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The Determinants of the Term Premium in the Term Structure of Interest Rates

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ABSTRACT

In support of the recent U.S evidence, the Garch methodology reveals in two fold that, the term premium is time varying and the conditional variances of the yield spread, money supply and the exchange rate determines the term premium implicit in the U.S. economy. However the impact of the conditional variance of industrial production index as a determinant of the term premium is felt only for longer maturity bonds.

Keywords: Term Premium, Yield Spread, Money Supply, Exchange Rate, Industrial Production Index.

1.0 INTRODUCTION

The uncertainties associated with the term structure of interest rates have gained much attention by academic researchers and practitioners. Understanding how yields changes with time as well as its volatility is necessary for certain areas in the economy like the conduct of monetary policy, and investment sectors such as the financing of public debt, formation of expectations about real economy activity and inflation, risk management of a portfolio of securities, interest rate derivatives valuations.

The term structure of interest rates takes into account the risk premium that are required by investors as a compensation for being exposed to different sources of macroeconomic risk. The CAPM in finance congrats to Merton,1983, explains that(Lee Sang-Sub, May 1995) risk premium are the prices of risk built in assets priced with respect to how they are hedged against the shocks related to some state variables in the economy. Subject of the macroeconomic state variables to uncertainties makes it varies over time and therefore the prices of risk that depend on the state variables also changes over time. Consequently, the risk premium on assets in general, varies over time, too.

Research conducted by Shiller (1979); Pesando (1975); Mankiw and Summers(1984); Nelson (1970) to determine the time-varying risk premium of the term structure of interest rates paid attention to the first moments of variables i.e., unemployment rates, yield spreads and the level of interest rates. Studies nowadays employ the conditional variances of excess returns aid the explanation of the intuition relating to the rejection of the expectation theory. Example of such studies are; Engle 1982; Engle, Lillien and Robbins 1987; Engle, Ng and Rothschild 1990; and Lee 1995. researchers like Breden 1986;Campbell 1986,1987 directed their minds to the equilibrium asset pricing models because they realized that the expectations hypothesis have failed and the term premium in the term structure of interest rates is time varying. Investors require risk premium for the risk that they take in investing in securities like bond. Understating the risk premium may reduce the number of investors and overstating the risk premium may lead to a collapse and a loss of a bank and financial companies. Researching into the macroeconomic determinants of the term structure will help calculate a correct risk premium for both investors and firms.

Interest rates are very volatile and unpredictable despite various economic models including Heath, Jarrow and Merton's model, the model of Vasicek, Ho and Lee, Hull and White, Black Derman and Toy(BDT),and Black-

Karasinki. The macroeconomic variables that causes such changes should be investigated in order to get a correct prediction.

There has been a lot of research on the effect of monetary policy and yield spread on the term structure. Most researchers neglect the effect on the conditional variance of excess return on the term structure. It is therefore very necessary to see the combined effect of monetary policy, yield spread and the conditional variance of excess return on the term structure of Interest rates.

1.6 OVERVIEW OF THE UNITED STATES ECONOMY, THE UNITED STATES BOND MARKET AND THE UNITED STATE MONEY MARKET.

The U.S. has the world largest GDP around $13.21 trillion and has a mixed economy where corporations and other private firms make the majority of microeconomic decisions while being regulated by the government. The U.S. economy maintains a high capita GDP, a reasonably high GDP growth rate, a low unemployment rate, and a high level of research and development investment. The federal government attempt to guide the overall pace of economic activity, attempting to maintain steady growth, high level of employment and price stability. At its disposal, the government uses powerful tools to forward a growth and stability agenda. Adjusting spending and tax rates through fiscal policy or managing the money supply and controlling the use of credit through monetary policy. This end up slowing down or speeding up the economy's rate of growth, which affect the level of prices and unemployment (Source-Wikipedia-the free encyclopedia).

The U.S. bond market is the largest bond market in the world. It is divided into six sectors namely, the U.S. treasury sector, agency sector, municipal sector, corporate sector, asset-backed securities sector, and mortgage sector. The treasury sector is made up of securities that are issued by the U.S. government. Treasury bills, notes and bonds are included in these securities. The treasury sector being the largest issuer of securities in the world determines the interest rate in all parts of the world. The government of the United States with credit and full faith supports securities issued by the treasury department. This makes market participants around the world see them as having no credit risk. In effect, interest rates on the treasury securities serve as the benchmark interest rates in the United States economy. Finally because the treasury department issues the largest size of securities as far as the treasury market in the world is concern, it is regarded as the most active and the most liquid in the world. The united state money market is a division of the fixed income market, which consists of very short-term debt securities that are marketable in high sense. Individual investors mostly do not get access to most of these securities because they trade in large denominations. However, small investors resort to money market funds. The way in which money market funds operate is that they pool the resources of most investors and buy many money market securities on their behalf. The money market consist of treasury bills, certificate of deposit, commercial papers, bankers acceptances, Eurodollars, repos and reserves, federal funds, broker's calls, the libor market. The united state treasury bills are the most marketable security of all money market instruments. Treasury bills are seen as a form of borrowing. The government sells bills to the public in order to raise money. What investors do is that they purchase bills at a discount from the maturity value stated. During maturity, the bill holder gets from the government a value same as the face value of the bill. Investors earning is calculated as the difference between the purchase price and the ultimate maturity value.28, 91, or182 days are the initial maturities with which t-bills are issued-bills are converted to cash with ease and are sold at low action cost, which does not contain much risk. Treasury bills can be bought directly, at auction, or on the secondary market from a government securities dealer. A distinguishing feature that distinguishes Treasury bill from other money market instrument is that the income earned on treasury bills is exempt from all state and local taxes. Moreover treasury bills sell in minimum denominations of $10000, unlike most other money market instruments which sell in minimum denomination of $100000.

Source: Frank J. Fabozzi. Bond market analysis and strategies. Sixth edition and Frank J. Fabozzi. The handbook of fixed income securities. Seventh edition

1.7 MACROECONOMIC VARIABLES SELECTION AND DESCRIPTION

The purpose of this research is to identify the macroeconomic variables that are significantly influencing the term structure of interest rates in the united state economy. Four macroeconomic variables have intuitively been chosen as likely factors to posses the power of explaining the term structure of interest rates. This has mainly been done in line with previous research such as Campbell (1995), Shiller (1990); Melano (1988) Laurence Jay Mauer, Robert F. Engle, David M. Lillien, and Russel P. Robins 1987; Walid Hejazi, Huiwen lai and Xian Yan (Feb 2000) ; Engle, Ng and Rothschild 1990; and Lee 1995. Empirical literatures have shown that these variables have a relationship with the term structure of interest rates and partly have unique association with the United States economy.

TERM STRUCTURE

The term structure of interest rates describes how a bonds yield changes as the bonds maturity changes. It gives a function that relates the interest rate to the term. The term of a debt instrument with a fixed maturity date is the time until the maturity date. Exploring the pattern of interest rate for different term assets identifies the factors that account for the pattern and determines what information may be derived from the term structure of interest rates. An interesting relationship that exists between short rates and long rates is that most central banks at a certain times influence short-term interest rates as a lever on the real economy. Monetary authorities accomplish this by engaging in open market operations, which help influence the rate of inflation. Behavior of interest rates and bond prices are necessary in testing different behavioral hypothesis about market participants and market efficiency.

INDUSTRIAL PRODUCTION INDEX

The Industrial Production Index is an economic indicator, which measures real production output. It is expressed as a percentage of real output with base year currently at 2002. Production indexes are computed mainly as fisher indexes with the weights based on annual estimates of value added. This index, along with other industrial indexes and construction, accounts for the bulk of the variation in national output over the duration of the business cycle. The production index is the most important business indicators in the short term, which aims to measure at a monthly frequency the difficulties of industrial production during the long period. Monthly survey on industrial production index helps to identify the turning points in economic development at an early stage; also the timely industrial production index is one of the most important measures of economic activity. Below represent the graph of industrial production index for the United States data between the periods January 1921 to July 2007 taken from st. Louis fed database.

