and this difference is known as the liquidity premium.

Telser [8] sights two primary conditions that support the Liquidity Premium theory - there exists a bias of the forward rate as a predictor of the spot rate, and the relation between the term structure of interest rates and the maturity composition of debt. A further discussion of these two reasons can be found in Telser study.

RELEVANT LITERATURE

As stated in the introduction, the primary focus of this paper is to analyze how liquidity premiums vary through time. More precisely, how liquidity premiums vary relative to the level of interest rates. This section reviews the works of two important researchers in this area. Their investigations proved to be of great assistance in this study, and merit further discussion. Furthermore, the evidence here is relevant for evaluating the importance and credibility of this thesis.

The Kessel Study

Kessel argues that liquidity premiums vary positively with the level of interest rates, based on data from the post-World War II period for the short end of the yield curve. He believes that shorter-term securities carry less risk of loss of principal than do longer-term securities, and therefore provide the investor with a higher degree of liquidity. Because of this higher liquidity, Kessel claims shorter-term securities are closer substitutes for money. As interest rates increase, so do the opportunity costs associated with holding money. Investors will replace their money holdings with securities, with a tendency to substitute short-term for longer-term securities because of the greater liquidity and smaller risk associated with the former. Consequently, the prices of these shorter-term instruments would be driven up and their rates down relative to longer-term instruments, widening the spread between short and long-term rates. According to Kessel, this confirms that the premium varies directly with changes in interest rates.

Kessel found that the premium on eight-week bill rates over four-week bill rates, adjusted for expectations, varied positively with the level of four-week rates from October 1949 to February 1961. Furthermore, he found that the premium on six-month bill rates over three-month bill rates, adjusted for expectations, also varied positively with the level of three-month bill rates for the period January 1959 to February 1961. The yield period he selected for comparison was the period to maturity of the longer-security.

Kessel determines the premium as the difference between the actual and the forward rates. He regresses this premium on the actual rate of the preceding period. In both series of data, as expected in his hypothesis, the coefficient of the previous spot rate is positive.

Kessel adjusts his premiums for expectations by assuming that the market adjusts prices so that expected holding period yields on various instruments will be the same. Kessel's evidence relies on this assumption and would hardly prove to be as relevant without it. Kessel himself admits his findings rely on this assumption that errors in expectations are independent of the liquidity premium.

In an attempt to avoid such problems, the method of determining the liquidity premium in this study is unlike that of Kessel, and very similar to the method used by Cagan. The liquidity premium is determined such that errors in expectations, although not completely eliminated, can be taken into account to give a more feasible estimation of the liquidity premium for time-series analysis.

<u>The Cagan Study</u>

There exists little disagreement that the liquidity premium exists due to investors' fear of the risk of capital loss associated with holding longer-term securities as interest rates change. However, the issue of how the liquidity premium fluctuates through time is unsettled. Cagan's study concerns two theories that address this issue. One theory holds that shorter-maturity securities are better money substitutes than longer-maturity securities. It claims that liquidity premiums exist and change relative to the services a security renders with regard to its substitutability. The other theory supposes that investors tend to believe interest rates will return to "normal" levels. It claims that liquidity premiums exist and change relative to the relationship between current rates and a rate considered "normal". These two theories, although not incompatible, do give opposite conclusions regarding how liquidity premiums vary with the level of interest rates.

According to the first theory of money substitutes, Cagan, along with Kessel, submits that securities of shorter-term maturity are closer substitutes for money than securities of longer-term maturity due to the high degree of liquidity and lower degree of risk associated with the former. As interest rates rise, so does the cost of holding money, and investors will substitute securities for part of their money balances. Because investors prefer liquidity and less risk they will purchase shorter-term securities. As the demand for shorter-term securities rises, so does the price, which consequently prevents the short end of the yield curve from rising as quickly as the long end. Therefore, as rates rise, the liquidity premium on long securities over short securities also rises. The reverse is true for a decline in interest rates. In other words, a positive correlation exists between changes in the liquidity premium and changes in the level of interest rates.

