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Testing the expectations hypothesis for the Eurozone: A nonlinear cointegration analysis



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ABSTRACT

Most studies examining the expectations hypothesis (EH) of the term structure of interest rates assume that the adjustment process between short term and long term interest rates is linear. However, ignoring the possible nonlinearity between interest rates may result in misleading empirical results. In this paper, we investigate the term structure of interest rates for selected Eurozone countries using the nonlinear cointegration tests introduced by Kapetanios et al. (2006). Accounting for the effects of global financial and debt crisis, we find supportive evidence for the EH for Greece during the period covering the sovereign debt crisis.

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1. Introduction

The term structure of interest rates, which shows the relation between short and long term interest rates, is of considerable interest for both market participants and monetary authorities. For investors, the term structure of interest rates may contain valuable information regarding the future rate of returns. The term structure has also implications for monetary policy transmission channels. One of the theories proposed to explain the term structure of interest rates is the expectations hypothesis

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(EH), which implies that long term interest rate is a weighted average of current and expected future short term interest rates plus liquidity premium.

The EH has been extensively tested in financial economics with mixed results regarding its validity. The majority of studies applied the linear cointegration approach to investigate the term structure of interest rates, including [Campbell and Shiller \(1987\)](#), [Hall et al. \(1992\)](#), [Engsted and Tanggaard \(1994\)](#) and [Gerlach and Smets \(1997\)](#) among many others. A common feature of these studies is that they assume a linear adjustment process. Yet, the term structure adjustment may well be nonlinear. Indeed, several reasons for nonlinearity have been put forward in the literature such as the effects of transaction costs ([Anderson, 1997](#)); time varying risk premia ([Fama, 1990](#)); regime switching behavior ([Bekaert et al., 1997](#)); structural changes in monetary policies ([Mankiw and Miron, 1986](#)) and large differences in maturities ([Bachmeier, 2002](#)). It is well known that conventional cointegration tests assuming linear adjustment provide less power and fail to detect a long run relationship between short and long term interest rates under such conditions. It is therefore not surprising that recent studies began to apply nonlinear methods to examine the EH. Several authors including [Clements and Galvao \(2003\)](#), [Clarida et al. \(2006\)](#), and [Mili et al. \(2012\)](#) recently found strong evidence of nonlinearities in the relationship between interest rates.

Against this background, our objective in this study is to examine the empirical adequacy of the EH by applying the nonlinear cointegrating approach developed by [Kapetanios et al. \(2006\)](#) (henceforth KSS). This approach, which is based on the linear smooth transition autoregression (STAR) framework, is more appropriate for investigating the EH in the presence of nonlinearities.

The second objective of this paper is to provide an analysis of the EH for the Eurozone countries. There are only a few papers that have explicitly examined the EH for the Eurozone. [Durré \(2006\)](#) and [Musti and D'Ecclesia \(2008\)](#) investigated the empirical validity of the EH for Italy and Germany respectively and concluded that interest rates of different maturities are linked together over time. [Koukouritakis and Michelis \(2008\)](#) found supportive evidence of the EH for 28 countries of the European Union. In a recent study, [Koukouritakis \(2013\)](#) reported that the empirical findings are against the EH for five largest EU countries except for some specific spreads.

Our paper is different from the aforementioned empirical studies in two respects. To the best of our knowledge, none of these studies have applied the nonlinear cointegration approach. Secondly, we extend previous studies by examining the term structure of interest rates over a more recent time span covering the period between 1999:01 and 2015:2. Performing this analysis for the recent data is important to capture the effects of the global financial and debt crisis on European yields. To this end, we use monthly short term and long term interest rate data from 15 countries in the Eurozone and analyze how the new financial environment has affected the relation between short and long term rates by considering distinct sample periods. First, we have divided the sample period into two sub periods as before and after July 2007 to take into account the effect of global financial crisis. Then, we have chosen different sample periods for Greece, Ireland, Portugal and Spain to cover the sovereign debt crisis.

The rest of the paper is organized as follows: [Section 2](#) explains the methodology used in the paper, [Section 3](#) presents the data and the empirical results, and finally, [Section 4](#) provides a conclusion.

2. Econometric methodology

The EH can be formally written as a weighted average of current and expected future short term interest rates plus the liquidity premium as suggested by [Hall et al. \(1992\)](#):

$$R_t(k) = \frac{1}{k} \left[\sum_{j=1}^k E_t [R_{t+j-1}(1)] \right] + L_t(k) \quad (2.1)$$

where $R_t(k)$ is the continuously compounded yield on time t and maturity of the k period, E_t is the expectation operator conditioned on information available at time t , and $L_t(k)$ is the liquidity premium of the k period. Reflecting investors' risk considerations or liquidity preference, liquidity premium is assumed to be constant (zero) under the strong (weak) version of the EH.

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