MONEYSUPPLY

In financial economics, monetary aggregates or money supply or money stock is the quantity of currency and money in bank accounts in the hands of the non-bank public available within the economy to buy items, render services, and serving as securities. The relationship between the rate of interest and money is that the rate of interest is the price of money. The two are related inversely, such that, a rise in money supply decreases interest rates. When the interest rate equals the quantity of money demanded with the quantity of money supply, the economy is said to be operating at the money market equilibrium. The market of money demand utilizes the tools of analysis that are similar to other markets. Supply and demand give rise to a price known as equilibrium price. A price is said to be in equilibrium price when the sum of long-term interest rate or free market and the quantity of available real money balances the demand for money. The Federal Reserve manipulates the Short-term interest rates artificially. An accurate way for calculating the concept of monetary aggregates is to take into account of all-electronic, credit-based deposit balances in banks accounts and financial accounts and all printed-paper and minted coins.

EXCHANGE RATE

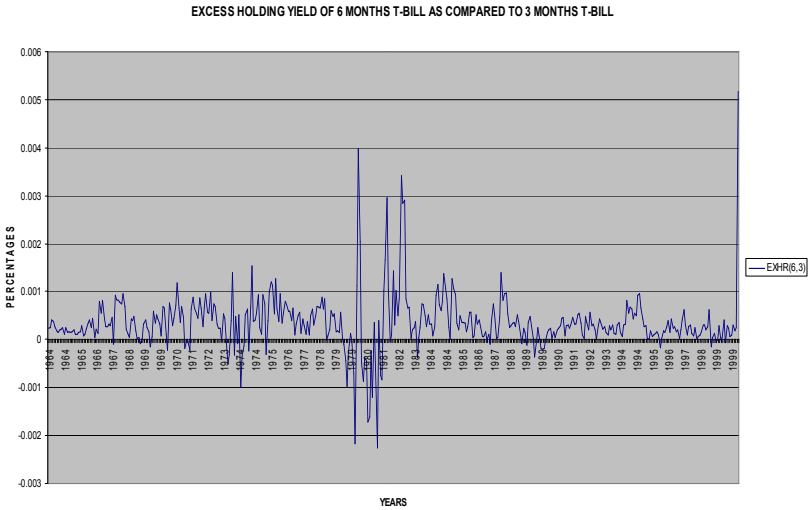
In financial economics, exchange rate between two currencies shows the value of one currency as far as the other is concern. A typical case is an exchange rate of 123 Great Britain pound (GBP, $) to the United state dollar (USD, $) means that GBP 123 has a value equal to USD 1. The exchange rate is one of the largest markets globally. Statistics show that, around 2 trillion USD values of currency changes hands every single day. The current exchange rate in the market is termed as the Spot exchange rate. Exchange rate that is announced and traded today in the market but for delivery and payment on a certain future date is termed as forward exchange rate. The US Dollar is the main currency for international trade. The dollar-pound exchange rate is therefore important since this is translated into the cost for importing raw materials and other inputs. The exchange rate therefore affects business cash flow, investments and hence the amount of interest paid, thus it is hypothesised that exchange rate will relate risk premia. Empirical evidence, have given its explanatory power on the time varying risk premia

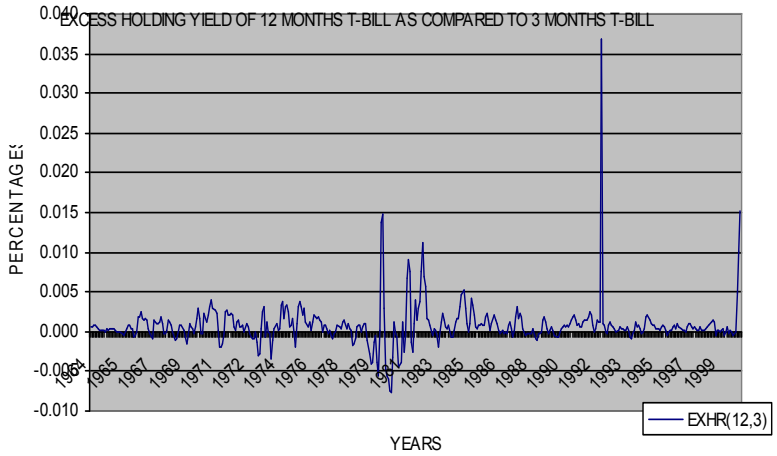
YIELD SPREAD

Yield spread is the differences in yields so far as different types of debt securities, a function of supply and demand, credit rating, and interest rate changes are concern. Technically, it is the difference between the quoted rates of return on two different investments, usually of different credit quality. The yield spread of A over B is obtained by subtracting the percentage return on investment from financial instrument B from the percentage return on investment from financial instrument A minus in a year. The higher the yield spread, the greater the difference between the yields offered by each of the instruments. The spread can be measured between debt instruments that have different maturities, credit ratings and risk. One way of comparing any two financial products is the use of their yield spread. It indicates the risk premium that an investor gets when he choose one investment product over the other investment product. When yield spreads between bonds of unequal quality rates widen, it means that the financial market is giving more risk of default on lower grade bonds.

EXCESS RETURN

Excess return is the difference between the actual wealth and expected wealth at the end of a certain measurement time. It is also termed as the returns in excess of those required by some pricing model, or a risk free return or a given market measure such as Dow Jones.





2.0 THEORETHICAL FRAMEWORK

2.1 THE EXPECTATIONS THEORY OF THE TERM STRUCTURE OF INTEREST RATES.

Assuming that by the principle of risk neutrality all agents are only concerned with expected return, then no matter what their maturity, the expected one period HPR over say one month or one quarter on all bonds would be the same and would be equal to the known safe return of a one period asset. This gives the pure expectations hypothesis where the risk premium is zero for all maturities. Adding the assumption of rational expectation gives a simple test of the pure expectation hypothesis in that the ex post excess holding period yield should have a zero mean, be independent of all information at time t whereas the residual Should be serially uncorrelated. It is a very reasonably assertion because there is uncertainty related to the return on holding a long bond for one period, the excess holding period return ought to depend on some form of reward for risk. This reward for risk is the term premium.

The basic assumptions, which constitute the expectation hypothesis, are

1. The term premium is constant over time.

2. The term premium is independent on the term to maturity of the bond.
A combination of the expectation hypothesis and the real expectation coupled with a time invariant term premium gives a variance inequality such that the variance of the one period holding period return on an n period bond should be greater than or equal to the one period safe rate. It can also be explained that the variance of the excess holding return should be the same for different maturity bonds.

The theory concerning the expectation hypothesis has gained a lot of attention by researchers. Studies by Campbell (1995), Shiller (1990); Melano (1988) has rejected the expectation theory of the term structure of interest rates explains that agents that hold rational expectations and term premia are time invariant. The rejection can either be attributed to two reasons. Either time-varying term premia caused the rejection or the rejection is because of forecast errors, which appear biased when viewed ex-post. Most of these researchers used the United States data, which is in line with this study. Researchers like Pesando (1978), Gregory and Voss (1991), Johnson (1993) and Kingler (1990) used Canadian government Treasury bill and Treasury bond data in support of the expectation hypothesis. Other researchers for the expectation theory for different countries apart from the united states and Canada are Kugler (1990), and Hardouvelis (1994), Gerlach and Smets (1997a,b).

Pesando (1978) identified that the changes in Canadian long-term interest rates are well approximated by a martingale when he used quarterly interest rate data on Government of Canada long -maturity bonds from 1961 to the period 1976.

