The expectations hypothesis: New hope or illusory support?

Boonlert Jitmaneeroj [a], Andrew Wood [b],*

[a] School of Business, University of the Thai Chamber of Commerce, Bangkok 10400, Thailand
[b] Essex Business School, University of Essex, Wivenhoe Park, Colchester CO4 3SQ, United Kingdom

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ABSTRACT

Recent studies of the expectations hypothesis of the term structure (EHTS) find evidence in favor of the EHTS using post 1980s US data. This has been attributed to the relative macro stability of this period and greater market efficiency. Using a panel of forecasts for 3-month interest rates for ten countries we test separately for EHTS and rational expectations. Assuming rational expectations holds we find support for the EHTS is illusory due to an off-setting time-varying term premia and non-rational expectations. Previous forecast-based studies suggest biased expectations tend to reinforce the effect of a time varying term premium. This change can be understood in the context of Fama's (2006) argument that markets tend to underestimate future spot rates during periods of long-run increases and overestimate during declines.

1. Introduction

Despite a well documented lack of empirical support, the expectations hypothesis of the term structure (EHTS) remains central to our understanding of the behavior of interest rates. The endurability of the theory in the face of a volume of contrary evidence has been such that it has been likened to a cartoon character that no matter how apparently life terminating is the assault it is subject to, it will always bounce back to fight another day (Shiller et al., 1983). In what is perhaps a surprising twist to this saga, the faith that has implicitly been placed upon the EHTS appears to have been justified by the "new hope" offered by recent studies that present evidence purporting to support the EHTS for more recent sample periods (Bulkley et al., 2011; Rudebusch and Wu, 2007).

Two types of explanation have been offered for this turnaround. In their examination of an update of McCulloch and Kwon (1993) US Treasury yield data for the post-1991 period, Bulkley et al. (2011) suggest the recent support for the EHTS reflects increased efficiency in the bonds market as market participants exploited the anomalies identified in the earlier literature. This process was further facilitated by the various financial innovations introduced from the 1980s onwards that had the effect of reducing transaction costs and increasing liquidity in the bond markets. The second approach considers the macro environment. Rudebusch and Wu

(2007) allow for a structural break in term structure behavior and find support for the EHTS post-1988 but not the preceding period which they suggest can be explained by relative factor stability and lower risk premia during the period of 'great moderation' relative to the earlier period of high and volatile inflation.[1]

In this paper, we use survey data to directly examine the behavior of the term premia for short term interest rates and the way in which expectations are formed during the period identified by Bulkley et al. (2011) and Rudebusch and Wu (2007) as consistent with the EHTS. The advantage of using survey data is that it frees us from the joint hypothesis problem of testing the EHTS alongside the rational expectations hypothesis (REH). Moreover, it enables an investigation of the interplay of a time-varying term premium and any deviations from rational expectations.

Although the evidence provided in the current study is restricted to 3 month interest rates, our findings provide an interesting perspective on those of Bulkley et al. (2011) and Rudebusch and Wu (2007). Assuming rational expectations, we show that the recent evidence in support of the EHTS, at least at the short

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* Corresponding author. Tel.: +44 1206 872402; fax: +44 1206 873429.
E-mail addresses: boonlert_jit@utcc.ac.th (B. Jitmaneeroj), wooda@essex.ac.uk (A. Wood).

[1] Some other studies that adopt a framework that allows for what Fuhrer (1996) describes as a "time varying monetary policy" have been more bullish in their support of the EHTS. For example, Bianchi et al. (2009) demonstrate that allowing for changes in monetary regimes or different phases of the business cycle can reconcile the theory of the EHTS with the empirical evidence. By contrast, Ravenna and Seppälä (2007a, 2007b) combine habit-formation preferences and an inertial monetary policy rule to produce a model that accounts for term structure behavior that is otherwise inconsistent with the EHTS. On the other hand, Brown et al. (2008) suggest recent evidence in support of the EHTS may be sample specific.

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end of the yield curve, can be extended beyond the US with results for nine out of the ten countries in our sample failing to reject the EHTS. Exploiting our survey data, we find that although the forward premium has predictive power for future spot rates, we nevertheless reject both the EHTS and REH; a result that is contrary to Bulkley et al. (2011) and Rudebusch and Wu (2007) but is consistent with previous studies that use survey evidence (Froot, 1989; MacDonald and MacMillan, 1994).

A closer examination of the way expectations are formed helps to explain how the recent evidence may be providing illusory support for the EHTS, especially for short term rates. Froot (1989) demonstrated that the slope coefficient from a standard test of the EHTS which assumes the REH holds can deviate from one, either because of a time varying term premium or systematic expectational errors. He finds evidence of both with expectations systematically overweighting on the forward premium and thereby contributing to the rejection of the EHTS. It follows that for Froot's sample, tests of the EHTS that assume rational expectations overstate the magnitude of the rejection of the theory. By contrast, we find that expectations systematically underweight on the forward premium, thereby off-setting the effect of the time-varying term premium and giving rise to the possibility of a false acceptance of the EHTS in a standard test.

The idea that there is inertia in expectations of inflation and interest rates is not new (Fisher, 1930; De Bondt and Bange, 1992) and has recently been highlighted by Fama (2006) who suggests that bond markets are slow to recognize the impact of major changes to the monetary regime and are consequently slow to adjust their inflationary and interest rate expectations. He shows that markets in the US were surprised by the permanence of the increase in inflation during the 1960s and 1970s and were then again surprised by the subsequent decline during the 1980s and 1990s. As a consequence, expectations tended to systematically underestimate spot rates during the former period and overestimate them during the latter. Fama's (2006) findings are important for the current study because the systematic errors he identifies highlight the inappropriateness of assuming rational expectations as conventionally defined.[2] Even more importantly, the switch in expectations from overweighting on the forward premium in Froot's study to underweighting in the current study is consistent with Fama's finding that markets systematically underestimated future spot rates during the period corresponding to Froot's sample in which the interest rates trended upwards, and then systematically overestimated spot rates during the long downward trend that corresponds with our sample.