According to the second theory, the "normal" level of interest rates theory, there exists an opposite or negative relationship between changes in the liquidity premium and changes in the level of interest rates. Given an investor preference for short-term securities over long, this theory does not consider the substitutability of securities for money. Rather, it proposes the determination of a "normal" interest rate level toward which they expect interest rates to gravitate in the long run. The relationship between current rates and the determined "normal" rate would indicate the direction of any large changes in the current rate.

For example, when interest rates are well below the "normal" rate investors would anticipate an increase in rates. As a result, investors would require a premium on long-rates over short-rates to help decrease the risk of capital loss on longer-term securities if rates rise as expected. When interest rates are well above the "normal" rate investors would anticipate a decrease in rates. As a result the premium required to invest in the longer-maturity securities would decrease, as the risk of capital loss on longer-term securities is less when rates are expected to drop. In other words, a negative correlation exists between changes in the liquidity premium and changes in the level of interest rates.

This negative correlation, submitted by the "normal" level of interest rates theory, is the opposite of the position held by the money substitute theory, which holds that a positive correlation exists between the liquidity premium and the level of interest rates. Cagan attempts to test the conclusions of these two theories by using regression analysis.

Testing the Two Theories

Cagan proposes calculating yields on securities for the same holding period, regardless of maturity, and comparing the two to derive a liquidity premium. As with Kessel, errors in expectations can not be avoided here either, but Cagan adjusts the errors in the long end, so that estimates can appear feasible.

Holding period yields are most commonly associated with the rate of return on a security that is sold prior to its maturity. Cagan presents data for one week holding period yields on Treasury securities. He defines the one-week holding period yield,

$$H_{n,t} = 52 \log_e \frac{P_{n-1,t+1} + C_{n,t}}{P_{n,t}} \qquad (5)$$

where

$H_{n,t}$ = holding period yield on security of maturity n at time t,
$P_{n-1,t+1}$ = price of security with n-1 weeks to maturity at end of week t,
$C_{n,t}$ = coupon payment during week (if any), and
$P_{n,t}$ = price of security with n-1 weeks to maturity at beginning of week t.

Cagan tests the two theories of liquidity premiums by using regression analysis. He determines the liquidity premium by taking the difference between the holding period yields of the thirteen-week and one-week bills. He regresses the liquidity premium against the four relevant variables.

The following four independent variables are used in Cagan's analysis:

Level of Rate: the three-month bill rate (cost of holding money), quarterly average of monthly data.

Change in Rate: change over the quarter in three-month bill rate, percent per annum.

Deviation from "Normal": three-month bill rate minus weighted average of past rates for nine quarters, linearly declining weights, percent per annum. Quarterly data are averages of monthly rates.

Relative Supply: difference between one- and thirteen-week bills held by the public, quarterly average of weekly data, as percentage of mid-quarter total bills held.

Cagan's findings were as follows: Level of Rate variable was significant and was positively correlated with the liquidity premium. This supports the money substitute theory, and disagrees with the "normal" theory. The Change in Rate variable was significant was negatively correlated with the liquidity premium. Cagan does not indicate which theory this result supports, which I will address in the next section. The Deviation from "Normal" variable is insignificant, as also was the Relative Supply Variable.

<u>Conclusions</u>

Cagan concludes that his results do not support the "normal" level of interest rates theory, and instead support the money substitute theory. He comes to this conclusion primarily because the Level of Rates variable was significant in his analysis, and fluctuated positively with the level of interest rates. Although in his analysis he found the Relative Supply variable to be insignificant, Cagan felt that his method of determining relative supply may not have been adequate. In the next section, a different method of determining relative supply will be used, in an attempt to observe its significance on the fluctuations of the liquidity premium.

A strong comprehension of Cagan's study may be helpful in understanding the following section. This study uses a methodology similar to Cagan's in determining the liquidity premium and in the linear regression of the liquidity premium over different variables.