Gregory and Voss (1991) using quarterly priced data between 1961 and 1988 explained that using current information like forward premium, the premium on three and six months Canadian treasury bills can be predicted.

Johnson (1993) identified that when both the spread between the Canadian long-term and short-term interest rate as well as the spread between international yields are used, the significant difference that exist between excess returns on Canadian and the united states treasury bonds of maturity two, ten and twenty years are predictable. He came to this conclusion when he used Canadian and the united states treasury bills of maturity two, ten and twelve over the period 1971 to 1988.He further argued that his evidence suggest that there is no equalization in the long term bond returns so far as Canada and the united states are concerned.

The arguments raised above calls for an equation for testing the expectation hypothesis in searching for evidence of time varying risk premia.

Walid Hejazi, Huiwen lai and Xian Yan (Feb 2000) deduced an equation for performing such task. According to them,

The long-term rate say K period can always be written as an average of expected future short rates says one period plus a premium. Then mathematically the yield for pure discount bond purchased at time t can be written as

$$Y_t^k = \frac{1}{k}\sum_{i=0}^{k-1} E_t Y_{t+i}^1 + \theta_t^k \quad \text{..... (1)}$$

Where

Y_t^k Represent the yield to maturity on a K period pure discount bond.

E_t Represent the markets expectation conditional upon information available at time t.

θ_t^k Represent the expected excess return on holding a long bond relative to rolling over short bond. This serves as the premium component.

$\frac{1}{k}\sum_{i=0}^{k-1} E_t Y_{t+i}^1$ Represent the expectation component. This serves as the rolling premium.

So far as the expectation hypothesis is concern the rolling premia vary with the maturity k but does not vary with time t. Assume H_{t+1}^k is the investors realized one period excess return when he holds a k period bond for a single period that begins with time t, in excess of that to holding a one period bond. Expression this in an equation gives

$$H_{t+1}^k = kY_t^k - (k-1)Y_{t+1}^{k-1} - Y_t^1 \quad \text{..... (2)}$$

This linearization is appropriate for discount bond (shiller 1979, 1990; or shiller, Campbell, and schoenholtz 1983).

For pure discount bonds, the time-varying expected excess return is defined as

$\phi_t^k = E_t H_{t+1}^k = kY_t^k - (k-1)E_t Y_{t+1}^{k-1} - R_t^1$ … (3) = TERM PREMIUM

Equation (3) is the term premium.

Term premium are observed in the presence of forecast errors. A typical case is the equation $H_{t+1}^k = \phi_t^k - (k-1)[Y_{t+1}^{k-1} - E_t Y_{t+1}^{k-1}]$ ..... (4) Where excess return is decomposed into a sum of a term premium plus a single period forecast error. According to the expectation hypothesis, the markets best forecast of the change in the long-term interest rate is contained in the spread between the long K period yield and the short period yield or yield spread. Mathematically,

$(k-1)(Y_{t+1}^{k-1} - Y_t^k) = b_0 + b_1(Y_t^k - Y_t^1) + u_{t+1}$ …….. (5)

$b_o = -\phi_t^k \qquad b_1 = 1$

Rearranging gives

$H_{t+1}^k = a_o + a_1(Y_t^k - Y_t^1) + e_{t+1}$ …….. (6)

Where $e_{t+1} = \phi_t^k - (k-1)(Y_{t+1}^{k-1} - E_t R_{t+1}^{k-1} - a_o$

According to the expectation hypothesis $a_o = \phi^k$ and $a_1 = 0$

Equation (6) is use in the testing of the expectation hypothesis in searching for evidence of time varying risk premia. It can be seen clearly how equation (6) can be split into premium component and forecast error component. Assuming ex-ante that forecast errors are orthogonal to available information, Estimated values of a_1 that are not equal to zero serves as an indicative of time-varying risk premia.

2.2 THE ECONOMIC THEORY ON THE ASSOCIATION BETWEEN INDIVIDUAL MACROECONOMIC VARIABLES AND THE TERM STRUCTURE OF INTEREST RATES.

The theory as to what determines the term structure of interest rates has been of different views by researchers and economists. whiles some think monetary aggregates is a strong determinant of the term structure of interest rates, others think industrial production index, yield spread, excess returns have a strong linkage with the term structure of interest rates. However recent studies are of the view that all the macroeconomic indicators mentioned above determines the term structure of interest rates. Another school of thought is of the view that microeconomic variables have some link with the term structure of interest rates. This has been tested by different economist and researchers using different methods which include the Value at Risk approach, the linear regression approach and the Engle (1982) ARCH in mean or the GARCH approach.

Walid Hejazi, Huiwen lai and Xian Yan (Feb 2000) examined the determinants of the term premia implicit in the Canadian T-bill term structure of interest rates. They used monthly data over the period July 1960 to December 1995 on Canadian treasury bills with one to three months to maturity. In order to enhance their analysis, they used the united state treasury-bill during the same time periods for comparison. Their result s using Canadian data indicates that the conditional variances of industrial production, the money supply and the exchange rates are statistically insignificant determinants of excess returns. On the other hand, the level of yield spread and the conditional variance of excess

returns themselves do contain statistically significant information for excess returns. On the contrary, for the united state data, they found that the conditional variance of both industrial production and the money supply are statistically significant determinants of excess returns. The conditional variance of excess returns themselves as well as the level of yield spread is also significant predictors of excess returns. The conditional variance of industrial production disappears, however, when these additional conditional variances are added. Also, the coefficient estimates on the conditional variance of the money supply falls dramatically. They pursue the possibility that the term premium implicit in the Canadian term structure are related to the conditional variances of the united states macroeconomic variables and surprisingly, they saw a statistically significant link between the conditional variance of the united states money supply and the term premia implicit in the Canadian t-bill term structure. They therefore concluded that ,In contrast to the united states evidence, the second moments of macroeconomic variables are not significant predictors on Canadian treasury bill t of maturities of two and three months. On the other hand the conditional variance of excess returns and the level of yield spread do contain some important information for excess returns. Although there is evidence of time varying risk premia in the Canadian Treasury bill term structure, these premia are not related to the uncertainties in the macro economy as measured by their conditional variance of industrial production and the money supply. They again insisted that there is important link between the U.S. money supply and the Canadian term structure of interest rates and therefore the determinants of the term structure of interest rates of the two countries are different.

Lee Sang-Sub (May 1995) investigated the macroeconomic sources of the time-varying risk premia in the term structure of interest rates, based upon a monetary general equilibrium model of the term structure with a cash in advance constraint using monthly united states term structure data for one to six months treasury bill with a cash in advance constraint combined with general time series representations of the relevant macroeconomic forcing variables, the model derives the risk premium expression that succinctly describes the relationship between risk premia in the nominal term structure depending on the uncertainties related to the macroeconomic forcing variables, output and the money supply, measured by their conditional variance-covariance_s. Lee found out that uncertainties related to output and the money supply are important sources of time-varying risk premia in the nominal term structure of interest rates. He also found out that the Garch conditional variance estimates of the industrial production index and the money supply are significant in all the risk premium equations examined and they also show significant explanatory power for the monthly excess return under investigation. The conditional variance of industrial production index and the money supply remain significant when yield spread is added to the risk premium equation. He also found out that yield spread which contains information about the risk premium, have significant explanatory power, despite the presence of macroeconomic factors.

Paul Boothe (August 1991) used co integration tests and two different sets of Canadian and the united state data to evaluate a model of the term structure of interest rates in an open economy. He found out that the data were consistent with the hypothesis of high or perfect substitutability or uncovered interest parity between Canadian and the United States assets of comparable maturity. However, he found mixed support for the hypothesis of co integration of short and long interest rates, which was contrary to the findings of Engle and Granger and Campbell and Shiller.

