Economic Modelling 64 (2017) 178–200

Contents lists available at ScienceDirect

Economic Modelling

journal homepage: www.elsevier.com/locate/econmod

Modelling European sovereign bond yields with international portfolio effects

Franck Martin[1], Jiangxingyun Zhang*

University of Rennes 1 and CREM-CNRS, France

ARTICLE INFO

Keywords:
European sovereign debt crisis
Portfolio management
Term structure model of interest rates
Contagion
Flight-to-quality
Two-step econometric model
European QE programs

ABSTRACT

This paper proposes a portfolio choice model with two countries to evaluate the specific role of volatility and co-volatility risks in the formation of long-term European interest rates over the crisis and post-crisis periods with an active role of the European Central Bank. Long-term equilibrium rates depend crucially on the covariances between international bond yields anticipated by investors. Positively anticipated covariances amplify the phenomena of fundamental contagions related to the degradations of public finance and solvency of sovereign debt issuer, while negatively anticipated covariances amplify the phenomena of Flight-to-quality. The two-step econometric approach over the period January 2006 to September 2016 analyses 21 European market pairs in a bivariate GARCH framework. Empirical results show that the decline in German and French long-term rates from March 2011 is partially due to the decrease in both risk premium and covariances with periphery countries. These declines actually amplify the mechanisms of Flight-to-quality. Finally, a lower sensitivity of rate to volatility and co-volatility risks during the crisis period gives credit to the hypothesis of a occasional fragmentation of the European sovereign bond markets (De Santis and Stein, 2016; Ehrmann and Fratzscher, 2017).

1. Introduction

The articles focusing on the dynamics of sovereign interest rates during the debt crisis in euro area mainly seek to identify the episodes of contagion and Flight-to-quality between bond markets. These literature focus primarily on the default risks of sovereign issuers. Either they try to evaluate the solvability of issuers by relevant variables, typically the variables presented in the debt sustainability equation (Afonso et al., 2012; Arghyrou and Kontonikas, 2012; Gómez-Puig and Sosvilla Rivero, 2014; Ludwig, 2013), or directly by the premium paid on sovereign CDS (De Santis and Stein, 2016; Longstaff et al., 2011; Claeys and Vašíček, 2014). Certain articles also explain the credit risks by extreme events on sovereign bond markets (Metiu, 2012). One of the challenges met by these research is how to distinguish a phenomenon of fundamental contagion that declines in bond markets are associated with a downgrade of sovereign credit ratings, from pure contagion that declines in markets and rising rates are the consequences of speculative strategies. The border is porous between these two notions of contagion since pure contagion can, through the rise of the rates, lead to an objective downgrade of sovereign debt issuers and switch into a regime of fundamental contagion. In our opinion, this explains why empirical literature has difficulty in distinguishing between these two types of contagion. Most of the time, articles conclude on the coexistence of the two contagion regimes.[2]

In the contrast to contagion, the episodes of Flight-to-quality are defined as a decrease in the correlation between bond markets over a given period. It is conceived as a reallocation of bond portfolios to healthier markets, with little default risks. The mechanism of Flight-to-quality is therefore a decline in bond prices on markets in difficulty and higher prices on markets supposed healthier, which in turn leads to a decrease in the correlation and covariance between markets.

This type of sequence has been clearly observed in the European bond markets, for example from the beginning of 2011, where we see the scissor-type patterns of the price trajectories of German and French bond market (Figs. 1 and 2). It seems legitimate to ask whether the process of flight-to-quality could be connected to a traditional logic of optimal portfolio allocation, where precisely the choices of the inves-

* Corresponding author.

[1] A preliminary version of this article was presented at the 22nd Forecasting Financial Markets conference in May 2015, the applied economics seminar of CREM-CNRS in January 2016, and World Finance Conference in July 2016. We would like to thank the participants for their comments and discussions, in particular Roberto De Santis, Sylvain Barthélémy, Hans-Jörg Von Mettenheim, Guillaume L'Oeillet, Fabien Moizeau, Jean-Sébastien Pentecôte, Tovonony Razafindrade, Fabien Rondeau, Mamy Raoul Ravelomanana and Guillaume Queffelec.

[2] We can find a comprehensive literature review in Silvapulle et al., 2016.

http://dx.doi.org/10.1016/j.econmod.2017.03.031
Received 20 December 2016; Received in revised form 23 March 2017; Accepted 28 March 2017