METHODOLOGY

As mentioned earlier, this study, similar to Cagan's, is an empirical analysis of the determinants of the liquidity premium. These determinants, or variables, are very similar to those used in the Cagan study, however, the method of their determination is different, and the sample data used is from different time periods. The data used in this study, provided by Salomon Brothers Inc., are monthly U.S. Treasury bill statistics from January 1965 to June 1987.

Six models were regressed over four different time periods, yielding twenty-four total models. Seven relevant independent variables were used in the regression analysis, however only four were used in any one model. The following model includes the dependent variable LP and the seven independent variables:

$$LP = B_0 + B_1(TBILL) + B_2(CHTB) + B_3(NORM) + B_4(RELSUP)$$

where

LP = liquidity premium, difference in three-month holding-period yields between six-month and three-month Treasury-bills, ($HPY_{6mo} - HPY_{3mo}$).

TBILL = quarterly t-bill rate, three-month interest rate earned on Treasury-bills. Quarterly average of monthly data.

CHTB = change in quarterly t-bill rate, change over the quarter in three-month Treasury-bill interest rate, ($TR_{qtr\ x} - TR_{qtr\ x-1}$).

NORM = deviation from "normal", three-month Treasury-bill rate minus "normal" rate. Determined two ways:

1. NORM9 = "Normal" rate is a weighted average of the rates for the past nine quarters, linearly declining weights. Quarterly data are averages of monthly rates.

2. NORM16 = "Normal" rate is a non-weighted average of the rates for the past sixteen quarters. Quarterly data are averages of monthly rates.

RELSUP = quarterly supply of short-term securities relative to transaction balances. Quarterly average of monthly data. Determined three ways:

1. M3M1 =

$$\frac{\text{Large denomination certificates of deposit} + \text{Savings and smaller time deposits of all kinds}}{\text{Transaction balances}}$$

$$\frac{M3 - M1}{M1} .$$

2. LM1 =

$$\frac{\text{U.S. savings bonds, bills and other liquid treasury securities, banker's acceptances, commercial paper, term eurodollars held by U.S. residents other than banks} + \text{Large denomination certificates of deposit} + \text{Savings and smaller time deposits of all kinds}}{\text{Transaction balances}}$$

$$\frac{L - M1}{M1} .$$

3. LM3 =

$$\frac{\text{U.S. savings bonds, bills and other liquid treasury securities, banker's acceptances, commercial paper, term eurodollars held by U.S. residents other than banks}}{\text{Transaction balances}}$$

$$\frac{L - M3}{M1} .$$

EMPIRICAL RESULTS

The two theories mentioned earlier were tested by using regression analysis of the liquidity premium against the relevant independent variables. The following table shows the regression results of the twenty-four models.

The TBILL variable should, according to the money substitute theory, relate positively with the liquidity premium. The "normal" level of interest rate theory requires a negative relationship between this variable and the liquidity premium. However, the results clearly show, the TBILL variable is not significant.

As the CHTB variable is tied to fluctuations in the t-bill rate, it should have a similar relationship with the liquidity premium as does the TBILL variable. The CHTB variable is highly significant and possesses a negative correlation with the liquidity premium. This result is consistent with the "normal" level of interest rates theory.

The "normal" variable was derived using two different methods. As defined earlier, NORM9 is computed in a manner similar to that of Cagan's study. However, NORM16 is an unweighted average over a longer period of time. According to the "normal" theory, these variables should possess a negative relationship with the liquidity premium. The results show the variables to be insignificant, supporting neither theory.