Carlos Del Castillo and Jean- Francois Fillion (October 2002) using three months forward interest rate from 1960 to 2000 tested a theoretical model explaining the term premium. They found out that, the term premium depends on the degree of risk aversion and the degree of persistence in consumption growth and on one variable, the conditional variance of consumption growth. They found out that, the conditional variance of consumption growth is statistically significant in an econometric equation of excess returns.

Laurence Jay Mauer using six months maturity class and seven to twelve month maturity class analyzed the effect of commercial bank maturity behavior towards the term structure of interest rates. His aim was to verify the expectation hypothesis, which stresses the importance of expectations of future yields as a determinant of the present term structure of interest rates; again to also verify the liquidity hypothesis, which emphasizes the greater moneyness of

short-term debt as opposed to long-term debt. After their estimation and analyses, they found at microeconomic levels that both the liquidity and expectation theories are consistent with the data.

Arturo Estrella and Frederic S. Mishkin (1995) examined the relationship of the term structure of interest rates to monetary policy instruments and to subsequent real activity and inflation in both Europe and the United States. Their results show that monetary policy is an important determinant of the term structure spread, but is unlikely to be the only determinant. In addition, they found a significant predictive power for both real activity and inflation.

Rodrigo Sekkel and Denisard Alves using near-VaR estimation identified the effects of monetary policy and macroeconomic shocks on the dynamics of the Brazilian term structure of interest rates. They found out that monetary policy shocks flattens the term structure of interest rates, which is similar to that of the United States economy. Nevertheless, they found that monetary policy shocks in brazil appear to explain a significant larger share of the dynamics of the term structure than in the united states of America. Furthermore, there was an evidence of the importance of the standard macroeconomic variables, such as Gross domestic product and inflation on the term structure of Brazil.

2.3 THE THEORETICAL DERIVATION OF THE TIME VARYING RISK PREMIA.

A methodology by Engle et al (1987) known as the Arch -M model is use to determine the risk premium. In this methodology, the conditional variance of excess return determines the current risk premium.. Engle et al tested their model using 3-month and 6-month U.S. Treasury bill rate between 1960 to 1984.They used quarterly data and concluded that that risk premia vary systematically over time with agents perception of underlying uncertainty. In this research, I generate measures of the term premium by estimating the Arch-M model of excess holding return for 6 months treasury bill over 3 months and 12 months bill over 3 months treasury bill between the period 1964 and 1999. I used monthly observation as done by Pornpinun chantapacdepong (March 2007) and Walid Hejazi, Huiwen lai and Xian Yan (Feb 2000). This is in replicates Engle et al (1982) methodology, which incorporates expected conditional standard deviation of the error term in the mean equation of the excess holding yield.This, incorporates in pattern from a micro-founded model with risk-averse agents.

Below is a generalization of the works of Pornpinun chantapacdepong (March 2007) showing how to determine the time varying risk premia using the Arch-M model proposed by Engle et al. The first step is to decompose the excess holding yield into

$$E_t = \mu_t + \varepsilon_t \quad \text{..... (7)}$$

Where E_t =excess holding yield on 6 months Treasury bill over the 3 months Treasury bill.

μ_t =risk premium or the expected return that the risk averse investor would expect for holding such a riskier long-term asset. This parameter is non-static.

ε_t =difference between the ex ante and ex post rate of return which cannot be forecasted in an efficient market. This signifies that the expected excess return from holding the longer-term asset is just equal to the risk premium.

Expressing the risk premium in an equation gives

$$u_t = \beta + \delta h_t \quad \text{..... (8)}, \qquad \delta > 0$$

Where h_t =conditional standard deviation of the unforecastable shocks ε_t to the excess return on the long-term asset.

$\delta > 0$ = the coefficient of the relative risk aversion.

The assumption behind is that the risk premium is an increasing function of the conditional standard deviation of the unforecastable shocks (ε_t).

h_t^2 =The conditional variance of the error term and is a function of the information set that is available to investors.

$h_t^2 = Var(\varepsilon_t)$ For all available information.

A point of interest is that this model takes the mean as a linear function of the standard deviation h_t Instead of the variance h_t^2 .The main reason is that it is assumed that changes in the variance are reflected less than proportionality in the mean. Researchers including Domowitz and Hakko (1985), Engle, Wooldridge and Bollerslex (1988) used the same specification.

According to Engle,et al (1987), it is assumed that the conditional variance is a weighted sum of past squared innovations, ε_t^2 .The conditional variance follows an ARCH(P) process below.

$$h_t^2 = \alpha_0 + \alpha_1 w_i \varepsilon_t^2 \quad \text{..... (9)}$$

This means that the variance of the error term depends on the intercept α_o and the weighted average of the past squared innovations, where w_i Represent the weighting parameters. I used monthly observations. This means that every year I have 12 months and 13 lags on the assumption that the past years information is essential for predicting the mean.

Pornpinun chantapacdepong (March 2007) Discounted the older information using a linearly declining weight scheme where $w_i = \frac{13-1}{78}$ And $i = 1-12$.

He noticed the declining weight scheme on lag structure aids in coping with the co linearity of past square innovation terms. The equation is therefore

$$h_t^2 = \alpha_o + \alpha_1 \frac{12}{78}\varepsilon_{t-1}^2 + \frac{11}{78}\varepsilon_{t-2} + \text{.....} + \frac{1}{78}\varepsilon_{t-12}^2 \quad \text{..... (10)}$$

The above equation including the ones earlier analyzed concludes that the conditional mean of the excess holding yield $E(H_t)$ Depends on the conditional standard deviation of the unforecastable error term.

$E_{t-1}H_t = \mu_t$ indicates that the risk premium is an increasing function of the conditional standard deviation of the returns. On the assumption that the variation of return measures riskiness.

HYPOTHESIS

The following hypothesis are stated after the discussions above:

H1: The risk premia in the nominal term structure depends on the uncertainties

related to the macroeconomic forcing variables, output and the money supply

measured by their conditional variance-covariances.

H2: The term premia implicit in the u.s. term structure are time varying.

H3: The Garch conditional variance estimates of the industrial production index and M1

are significant in all the risk premium equations and show significant explanatory

power for the monthly excess return.

3.0 METHODOLOGY

This section presents the methods that were used to collect and analyse data for this research. The significance is that all scientific work has to be replicable and this can be done only if the researcher gives a laid down procedure as to how the study is carried out, Hussey and Hussey, 1997a. Researchers like shiller 1979; Pesando 1975; Mankiw and Summers 1984; Nelson 1970 used fist moments of variables, Robert F. Engle, David M. Lillien, and Russel P. Robins 1987; Walid Hejazi, Huiwen lai and Xian Yan (Feb 2000) used second moment where their conditional variances are taken into consideration, in the determination of the time-varying risk premia of the term structure of interest rates. In this research, single equation regression is used in testing for the expectation hypothesis. This in other words focussed on the first moment determinants of the term structure of interest rates. ARCH Model was used in the second moment determinants of the time varying risk premia where the conditional variances of both the dependent variable and the independent variable are taken into consideration. This helps identify the significant predictors of excess return, which is a sum of a term premium, and a single period forecast errors. It also explains the main reason why I rejected the expectation hypothesis in my single equation regression test.

3.1 Sources of Data

Data for the study were mainly obtained from secondary sources. Monthly macroeconomic data collected include, industrial production index, U.S dollar- G.B pound sterling exchange rate, money supply. Spot rates on 3 months, 6 months and 12 months Treasury bills were used in the calculation of the yield spread and the excess holding return. All data were collected from the st. Louis Fed economic research. The study covers the period of Jan 1964 to Dec 1999 using 432 monthly observations.

