Unbiased Expectation Theory

Unbiased expectation theory (UET), which posits that long-term interest rates are determined by the market's expectations of future short-term interest rates, is a fundamental concept in the field of fixed-income securities. According to the expectation hypothesis, forward interest rates should be unbiased estimates of expected future spot interest rates.

1. Introduction

The unbiased expectations theory (UET), also known as the interest rate expectation hypothesis, is commonly used in fixed-income markets, where forward rates are often used to estimate future interest rates and make investment decisions. The theory suggests that investors do not have a systematic bias in their expectations and that they do not prefer one type of investment horizon over another. In other words, long-term forward rates are expected to be, on average, the same as the compounded average of short-term interest rates over the same period. According to this hypothesis, investors form their expectations about future interest rates based on all available information, and the forward rates, which are the market's best estimate of future rates, are unbiased predictors of actual future spot rates. This theory has been developed and refined over time through contributions from various scholars in the field of finance and economics. Some early works that have been associated with its development took place in the 1930s [1][2] and later on the 1970s/1980s [3][4][5][6].

However, it is important to note that the relationship proposed between forward and spot rates is a theoretical concept and may not always hold true in practice. Various factors, such as market sentiment, investor sentiment, and changing economic conditions, can cause deviations from the hypothesis, leading to differences between expected and actual interest rate movements.

This hypothesis has been subject to empirical research and debate in the academic literature. Some studies have provided evidence in support of the theory, suggesting that forward rates do indeed provide unbiased predictions of future interest rates. Other studies, however, have found evidence of deviations from the theory, indicating that market participants may have systematic biases in their expectations, leading to discrepancies between forward rates and actual future rates.

For example, research by [7][8] found that forward rates are generally good predictors of future short-term interest rates, but they tend to overestimate long-term rates. Similarly, [9] proposed the "excess volatility puzzle," which suggests that long-term interest rates are more volatile than what the UET would predict, implying that market participants may have time-varying expectations.

More recent empirical studies have shown that there seems to be a systematic difference or *bias* between forward interest rates and expected future spot interest rates; see, for instance, [10][11][12][13][14] or [15]. This bias has, thus, been a topic of extensive research and has been found to persist despite various modifications and refinements to the expectation hypothesis.

The theory of the classical expectation hypothesis postulates that forward rates are unbiased predictors of future spot rates under the real-life probability measure, P. The empirical evidence, however, shows this does not hold in practice and proposes a risk premia (or risk aversion) explanation for the identified bias. In other words, the literature implicitly assumes the expectation hypothesis would work in a risk-neutral world, where the risk aversion effect does not influence the value of interest rates, or equivalently, when researchers take the expectation under the so-called risk neutral martingale measure Q. A "puzzle", however, arises when one realizes only abnormally high levels of risk aversion would be able to explain the observed bias. [16] analysed the expectation hypothesis using U.S. Treasury bills data. Based upon a representative agent with constant relative risk aversion (CRRA), they concluded that only CRRA coefficients greater

than 8 would support risk aversion as an explanation for the bias. However, commonly observed CRRA coefficients are much lower than these; see, for instance, [17], who refer to values of between 1 and 2 as bounds for the CRRA coefficient.

The existence of the expectation hypothesis bias has important implications for financial markets, as well as implications for pricing fixed-income securities, interest rate derivatives, and risk management strategies. Understanding the sources and implications of this bias is crucial for financial practitioners, policymakers, and researchers.

2. Unbiased Expectation Theory

There are several potential sources of the expectation hypothesis bias in fixed-income markets that have been proposed in the literature. The commonly cited source is risk aversion, which suggests that investors may require a premium for bearing uncertainty about future interest rate movements. This risk aversion adjustment results in a bias in the forward interest rates relative to expected future spot interest rates. Several studies have explored the role of risk aversion in explaining the expectation hypothesis bias and have found that it can account for only part of the observed bias [8][16][18][19]. Another potential source of the expectation hypothesis bias is market segmentation, which suggests that different market participants may have different expectations about future interest rate movements, leading to differences between forward interest rates and expected future spot interest rates. Market segmentation can arise from differences in information, trading strategies, and market liquidity, among other factors. Some studies have found evidence of market segmentation in fixed-income markets and have suggested that it can contribute to the expectation hypothesis bias [20]. Additionally, time-varying risk premia have also been proposed as a source of the expectation hypothesis bias. Time-varying risk premia may result from changes in market conditions, macroeconomic factors, or investor sentiment and can affect the relative pricing of forward interest rates and expected future spot interest rates. Several studies have examined the role of time-varying risk premia in explaining the expectation hypothesis bias and have found evidence of their significance [15][21][22]. More recently, it has been proposed that examining investors' well-known behavioural biases when computing expectations could help explain what risk aversion seems to be unable to explain [23].

Empirical methods, such as regression analysis and time series econometrics, have also been employed to explain and quantify the expectation hypothesis bias. These methods involve analysing historical data on interest rates, macroeconomic variables, and other relevant factors to identify patterns and relationships that may explain the observed bias. Empirical methods provide valuable insights into the potential sources of the expectation hypothesis bias and their quantitative effects, but they are also subject to limitations such as data availability, model specification, and potential confounding factors.

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