The three relative supply variables, M3M1, LM1, and LM3, show the changes in short-term securities relative to transaction balances. Cagan claims that the supply of short term

TABLE 1 REGRESSION RESULTS

QUARTERLY DATA FROM JANUARY 1965-APRIL1987

1. ADJUSTED R-SQUARED - 0.4549

LIQUIDITY PREMIUM =	INTERCEPT B_0	TBILL B_1	CHTB B_2	NORM9 B_3	M3M1 B_4
PARAMETER ESTIMATE	0.0001	-0.0069	-0.9377	-0.0385	0.0002
T STATISTIC	0.0120	-0.2660	-6.3250	-0.3300	0.0910
PROBABILITY > |T|	0.9907	0.7906	0.0001	0.7424	0.9279

2. ADJUSTED R-SQUARED - 0.4564

LIQUIDITY PREMIUM =	INTERCEPT B_0	TBILL B_1	CHTB B_2	NORM16 B_3	M3M1 B_4
PARAMETER ESTIMATE	0.0005	-0.0059	-0.9419	-0.0429	0.0001
T STATISTIC	0.0890	-0.2660	-7.8090	-0.5890	0.0150
PROBABILITY > |T|	0.9294	0.8214	0.0001	0.5575	0.9878

3. ADJUSTED R-SQUARED - 0.4549

LIQUIDITY PREMIUM =	INTERCEPT B_0	TBILL B_1	CHTB B_2	NORM9 B_3	LM1 B_4
PARAMETER ESTIMATE	0.0001	-0.0067	-0.9376	-0.0388	0.0001
T STATISTIC	0.0230	-0.2590	-6.3250	-0.3320	0.0690
PROBABILITY > |T|	0.9818	0.7962	0.0001	0.7408	0.9452

4. ADJUSTED R-SQUARED - 0.4564

LIQUIDITY PREMIUM =	INTERCEPT B_0	TBILL B_1	CHTB B_2	NORM16 B_3	LM1 B_4
PARAMETER ESTIMATE	0.0006	-0.0057	-0.9419	-0.0432	0.0001
T STATISTIC	0.1020	-0.2190	-7.8090	-0.5930	0.0080
PROBABILITY > |T|	0.9190	0.8271	0.0001	0.5549	0.9935

5. ADJUSTED R-SQUARED - 0.4548

LIQUIDITY PREMIUM =	INTERCEPT B_0	TBILL B_1	CHTB B_2	NORM9 B_3	LM3 B_4
PARAMETER ESTIMATE	0.0006	-0.0061	-0.9375	-0.0398	0.0001
T STATISTIC	0.0670	-0.2430	-6.3240	-0.3400	0.0060
PROBABILITY > |T|	0.9468	0.8086	0.0001	0.7345	0.9956

6. ADJUSTED R-SQUARED - 0.4565

LIQUIDITY PREMIUM =	INTERCEPT B_0	TBILL B_1	CHTB B_2	NORM16 B_3	LM3 B_4
PARAMETER ESTIMATE	0.0012	-0.0053	-0.9421	-0.0442	0.0010
T STATISTIC	0.1450	-0.2120	-7.8100	-0.6070	0.0810
PROBABILITY > |T|	0.8848	0.8329	0.0001	0.5455	0.9357

TABLE 1 REGRESSION RESULTS (con't.)

QUARTERLY DATA FROM JANUARY 1965-1980(END)

1. ADJUSTED R-SQUARED - 0.3989

LIQUIDITY PREMIUM =	INTERCEPT B_0	TBILL B_1	CHTB B_2	NORM9 B_3	M3M1 B_4
PARAMETER ESTIMATE	-0.0009	-0.0068	-1.0617	-0.0526	0.0006
T STATISTIC	-0.1080	-0.2200	-4.8010	-0.2610	0.1860
PROBABILITY > |T|	0.9142	0.8263	0.0001	0.7949	0.8532

2. ADJUSTED R-SQUARED - 0.3986

LIQUIDITY PREMIUM =	INTERCEPT B_0	TBILL B_1	CHTB B_2	NORM16 B_3	M3M1 B_4
PARAMETER ESTIMATE	-0.0008	-0.0070	-1.0862	-0.0259	0.0006
T STATISTIC	-0.0940	-0.2230	-6.0940	-0.2050	0.1750
PROBABILITY > |T|	0.9256	0.8242	0.0001	0.8385	0.8621