3.2 EXCESS RETURN GENERATION AND DESCRIPTION

Before generating risk premia, it is useful to explain in twofold how the properties of the excess return was obtain. On the assumption that excess return is decomposed into a sum of a term premium plus a single period forecast error, the excess holding yield return for holding a 6-month treasury bill compared to the return from holding consecutive 3-months treasury bills as well as the excess holding yield return for holding a 12-month treasury bill compared to the return from holding consecutive 3-months treasury bills are calculated. The risk premia of the excess holding yields

was generated as a result of the volatility of excess holding yield. This methodology is similar to that of Engle,et al (1987) where he used the treasury bill to calculate for the risk premia. Pornpinun chantapacdepong (March 2007) used the same methodology but he represented the treasury bills with zero coupon bills with the understanding that U.S. treasury bills are zero coupon bills which do not pay interest prior to maturity; instead they are sold at a discount of the par value to create a positive yield to maturity. In my term premium estimations, I used the same formula and procedure as done by Engle et al(1987), Dotsey et al(1995), Harris(2004), Pornpinun chantapacdepong (March 2007) in constructing the excess holding yield of 6- months over 3-months treasury bills. This is equal to

$$H_t^{6,3} = [\frac{(1+R_t)^{\wedge}2}{1+r_{t+1}}] - (1+r_t)$$

This is approximated as

$$H_t^{6,3} = 2R_t - r_{t+1} - r_t$$

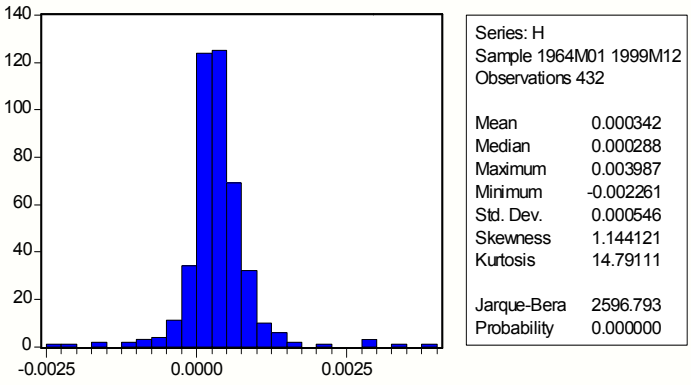
Where; the unit of time t stands for every 3 months.

R_t Is the yield on a 6 month treasury bill

r_t Is the yield on the 3 month Treasury bill.

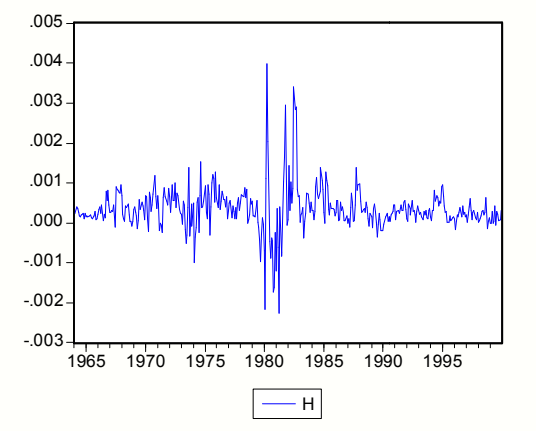
The descriptive statistics of the excess holding yield of 6- months over 3-months treasury bills shown below help us to see clearly the risk premia expected characteristics.

HISTOGRAM AND STATISTICS



The standard deviation is a measure of risk and it shows how the return series deviate from its mean. In that, sense a large standard deviation represents a large deviation in the return series of assets. The number of observation indicates the number of months. The mean (0.000342) is positive in sign .This indicates that an investor would be better of if he keeps investing in a shorter-term asset (3-months bill) for a year than buying a single 6-month t-bill that gives less return in time t+1.There is an evidence of a slight volatility as indicated by the standard deviation. It is also seen from the graph below in percentages how the mean values of excess returns and standard deviation increase with maturity.

EXCESS RETURN (6)



Regressing the excess holding yield on a constant gives

$$H_t^{6,3} = 0.000342 + e_t$$

In order to test for the robustness of my econometric results, it is necessary to construct the excess return of 12 months over 3 month's Treasury bill rate. I did this in the same way as done in Engle et al(1987), Dotsey et al(1995), Harris(2004), Pornpinun chantapacdepong (March 2007) in constructing the excess holding yield of 12- months over 3-months treasury bills. This is equal to

$$H_t^{12,3} = [\frac{(1+R_t)\text{^}4}{(1+r_{t+3})(1+r_{t+2})(1+r_{t+1})}] - (1+r_t)$$

This is approximated as

$$H_t^{6,3} = 4R_t - r_{t+3} - r_{t+2} - r_{t+1} - r_t$$

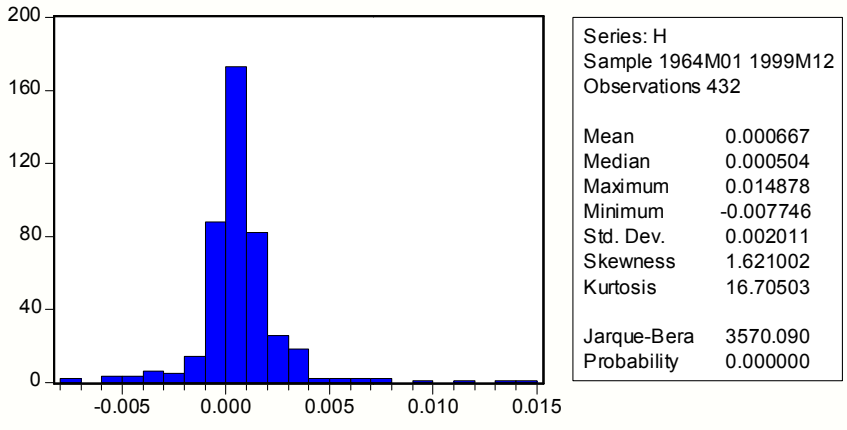
Where; the unit of time t stands for every 3 months.

R_t Is the yield on a 6 month treasury bill

r_t Is the yield on the 3 month Treasury bill.

The descriptive statistics of the excess holding yield of 12- months over 3-months treasury bills is as shown below

HISTOGRAM AND STATISTICS



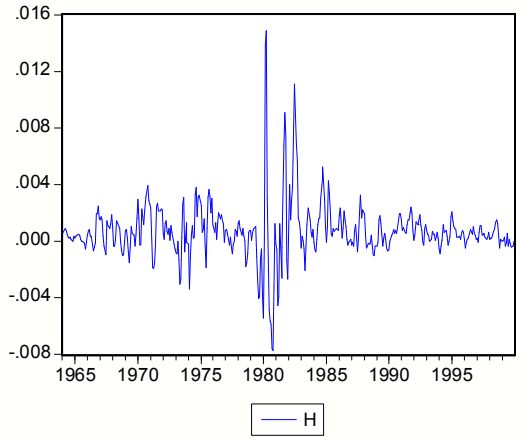
It has a mean of 0.000667 which is positive in sign .This is an indication as to how an investor would be better of if he keeps investing in a shorter-term asset (3-months bill) for a year than buying a single 6-month t-bill that gives less return in time t+1.

A Regression of the excess holding yield on a constant gives

$$H_t^{12,3} = 0.000667 + e_t$$

Standard deviation of 0.002011 indicates a slight volatility. It is also seen from the graph below in percentages how the mean values of excess returns and standard deviation increase with maturity.