The remainder of this paper is structured as follows. Section 2 presents the analytical framework and methodology. In Section 3, we provide a description of the data set. Section 4 reports the empirical findings and compares the results between the different approaches of the EHTS tests. Finally, Section 5 concludes.

2. Analytical framework and methodology

In the absence of direct measures of interest rate expectations, a common test of the EHTS in conjunction with the REH is based on estimations of the following equations (see for example Fama, 1984)

$$r_{t+k} - r_t = \alpha_1 + \beta_1(f_{t,k} - r_t) + \varepsilon_{t+k,1} \tag{1}$$

where r_t denotes the interest rate at time t, r_{t+k} denotes the interest rate at time $t + k$, and $f_{t,k}$ denotes the forward rate at time t maturing in k-periods ahead. The joint null hypothesis of the EHTS and REH is $\beta_1 = 1$. Conditional on the REH assumption, a finding that β_1 is significantly different from unity implies that variations in the forward premium are explained by variations in the expected interest rate change and a time-varying term premium. In other words, the EHTS does not hold. The primary limitation of this non-forecast approach is that deviations of β_1 from unity are commonly attributed to the existence of a time-varying term premium because the REH is assumed to hold although this assumption is not tested.

To overcome the joint hypothesis problem some studies have employed consensus forecasts as proxies for the market's expectations. This consensus forecast approach enables separate tests of the EHTS and the REH. The following regressions are the focus of empirical studies based on consensus forecasts (see for example Froot, 1989).

$$r_{t,k}^s - r_t = \alpha_2 + \beta_2(f_{t,k} - r_t) + \varepsilon_{t,k,2} \tag{2}$$

$$r_{t+k} - r_{t,k}^s = \alpha_3 + \beta_3(f_{t,k} - r_t) + \varepsilon_{t+k,3} \tag{3}$$

where $r_{t,k}^s$ is the consensus forecast of the interest rate at time t for k-periods ahead. The EHTS cannot be rejected if the null hypothesis $\beta_2 = 1$ holds. Evidence that β_2 significantly deviates from one can be interpreted as evidence of a time-varying term premium, implying rejection of the EHTS. We use Eq. (3) to test the REH under the null hypothesis $\alpha_3 = 0$ and $\beta_3 = 0$. Non-rejection of the null hypothesis implies that consensus forecasts already reflect the information available in the forward premium.

However, there remains a concern regarding the use of a consensus measure of survey expectations since it may conceal heterogeneous expectations among individual agents. Bonham and Cohen (2001) demonstrate that unless individual expectations are homogeneous, tests of the REH, and by extension the EHTS, should be performed by individual regressions because the use of a consensus forecast introduces an aggregation bias that conceals heterogeneity amongst individual forecasts, thereby resulting in misleading statistical inferences. In response to these concerns, we integrate the consensus-based test of the EHTS developed by Froot (1989) with the homogeneity test introduced by Ito (1990) and later extended by MacDonald and Marsh (1996). We test for homogeneity by regressing the deviation of individual forecasts from the consensus mean forecast on the forward premium

$$r_{i,t,k}^e - r_{t,k}^s = \alpha_{4i} + \beta_{4i}(f_{t,k} - r_t) + \varepsilon_{i,t,k,4} \tag{4}$$

where $r_{i,t,k}^e$ denotes individual agent i's expectations of interest rates at time t for k-periods ahead and $r_{t,k}^s$ denotes the consensus mean forecast of interest rate at time t for k-periods ahead. If homogeneity holds, we would expect that $\alpha_{4i} = 0$ and $\beta_{4i} = 0$. We can re-formulate Eqs. (2) and (3) to test the EHTS and REH for individual agents. Adding Eq. (4) to Eq. (2), subtracting Eq. (4) from Eq. (3) and rearranging, we obtain the following equations corresponding to Eqs. (2) and (3) respectively.

$$r_{i,t,k}^e - r_t = \alpha_{5i} + \beta_{5i}(f_{t,k} - r_t) + \varepsilon_{i,t,k,5} \tag{5}$$

$$r_{t+k} - r_{i,t,k}^e = \alpha_{6i} + \beta_{6i}(f_{t,k} - r_t) + \varepsilon_{i,t+k,6} \tag{6}$$

We use Eq. (5) to test the EHTS under the null hypothesis $\beta_{5i} = 1$. The REH can be tested by Eq. (6) with the null hypothesis $\alpha_{6i} = 0$ and $\beta_{6i} = 0$. Thus far, we have demonstrated that the EHTS can be investigated by three approaches: the non-forecast, the consensus forecast and the individual forecast approaches. It is important to note that Eqs. (1)–(6) share a common regressor, thus enabling the investigation of the relationship between betas estimated from all six equations.

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[2] Since it is customary for studies that adopt the methodology used in this paper to assume rational expectations to hold, when discussing our empirical results we will refer to the evidence as relating to 'rational' or 'non rational' expectations in the context of the rational expectations hypothesis. We are aware that this terminology would not be appropriate should we adopt a broader definition of rationality that allows for systematic errors such as implied by Fama (2006).