3. ADJUSTED R-SQUARED - 0.3988

LIQUIDITY PREMIUM =	INTERCEPT B_0	TBILL B_1	CHTB B_2	NORM9 B_3	LM1 B_4
PARAMETER ESTIMATE	-0.0010	-0.0066	-1.0616	-0.0524	0.0005
T STATISTIC	-0.0960	-0.2110	-4.7850	-0.2580	0.1600
PROBABILITY > |T|	0.9238	0.8334	0.0001	0.7975	0.8736

4. ADJUSTED R-SQUARED - 0.3986

LIQUIDITY PREMIUM =	INTERCEPT B_0	TBILL B_1	CHTB B_2	NORM16 B_3	LM1 B_4
PARAMETER ESTIMATE	-0.0009	-0.0067	-1.0857	-0.0263	0.0005
T STATISTIC	-0.0850	-0.2150	-6.0820	-0.2040	0.1010
PROBABILITY > |T|	0.9323	0.8305	0.0001	0.8391	0.8802

5. ADJUSTED R-SQUARED - 0.3985

LIQUIDITY PREMIUM =	INTERCEPT B_0	TBILL B_1	CHTB B_2	NORM9 B_3	LM3 B_4
PARAMETER ESTIMATE	0.0006	-0.0046	-1.0667	-0.0429	-0.0001
T STATISTIC	0.0300	-0.1540	-4.6410	-0.1960	-0.0020
PROBABILITY > |T|	0.9763	0.8780	0.0001	0.8455	0.9984

6. ADJUSTED R-SQUARED - 0.3983

LIQUIDITY PREMIUM =	INTERCEPT B_0	TBILL B_1	CHTB B_2	NORM16 B_3	LM3 B_4
PARAMETER ESTIMATE	0.0004	-0.0049	-1.0870	-0.0209	0.0003
T STATISTIC	0.0160	-0.1590	-5.8340	-0.1270	0.0090
PROBABILITY > |T|	0.9871	0.8740	0.0001	0.8993	0.9931

TABLE 1 REGRESSION RESULTS (con't.)

QUARTERLY DATA FROM JANUARY 1975-1980 (END)

1. ADJUSTED R-SQUARED - 0.3206

LIQUIDITY PREMIUM =	INTERCEPT B_0	TBILL B_1	CHTB B_2	NORM9 B_3	M3M1 B_4
PARAMETER ESTIMATE	0.0066	-0.0129	-1.0833	-0.1419	-0.0010
T STATISTIC	0.0630	-0.2370	-2.0870	-0.2070	-0.0310
PROBABILITY > |T|	0.9501	0.8153	0.0506	0.8379	0.9757

2. ADJUSTED R-SQUARED - 0.3191

LIQUIDITY PREMIUM =	INTERCEPT B_0	TBILL B_1	CHTB B_2	NORM16 B_3	M3M1 B_4
PARAMETER ESTIMATE	0.0242	-0.0096	-1.1719	0.0064	-0.0064
T STATISTIC	0.2260	-0.1710	-3.2580	0.0150	-0.1960
PROBABILITY > |T|	0.8238	0.8660	0.0041	0.9880	0.8469

3. ADJUSTED R-SQUARED - 0.3211

LIQUIDITY PREMIUM =	INTERCEPT B_0	TBILL B_1	CHTB B_2	NORM9 B_3	LM1 B_4
PARAMETER ESTIMATE	0.0150	-0.0120	-1.1074	-0.0988	-0.0029
T STATISTIC	0.1430	-0.2210	-2.1140	-0.1430	-0.1110
PROBABILITY > |T|	0.8880	0.8275	0.0480	0.8876	0.9128

