Predictions of short-term rates and the expectations hypothesis

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ABSTRACT

This paper emphasizes that traditional tests of the EH are based on two assumptions: the expectations hypothesis (EH) per se and an assumption about the expectations generating process (EGP) for the short-term rate. Arguing that conventional tests of the EH need to assume EGPs that may be significantly at odds with the true EGP, we investigate this possibility by analyzing the out-of-sample predictive performances of several models for predicting interest rates, including a few models which assume that the EH holds in its functional form that relates long- to short-term yields. Using US riskless yield data for a 1970–2016 monthly sample and testing methods that take into account the parameter uncertainty, the null hypothesis of an equal predictive accuracy of each model relative to the random walk alternative is hardly ever rejected at intermediate and long horizons. This confirms that, at least at a practical level, the main difficulty with the EH is represented by the effective prediction of short-term rates. We discuss the relevance of these findings for central banks' use of forward guidance.

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"The forecasting of short term interest rates by long term interest is, in general, so bad that the student may well begin to wonder whether, in fact, there really is any attempt to forecast."

Macaulay (1938, p. 33)

1. Introduction

The expectations hypothesis (EH) of the term structure of interest rates—the proposition that the long-term rate is determined by the market's *expectations* of short rates over the holding period of the long-term bond plus a (constant) risk premium—is a key paradigm that is at the core of the monetary policy transmission mechanism. Indeed, virtually every central bank conducts monetary policy by targeting a short-term rate. However, as has been noted

by Woodford (2003) and others, the effectiveness of monetary policy depends critically on a central bank's ability to affect the longer-term rates that matter most for the aggregate demand. This observation has prompted at least five central banks—the Reserve Bank of New Zealand, the Norges Bank, the Riksbank, the Czech National Bank, and the Federal Reserve—to provide forward guidance (i.e., a detailed, state-contingent commitment to a certain path of future monetary policy actions) about the path of the relevant short-term interest rate in an attempt to have a larger effect on longer-term interest rates (e.g., see Andersson & Hoffman, 2010; Kool & Thornton, 2015).

This adoption of forward guidance has occurred despite the EH having been rejected using a wide range of interest rate series, over a variety of sample periods, alternative monetary policy regimes, and a range of other details of the typical research design (e.g., see Campbell & Shiller, 1991; Della Corte, Sarno, & Thornton, 2008; Mankiw & Miron, 1986; Roberds, Runkle, & Whiteman, 1996; Sarno, Thornton, & Valente, 2007; Thornton, 2005). The most common

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explanations for the failure of the EH are that the single-equation models that are used most often for testing it are subject to spurious rejections because of time-varying risk premia, non-rational expectations, peso problems, and measurement errors (e.g., Bekaert, Hodrick, & Marshall, 2001; Dai & Singleton, 2002; Driffill, Psaradakis, & Sola, 1997; Hess & Kamara, 2005; Roberds & Whiteman, 1999; Tzavalis & Wickens, 1997).

However, Froot (1989) and others have noted that tests of the EH are really tests of two hypotheses: (a) the functional form that relates long- and short-term rates and that is commonly called the EH, and (b) a hypothesis about the process that generates the market's expectations of future short rates, the expectations generating process (EGP). Hence, the EH can be rejected either because (a) is false, i.e., the linkages between long- and short-term rates implied by the EH are inconsistent with the data; or because (b) is false, with the assumed EGP being significantly at odds with the true, but unknown, EGP. It is important to know the source of the failure of the EH. If the empirical failure of the EH stems from (b) rather than (a), the recent forward guidance policies may be effective, but only if central banks can credibly commit to a path for the policy rate, as Woodford (2012) emphasized. However, if the rejection of the EH is due to a rejection of (a), such central bank forward guidance is unlikely to be successful.[1]