EXCESS RETURN



3.4 METHODS OF ANALYSIS

ORDINARY LEAST SQUARE REGRESSION

Ordinary least square regression or single equation regression was used in testing for the expectation hypothesis. According to Fama (1984; Mankiw (1986); Evans and Lewis (1994), yield spreads is the method mostly use in testing hypothesis. In this case, the spread between the long K-period yield and the short one period yield is known as the

yield spread, contains the markets best forecast of the change in the long term interest rate. Writing and Rearranging gives equation (6)

$$H_{t+1}^{k} = a_o + a_1(Y_t^k - Y_t^1) + e_{t+1}$$

For reasons attributed to Eviews compatibility and simplicity, I rewrite the equation above as

$$H = a_o + a_1 YS + e_{t+1}$$

Where a_o and a_1 are constant coefficients and YS= yield spread and H=excess return

According to the expectation hypothesis $a_o = \phi^k$ and $a_1 = 0$.

The expectations hypothesis assumes the term premium to be a constant term.

THE GARCH AND THE ARCH IN MEAN MODEL OF THE TERM PREMIA.

Unlike the above methodology that assumes the term premium to be a constant, Engle et al proposed the Garch methodology that assumes the term premium to be time varying instead of being a constant. In Financial economics, autoregressive conditional heteroskedasticity (ARCH, Engle (1982)) model takes into consideration the variance of the current error term to be a function of the variances of the previous period's error terms. ARCH links the error variance to the square of a previous period's error. It is employed commonly in modelling financial time series that exhibit time-varying volatility clustering, i.e. periods of swings followed by periods of relative calm .If an ARMA model is assumed for the error variance, the model is a generalized autoregressive conditional heteroskedasticity (GARCH, Bollerslev(1986)) model. The GARCH-in-mean (GARCH-M) model adds a heteroskedasticity term into the mean equation.

In replication of the works of Walid Hejazi, Huiwen lai and Xian Yan (Feb 2000), I used the Arch in mean model of the term premia. Excess return is expressed as a linear function in the form

$$H_{t+1}^{k} = B_O + B_{ys}\sigma_{t+1,ys}^2 + B_y\sigma_{t+1,y}^2 + B_m\sigma_{t+1,m}^2 + B_{ex}\sigma_{t+1,ex}^2 + \mu_{t+1}$$

Where

y=log of industrial production index

m=log of money supply

ex=log of the dollar-pound exchange rate

ys= yield spread

H=excess return

B_O =constant term

By =coefficient on the conditional variance of the industrial production index.

Bm =coefficient on the conditional variance of the money supply

Bys =coefficient on the level of yield spread

Bex =coefficient on the conditional variance of exchange rate

$\sigma^2_{t+1,y}, \sigma_{t+1,m} and \sigma^2_{t+1,ex}$, the conditional variances of industrial production, money supply, and exchange rate respectively.

Moreover, the conditional variances were modeled as described below.

$$\sigma^2_{t+1,H} = a_o + a_1 e^2_{t,H} + a_2 \sigma^2_{t,H}$$

$$\sigma^2_{t+1,y} = b_o + b_1 e^2_{t,y} + b_2 \sigma^2_{t,y}$$

$$\sigma^2_{t+1,m} = c_o + c_1 e^2_{t,m} + c_2 \sigma^2_{t,m}$$

$$\sigma^2_{t+1,ex} = d_o + d_1 e^2_{t,ex} + b_2 \sigma^2_{t,ex}$$

$e_{t,y}, e_{t,ex}, e_{t,m}$ Denotes serially uncorrelated innovations in industrial production, exchange rate and money supply respectively. During this estimation,the conditional variance are estimated simultaneously with the excess return regressions. It is known as multivariate Arch in mean estimation. One merit of this model estimation is that it takes into account the real and the monetary sides of the economy and therefore allows excess returns to be dependent on the conditional variances of industrial production and the money supply.

4.0 ANALYSES, INTERPRETATION AND DISCUSSION OF EMPIRICAL RESULTS.

4.1 TESTING THE EXPECTATION HYPOTHESIS

OLS regression test using the equation below

$H = a_o + a_1 YS + e_{t+1}$ To test for my expectations hypothesis

Appendices 1 and 2, together with Tables 1 show the OLS E-VIEWS and Tabulated output of the effect of yield spread and the constant on excess return for both the 6 months and the 12 months Treasury bill each compared with the 3 months Treasury bill

TABLE 1

TABULATED OUTPUT OF VARIABLES (6 MONTHS TREASURY BILL AS COMPARED TO 3 MONTHS)

VARIABLE	C	YS
COEFFICIENT	6.03E-05(a_o)	1.631478(a_1)
PROBABILITIES	0.0631[P (a_o)]	0.0000[P (a_1)]

TABLE 2

TABULATED OUTPUT OF VARIABLES (12 MONTHS TREASURY BILL AS COMPARED TO 3 MONTHS

VARIABLE	C	YS
COEFFICIENT	0.000483 (a_o)	0.684726 (a_1)
PROBABILITIES	0.0000 [P (a_o)]	0.0027[P (a_1)]

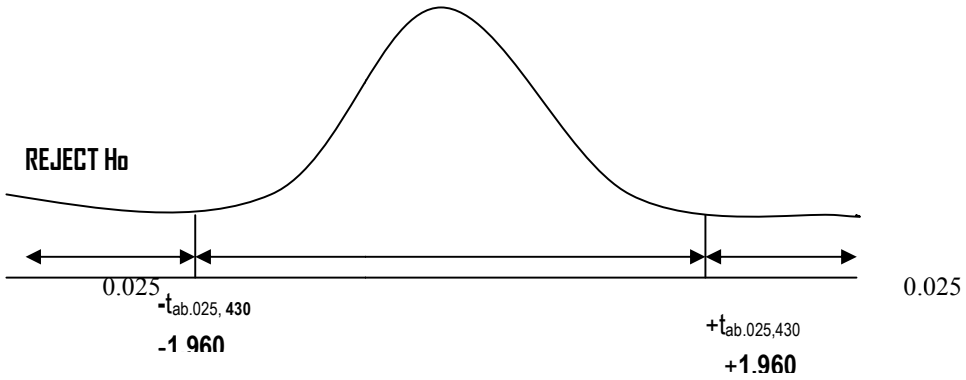
Firstly, T-tests are conducted to evaluate the significance of the yield spread and this was conducted at 5% level of significance (=0.05). Sample size (n =432), number of explanatory variables (k = 1), degree of freedom d.f. = n-k-1, this is 432-1-1 = 430, with 5% level of significance and degree of freedom 430, t_{tab} =1.9600

According to the expectations hypothesis, $a_o = \phi^k$ (Term premium) and $a_1 = 0$.

My Hypotheses are: $H_{0:}$ $a_1 = 0$ (insignificant);

$H_{1:}$ $a_1 \neq 0$ (significant)

Note, two tail-test = /2 = 0.05/2 = 0.025



The t-distribution above provides us with a useful tool in making decision whether the explanatory variable is significant in determining stock returns or not at the 5% level of significance and according to the t-values of the explanatory variable. In general, the explanatory variable is said to be insignificant when the null hypothesis is accepted, this means that $a_1 = 0$ and it is significant when the null hypothesis is rejected that is $a_1 \neq 0$. The following table and the analysis below explain the decision rule for rejecting the expectations hypothesis.

A very simple way of doing this is by using the probabilities from the eviews output of both the constant and the yield spread. The principle we apply here is that if the probability is less than .005 (5%), we reject the null hypothesis. let p denote probability.

From our eviews results

P (a_1) for the 6 months bill =0.0000 $\prec$ 0.05

We therefore reject the null hypothesis that $a_1 = 0$

Similarly, for the 12 months bill P (a_1) =0.0027 $\prec$ 0.05

Therefore, the null hypothesis $a_1 = 0$ is rejected. This in effect shows that I have rejected the expectations hypothesis. . Another point of interest is that as we can see my a_1 estimates significantly are not equal to zero and it is also assumed that all my forecast errors are orthogonal within the sample. This brings an evidence that the term premia are time varying.