4. ADJUSTED R-SQUARED - 0.3207

LIQUIDITY PREMIUM =	INTERCEPT B_0	TBILL B_1	CHTB B_2	NORM16 B_3	LM1 B_4
PARAMETER ESTIMATE	0.0364	-0.0079	-1.1879	0.0478	-0.0084
T STATISTIC	0.3170	-0.1410	-3.2460	0.1070	-0.2890
PROBABILITY > |T|	0.7550	0.8897	0.0042	0.9160	0.7758

5. ADJUSTED R-SQUARED - 0.3225

LIQUIDITY PREMIUM =	INTERCEPT B_0	TBILL B_1	CHTB B_2	NORM9 B_3	LM3 B_4
PARAMETER ESTIMATE	0.0245	-0.0124	-1.1352	-0.0552	-0.0301
T STATISTIC	0.2680	-0.2360	-2.2530	-0.0890	-0.2320
PROBABILITY > |T|	0.7913	0.8162	0.0362	0.9299	0.8188

6. ADJUSTED R-SQUARED - 0.3253

LIQUIDITY PREMIUM =	INTERCEPT B_0	TBILL B_1	CHTB B_2	NORM16 B_3	LM3 B_4
PARAMETER ESTIMATE	0.0631	-0.0073	-1.2425	0.1547	-0.0867
T STATISTIC	0.4860	-0.1330	-3.1460	0.2940	-0.4620
PROBABILITY > |T|	0.6324	0.8953	0.0053	0.7720	0.6494

TABLE 1 REGRESSION RESULTS (con't.)

QUARTERLY DATA FROM JANUARY 1981-JUNE 1987

1. ADJUSTED R-SQUARED - 0.6990

LIQUIDITY PREMIUM =	INTERCEPT B_0	TBILL B_1	CHTB B_2	NORM9 B_3	M3M1 B_4
PARAMETER ESTIMATE	-0.0077	-0.0779	-0.7483	0.0142	0.0038
T STATISTIC	-0.1730	-0.8700	-5.2360	0.1010	0.3390
PROBABILITY > |T|	0.8642	0.3943	0.0001	0.9207	0.7378

2. ADJUSTED R-SQUARED - 0.7087

LIQUIDITY PREMIUM =	INTERCEPT B_0	TBILL B_1	CHTB B_2	NORM16 B_3	M3M1 B_4
PARAMETER ESTIMATE	0.0167	0.0864	-0.7254	-0.1683	-0.0062
T STATISTIC	0.3200	0.4400	-6.6900	-0.8440	-0.3920
PROBABILITY > |T|	0.7521	0.6641	0.0001	0.4081	0.6993

3. ADJUSTED R-SQUARED - 0.6976

LIQUIDITY PREMIUM =	INTERCEPT B_0	TBILL B_1	CHTB B_2	NORM9 B_3	LM1 B_4
PARAMETER ESTIMATE	0.0019	-0.0704	-0.7493	0.0063	0.0010
T STATISTIC	0.0430	-0.8090	-5.2270	0.0450	0.1210
PROBABILITY > |T|	0.9664	0.4274	0.0001	0.9644	0.9049

4. ADJUSTED R-SQUARED - 0.7102

LIQUIDITY PREMIUM =	INTERCEPT B_0	TBILL B_1	CHTB B_2	NORM16 B_3	LM1 B_4
PARAMETER ESTIMATE	0.0201	0.0775	-0.7212	-0.1677	-0.0056
T STATISTIC	0.4260	0.4780	-6.6670	-0.9590	-0.5120
PROBABILITY > |T|	0.6744	0.6378	0.0001	0.3484	0.6140

5. ADJUSTED R-SQUARED - 0.7016

LIQUIDITY PREMIUM =	INTERCEPT B_0	TBILL B_1	CHTB B_2	NORM9 B_3	LM3 B_4
PARAMETER ESTIMATE	0.0266	-0.1050	-0.7558	0.0291	-0.0180
T STATISTIC	0.7250	-0.9800	-5.3030	0.2020	-0.5470
PROBABILITY > |T|	0.4762	0.3380	0.0001	0.8421	0.5903