Others have addressed this problem using alternative EGPs. Froot (1989) used survey data in order to test the EH independently of conventional assumptions on the expectations generating mechanism. Fuhrer (1996) compared the observed long-term rate with that implied by the pure EH based on rational expectations of the federal funds rate obtained from a Taylor-style reaction function that allowed for shifts in the Fed's reaction function. He found that his EH-implied long-term rate matched the observed long-term rate more closely than that implied by a five-variable VAR. Kozicki and Tinsley (2001) performed a similar analysis allowing for historical shifts in the market perceptions of an estimated Fed's inflation target.[2] Elsewhere, they concluded that "(…) empirical rejections might reflect incorrect assumptions about expectations formation rather than incorrect assumptions about the theoretical link between long rates and short rates," i.e., a rejection of the EH (Kozicki & Tinsley, 2005 p. 444). Carriero, Favero, and Kaminska (2006) suggested that the common practice of using the actual, realized short-term rate as a proxy for the *h*-period-ahead expectation of the short-term rate may be grossly inappropriate, and report that the evidence against the EH is reduced by using an alternative EGP.

Our research is also motivated by the fact that, while the validity of the EH may be independent of the market's ability to predict future short-term rates, its practical usefulness is not. For example, if the market were unable to predict changes in the short-term rate beyond its current level, the EH could still be valid but would be of little use, as the term spread would provide no valuable information about the future path of interest rates. Indeed, based on their prior failure, investors would be best advised to avoid any temptation to predict future short-term rates.

Testing the EH under alternative assumptions about the EGP is problematic, as Thornton (2006) showed that conventional tests of the EH can yield evidence favorable to the EH even when the EH is known to be false. Moreover, Bekaert, Hodrick, and Marshall (1997) showed that the coefficient estimates from single-equation tests of the EH are subject to a small-sample bias that is extremely slow to die out as the sample size increases. As a consequence, rather than proposing a specific alternative EGP as others have done, we investigate the possibility that the well-documented rejections of the EH may be due simply to an inability to forecast future short-term rates. We do this by investigating the forecasting powers of a rich set of models that have emerged in the literature (e.g., Bali, Heidari, & Wu, 2009; Dai & Singleton, 2002; DL, 2006; Diebold, Rudebusch, & Aruoba, 2006; Duffee, 2002) and have been shown elsewhere to have predictive power. Specifically, using monthly data on US riskless pure discount bond yields for the period January 1970–December 2016, we use these models to produce real-time, out-of-sample forecasts of short-term rates. We also use a relatively simple identification procedure that can accommodate time variation in the risk premia—a common explanation for the empirical failure of the EH—to obtain estimates of the conditional expectation of the short-term rate under the assumption that the EH holds.

Hence, we consider both forecasting models that impose the EH but make no specific assumptions about the EGP, and models that implicitly encompass a fairly broad range of sensible EGPs. Some of the models considered impose little or no structure on the term structure of rates, while others impose a considerable structure. For instance, affine term structure models allow for variation in the risk premia and impose no-arbitrage. Finally, we generate forecasts from two naive benchmark models: the random walk model and a simple regression model that forecasts the short-term rate by using the slope of the yield curve, as suggested by Duffee (2002). The forecasts are computed for a range of maturities over the period April 1983–December 2016. However, because we are interested in providing a better understanding of the empirical failure of the EH prior to the financial crisis (when the results cannot be affected by the financial market instability that followed the Lehman Brothers' bankruptcy in September 2008), we place a special emphasis on results for the period up until August 2008, and treat the sub-sample September 2008–December 2016 as a robustness check. There is of course a fairly extensive body of literature on the forecasting of short-term riskless rates; however, we believe that both the breadth of the models that we investigate and our exhaustive set of recursive out-of-sample exercises are unique, and provide an important insight into the commonly-reported failure of the EH.

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[1] Note that finding that (b) is empirically plausible, i.e., that there is an EGP that supports the notion that future short rates are predictable, does not imply that the EH holds. In fact, it merely makes the logical standing of the EH more fragile, because any direct rejection of the EH restriction must then derive from a rejection of (a).

[2] Kozicki and Tinsley (2005) performed a similar analysis but emphasized the fit of long-term yields based on conventional tests of the EH, rather than a comparison with the observed long-term yield as Fuhrer (1996) and Kozicki and Tinsley (2001) do.