Although my R^2 indicates that only 25.7 % and 20.6% respectively for my six month and my 12 months of the changes in the excess holding return of my data has been explained by the yield spread and the constant, my rejection of the expectations hypothesis obtained similar results when the research was conducted by Campbell (1995), Shiller (1990); Melano (1988) whose works rejected the expectation theory of the term structure of interest rates which is a joint hypothesis that agents that hold rational expectations and term premia are time invariant. They rejected it on the basis of either or both of these two reasons. Either time-varying term premia caused the rejection or the rejection is because of of forecast errors, which appear biased when viewed ex post. Walid Hejazi, Huiwen lai and Xian Yan (Feb 2000),), Gregory and Voss (1991), Johnson (1993) and Kingler (1990) also had a similar results in testing the expectations hypothesis. The conditional variance of the yield spread in both the 6 months Treasury bill and the 12 months Treasury bill each compared to the 3 months treasury bill are positive and can also be viewed statistically as significant predictors of excess return in the united state economy. I further reject the expectations hypothesis based on the sign and the statistically significance of the yield spread. The expectations hypothesis is wrong because According to my results, when there is an increase in yield, investors of long-term treasury bills get a capital gain plus the increase in the yield. There is an evidence of serial correlation in the residuals as explained by my Durbin Watson test embedded in the ols results output at the appendix for my 6 months compared to 3 months and my 12 months compared to 3 months treasury bill at the appendix. Moreover comparing the R^2 of the two sets of results indicates that the R^2 statistics of the test increases as the term to maturity increases. The explanation is that the risk or the volatility associated with the excess returns increases variably with the term to maturity.

4.2 THE MACROECONOMIC DETERMINANTS OF THE TERM STRUCTURE.

On the assumption that the term premium is time varying as proposed by Engle (1987), certain macroeconomic variables were factored into the excess return equation to capture their effect on the term premium. The equation we came about is the one described below

$$H_{t+1}^{k} = B_O + B_{ys}\sigma_{t+1,ys}^2 + B_y\sigma_{t+1,y}^2 + B_m\sigma_{t+1,m}^2 + B_{ex}\sigma_{t+1,ex}^2 + \mu_{t+1}$$

Running the garch equation with the help of eview software and my data gave my results in appendices 3 and 4 and the results on the next page.

TABLE 3. TABULATED OUTPUT OF VARIABLES (6 MONTHS TREASURY BILL AS COMPARED TO 3 MONTHS)

VARIABLE	C	YS	Y	M	EX
COEFFICIENT	8.80E-05	1.503442	-0.000582	-7.52E-08	0.000366
PROBABILITIES	0.7372	0.0000	0.0023	0.4901	0.0157
SIGNIFICANT	NO	YES	YES	NO	YES

TABLE 4. TABULATED OUTPUT OF VARIABLES (12 MONTHS TREASURY BILL AS COMPARED TO 3 MONTHS

VARIABLE	C	YS	Y	M	EX
COEFFICIENT	-0.001834	0.931781	5.33E-06	-6.22E-07	0.002814
PROBABILITIES	0.0000	0.0000	0.3495	0.0244	0.0000
SIGNIFICANT	YES	YES	YES	YES	YES

Theory and evidence have shown that macroeconomic variables possess some degree of explanatory over excess return which combination of the term premium and forecast errors. The results are shown in tables 3 and 4. Generally, it can be said to be a meaningful result as most of the variables came out to be statistically significant except the money supply index for the 6 months Treasury bill compared to 3 months, which was not statistically significant... The significant variables include the yield spread, industrial production, money supply, exchange rate. Considering the signs of the variables coefficients, although there are no established theoretical foundations for it, it is worth noting whether their signs have implications on the term structure of interest rate in the United States economy. With exception of the industrial production index for the 6 months Treasury bill as compared to the 3 months, the signs of significant coefficients are consistent with expectations.

Excess return establishes positive relationships between yield spread and the dollar-pound exchange rates. There is a negative significant association between the excess return and the money supply for the 12 months compared to3 month's Treasury bill. However, the effect of the 6 months Treasury bill on the term premium is statistically insignificant. Industrial production index has a negative relationship with excess return for 6 months compared to 3 months Treasury bill. However, a positive relationship is identified when the maturity is increased to 6 months and compared to 3 months. This indicates that yield spread, industrial production, money supply, exchange rate possess explanatory power on the term premium in the term structure of interest rates.

Let us now take a look at how these variables are correlated in order to have an idea whether the relationship between them shows high or low correlation between excess return and the macroeconomic variables.

Table 5Estimated Correlation Matrix of Variables by EVIEW (6 MONTHS TREASURY BILL)

	H	YS	Y	M	EX
H	1	0.5070166932968506	-0.09277133166684791	-0.09101899261083397	-0.07182343179904155
YS	0.5070166932968506	1	-0.1585189494310804	-0.169418547936884	-0.148498536824932
Y	-0.09277133166684791	-0.1585189494310804	1	0.9360853494892 7	0.9615094095983871
M	-0.09101899261083397	-0.169418547936884	0.9360853494892 7	1	0.9722453666617723
EX	-0.07182343179904155	-0.148498536824932	0.9615094095983871	0.9722453666617723	1

Table 6 Estimated Correlation Matrix of Variables by EVIEW (12 MONTHS TREASURY BILL)

	H	YS	Y	M	EX
H	1	0.1847074976165291	-0.09035221412736021	-0.06392159562479022	0.1577282219700176
YS	0.1847074976165291	1	-0.1405016383894912	-0.07003454173868139	0.2628140812360633
Y	-0.09035221412736021	-0.1405016383894912	1	0.9046811741360365	0.3028976237536155
M	-0.06392159562479022	-0.07003454173868139	0.9046811741360365	1	0.3983520601937783
EX	0.1577282219700176	0.2628140812360633	0.3028976237536155	0.3983520601937783	1

While yield spread is positively correlated with excess returns, industrial production and money supply establishes a negative association. On the contrary dollar-pound exchange rates, is negatively correlated with excess return for the 6 months treasury bill and positively correlated with excess return for the 12 months treasury bill.

Generally, this result overlaps theoretical explanations as well as largely consistent with findings of most previous research.

Walid Hejazi, Huiwen lai and Xian Yan (Feb 2000) result s using Canadian data indicates that the conditional variances of industrial production, the money supply and the exchange rates are statistically insignificant determinants of excess returns. On the other hand, the level of yield spread and the conditional variance of excess returns themselves do contain statistically significant information for excess returns. On the contrary, for the united state data, they found that the conditional variance of both industrial production and the money supply are statistically significant determinants of excess returns. The conditional variance of excess returns themselves as well as the level of yield spread is also significant predictors of excess returns. The conditional variance of industrial production disappears, however, when these additional conditional variances are added. In addition, the coefficient estimates on the conditional variance of the money supply falls dramatically. They therefore concluded that ,In contrast to the united states evidence, the second moments of macroeconomic variables are not significant predictors on Canadian treasury bill t of maturities of two and three months. On the other hand, the conditional variance of excess returns and the level of yield spread do contain some important information for excess returns. Again, they found evidence of time varying risk premia in the Canadian Treasury bill term structure.

Lee Sang-Sub (May 1995) after investigating the macroeconomic sources of the time-varying risk premia in the term structure of interest rates, found out that the Garch conditional variance estimates of the industrial production index and the money supply are significant in all the risk premium equations examined. They also show significant explanatory power for the monthly excess return under investigation. The conditional variance of industrial production index and the money supply remain significant when yield spread is added to the risk premium equation. He also found out that yield spread which contains information about the risk premium, have significant explanatory power, despite the presence of macroeconomic factors.