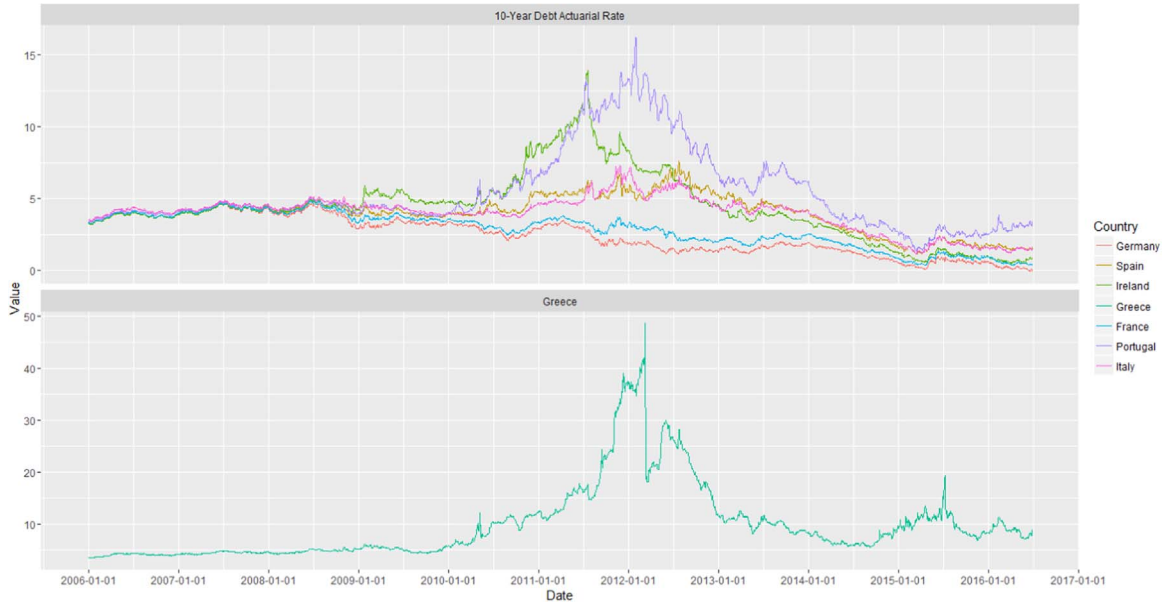

Fig. 1. Actuarial rates (RY, Yield to maturity) of major European countries.

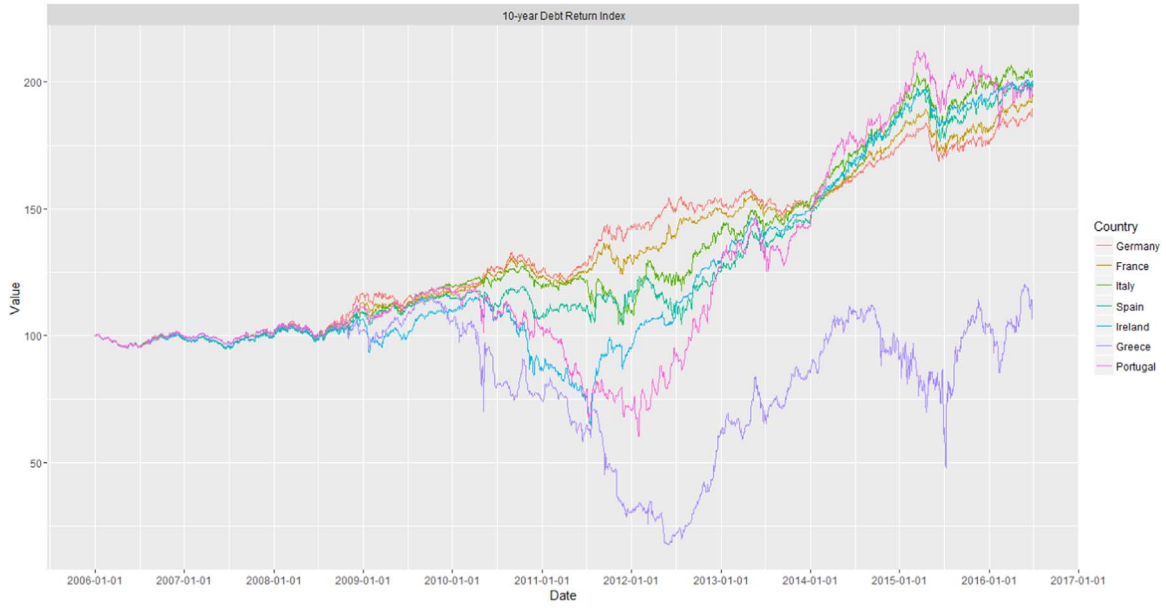

Fig. 2. Return index (RI) of major European countries bonds.

tors depend strongly on the anticipated variances and covariances of the bond yields. It is precisely this question we want to address in this paper. In addition to the credit risk effects, we try to explain the formation of the European sovereign interest rates over the debt crisis period in the euro zone, by rehabilitating the portfolio choice theory and the volatility and joint volatility risks. One of our main motivations is in particular to understand, to what extent the flight-to-quality processes of the German and French bond markets in early 2011 were able to feed on both the low volatility context and the declines in covariances with the periphery markets. Moreover, we are interested as well as in the post-crisis period, with particularly the implementation of the ECB's QE and the associated Asset Purchase Programmes (APP).

For this purpose, we propose an original theoretical model based on the optimal portfolio choices of a representative euro-based investor. He allocates over a short period its portfolio between two sovereign bonds having default risks and volatility risks, and a risk-free monetary asset. Optimal demand for bonds depends crucially on variances and covariances anticipated by investor. A lower covariance limits the joint risks between two bonds and stimulates the demands of the bonds at the price of risk-free rate. Optimal bond demands are confronted with available bond supply, that is to say not only the market values of sovereign debt stocks but also the ECB's QE programs. These bond purchases of the ECB have effectively reduced the net bond supply in circulation.

The equilibrium properties of this model generalize those of the traditional domestic term structure of interest rates theory (Artus, 1987; Mankiw et al., 1986; Shiller and McCulloch, 1987; Jones and Roley, 1983). The expected bond yields and the equilibrium rates dependent, expect for traditional properties, crucially on the anticipated bond yield covariances. These anticipated covariances, along with variances and bond supply, become essential components of volatility risk premium on bond yields. With optimal portfolio choices, we show that the anticipated covariances can indeed amplify or reduce, depending on different scenarios, the mechanism of contagion and Flight-to-quality between markets. To some extent, we propose a new intermediate channel of contagion which is situated between the fundamental contagion and the pure contagion.