6. ADJUSTED R-SQUARED - 0.7128

LIQUIDITY PREMIUM =	INTERCEPT B_0	TBILL B_1	CHTB B_2	NORM16 B_3	LM3 B_4
PARAMETER ESTIMATE	0.0171	0.0169	-0.7077	-0.1272	-0.0211
T STATISTIC	0.5220	0.1250	-6.4210	-0.9280	-0.6730
PROBABILITY >|T|	0.6071	0.9015	0.0001	0.3637	0.5081

securities should relate negatively with the liquidity premium according to either theory. For example, the price paid for short-term securities will decrease and their yield increase as the supply of such securities increases. As short-term rates rise relative to long-term rates, the liquidity premium will decrease as the gap between the rates closes. Thus, as the supply of short-term securities increases, the liquidity premium decreases. However, as the results demonstrate, the relative supply variables are insignificant.

The adjusted R-square values concerning the years beyond January 1980 are greater than those prior to 1980. A contributing factor to the increasing R-square values may be the Depository Institutions Deregulation and Monetary Control Act of 1980. This deregulation began the phasing out of interest rate ceilings on certain types of deposit accounts. The independent variables in this study have a greater explanation for changes in the liquidity premium since the deregulation of 1980. Although beyond the scope of this study, further investigation into the effects of DIDMCA may prove useful in determining the causes of fluctuation in the liquidity premium.

CONCLUSIONS AND IMPLICATIONS

The determination of the liquidity premium and how it fluctuates through time is an unsettled issue. Two leading theories with opposing views addressing this issue, the money substitute theory and the "normal" level of interest rates theory, were examined. According to the money substitute theory, the liquidity premium fluctuates positively with the level of interest rates. For example, as interest rates rise so does the cost of holding money. Investors exchange cash for short-term securities, as they possess greater liquidity and less risk than long-term securities. This increase in demand for short-term securities drives their prices up and their rates down relative to long-rates. Consequently, as interest rates rise, long-rates rise faster than short-rates, and the liquidity premium increases.

The "normal" level of interest rates theory proposes that the liquidity premium fluctuates negatively with the level of interest rates. This theory submits the existence of a "normal" level of rates toward which interest rates will gravitate in the long run. For example, when rates are below this "normal" level, investors would anticipate a rise in rates. They would require a substantial liquidity premium to invest in a long-term security due to the risk of capital loss associated with a rise in rates. Thus, as rates decrease the liquidity premium increases, opposite to the first theory.

The liquidity premium in this investigation, similar to Cagan's study, is determined by taking the difference in holding period yields on two securities of different maturity.

The results of this study give no support to the money substitute theory and instead favor the "normal" level of interest rates theory. The TBILL variable, the three-month interest rate earned on t-bills, was insignificant. The CHTB, the change in quarterly t-bill rate, is highly significant and possesses a negative correlation with the liquidity premium, consistent with the "normal" level of interest rates theory. The NORM9 and NOR16 variables, measuring the deviation of current rates from "normal" levels, are insignificant. The M3M1, LM1, and LM3 variables, measuring the quarterly supply of short-term securities relative to transaction balances, are insignificant.

The implications of this study on the yield curve theories give no support to the theory of expectations. This theory holds that forward rates are unbiased predictors of future spot rates. Furthermore, the theory implies that the holding period yield will be equivalent on securities of different maturity. This study shows that holding period yields on securities of different maturities are not equivalent, consistent with the market segmentation theory's position on holding period yields.

This study shows that the variance in the liquidity premium is better explained by the variance in the variables after January 1980. It may be of no coincidence that deregulatory legislation was enacted in 1980. Further investigation into the effects of this deregulation may be useful in answering questions regarding liquidity premium fluctuations.

Although changes in the liquidity premium can not currently be thoroughly explained, methods used in this study should help further research in this area.

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