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 SUMMARY OF RESULTS

The main purpose of this research is to provide empirical testing of the expectations hypothesis and the determinants of the term structure of interest rates in the United States economy in order to examine closely the impact of macroeconomic variables on the term structure of interest rates. Specifically, it has attempted to Investigate whether macroeconomic variables has any significant explanatory power on the term structure .tests as to why the earlier researchers rejected the expectations hypothesis was also investigated. To achieve these aims, an extensive review of the existing empirical literature on the expectations hypothesis, the theoretical derivation of the time varying risk premia and the association between some macroeconomic variables and the term structure of interest rates has been done. Similarly, 432 monthly secondary financial and macroeconomic data relating to the United States economy from 1964 to 1999 has been used for the analysis. Macroeconomic variables namely industrial production index, money supply, the dollar-pound exchange rates and the yield spread were selected for the study.

The yield spread is selected based on its dominant role in the excess return equation and its association with the term structure of interest rates. The other three variables were selected in accordance with the findings of previous researchers such as Engle et al(1987), Dotsey et al(1995), Harris(2004), Pornpinun chantapacdepong (March 2007) to mention but a few. In line with the works of Walid Hejazi, Huiwen lai and Xian Yan (Feb 2000, Lee Sang-Sub (May 1995) to mention but a few, excess return is used as a proxy for the term premium. the main assumption behind this is

that excess return is a combination of the term premium and forecast errors. The data were obtained from st. Louis Fed economic research .Two broad working hypotheses are set for the work. The first one is the expectations hypothesis and the second is that macro-economic variables have no explanatory power on the term structure of interest rates. These are of course empirical questions that on the face it seems to be researchable. To test these hypotheses, two major econometric tests are run.

First, a test as to whether the term premium is a constant or time varying using eviews. in line with the works and methodology of Walid Hejazi, Huiwen lai and Xian Yan (Feb 2000, Lee Sang-Sub (May 1995) and Pornpinun chantapacdepong (March 2007) ,an ordinary least square regression of 432 monthly data of excess retun and the yield spread is performed. The study found data expectations hypothesis that assumes the term premium to be a constant to be wrong. Thus the rejected the hypothesis was rejected . this research igave me a similar results when a research as to whether the expectations hypothesis should be accepted or rejected was performed by Pornpinun chantapacdepong (March 2007) and others.

Secondly, I investigated whether macroeconomic variables have any significant explanatory power on the term premia in the term structure of interest rate. using eviews and in line with the work and methodology of Engle et al (1987), a GARCH estimation of 432 monthly data of the industrial production index, money supply, the dollar-pound exchange rate and the yield spread is run under the broader framework of Walid Hejazi, Huiwen lai and Xian Yan (Feb 2000, Lee Sang-Sub (May 1995). excess return used as a proxy for the term premium. The major empirical finding is that the yield spread, money supply and the dollar pound exchange rate are statistically significant predictors of excess return in the United States economy. Further, positive association is reported for yield spread and the dollar pound exchange rate while negative association is found for the money supply index. However, while industrial production index has a negative relationship with the excess return for 6 months Treasury bill as compared to 3 months, a positive association is reported for the longer term maturity (excess return of 12 months Treasury bill as compared to 3 months). While most studies found industrial production index and to be statistically significant predictors of excess return no matter what the maturity is, my data found industrial production index to be weak a weak predictor of excess return for short term maturity on the United States economy. moreover my research gave the same result as Walid Hejazi, Huiwen lai and Xian Yan (Feb 2000, Lee Sang-Sub (May 1995),whose works found the money supply, the dollar-pound exchange rate and the yield spread to be statistically significant predictors of excess return.

5.2 CONCLUSIONS

It has overwhelmingly been documented by previous researchers including Walid Hejazi, Huiwen lai and Xian Yan (Feb 2000, Lee Sang-Sub (May1995), Pornpinun chantapacdepong (March 2007) that generally some macroeconomic variables possess explanatory power on the term premia in the term structure of interest rates. moreover, it is widely known that the term premium is time varying and not a constant as suggested by the expectations hypothesis. Walid et al used Treasury bill data and some macroeconomic variables in testing for both the expectations hypothesis and the determinants of the excess return in two countries namely Canada and the United States. Using the arch in mean methodology, they found out that the yield spread and the conditional variance of excess return are significant predictors of excess return. They emphasized on the recent united state evidence that suggested the conditional variance of industrial production and the money supply to be significant predictors of the term premia at the short end of the maturity spectrum.

However, my results found the conditional variance of the yield spread, money supply and the dollar-pound exchange rates to be significant predictors of the term premia. The effect of the conditional variance of industrial production index as a significant predictor of the term premia at the short end of the maturity is not felt. However, the conditional variance of industrial predicts the term premia for longer term to maturity treasury bills. In addition, the term premia in the United States economy are found to be time varying. This result came about as the expectations hypothesis that assumes the term premia to be a constant was rejected by my tests. The works of Pornpinun chantapacdepong (March 2007), Walid Hejazi, Huiwen lai and Xian Yan (Feb 2000, Lee Sang-Sub (May 1995) confirms this is true. Further, to

a greater degree, the evidence found for the United States case is highly consistent with previous evidence. However, these results must be explained in the light of the following observations. Most of the earlier studies tested the theory using OLS and the garch techniques. The United States is operates in a system where, the financial sector is dominated by the banking sector through which macroeconomic changes such as money supply primarily operate. Indeed, the general perception is decades of economic reforms are yet to be realised. Hence, if similar result is arrived at for subsequent periods, then it can strongly be concluded that the conditional variance of some macroeconomic variables namely industrial production index, money supply, the dollar-pound exchange rate and the yield spread are significant determinants of the term premium in the term structure of interest rates.

There are some limitations in this study arising from the lack of unified theoretical literature, difficulty in accessing the appropriate data and other related problems. Using excess return to proxy the term premium might not be ideal as it only captures in addition all forecast errors. Another shortcoming of the data analysis is the short observation period, which covers the period 1964 to 1999. It should be noted that this was the period in which all the data concerning my macroeconomic variable can be achieved on the internet. Given these limitations, there is a need for on-going research into their influence of other macroeconomic variables on the term premium. Thus, these tests might be re-examined under the consideration of more or other factors than considered.

5.4 RECOMMENDATIONS

I recommend the following advice to investors, government, exchange authorities and academia, researchers and banks in view of my findings.

Investors

It has been found that the conditional variance of industrial production index, money supply, the dollar-pound exchange rates and the yield spread determines the term premium. With exceptions of industrial production index that determines the term premium only at longer term to maturity treasury bills ,correlations also indicate that the conditional variances of industrial production index, money supply, the dollar-pound exchange rate and the yield spread are determinants of the term premium. Ceteris paribus, improvement in these variables signals the possibility of earning higher excess returns in an investment. Accordingly, investors should check the state of the conditional variance of industrial production index, money supply, the dollar-pound exchange rate and the yield spread before making an investment in order to get a premium.

Government

Conditional variance of money supply has been found to be statistically predictors of excess return in a negative correlation. The economic implication is that money supply possesses the potential of limiting the term premium. On the other hand, industrial production index, money supply, the dollar-pound exchange rate and the yield spread are positively associated with excess return. An indication is that they contribute to increases in excess returns in the interest rate market. Further, money supply, Treasury bill rate, world crude oil and cocoa prices are also found to be co-integrated with stock returns. Also, meaning, in the long-run, returns and growths of the market are determined by these macroeconomic variables. To ensure a guaranteed excess return, government should set realistic macroeconomic targets to limit chronic deviations.

Academics and Banks

Academia and banks should collaborate to initiate an intensive research focusing on different aspects of macroeconomic variables in the economy. Moreover, outcomes of these investigations should be published in all academic institutions and made available to all. This will promote and encourage further research.

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