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A comparative analysis of the informational efficiency of the fixed income market in seven European countries

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ABSTRACT

This letter investigates the time-varying behavior of long memory in sovereign and corporate bond indices of seven European Union countries from July 1998 to November 2011. We compute the Hurst exponent and detect that the current financial crisis affects more the informational efficiency of the corporate bond market than the sovereign bond market.

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1. Introduction

Over a century ago Bachelier (1900) developed the first mathematical model of security prices, applying the arithmetic Brownian motion model to French bonds. The formalization of the Efficient Market Hypothesis (EMH) remained latent until the development of Samuelson (1965) and the definition and classification by Fama (1970). Briefly, the EMH requires that returns of financial assets follow a memoryless stochastic process with respect to the underlying information set.

The weak form of informational efficiency excludes the possibility of finding, systematically, profitable trading strategies. As a corollary, returns time series cannot exhibit predictable memory content. However, there are several studies that find long memory in financial time series, using different methods. For example, Barkoulas et al. (2000) and Blasco and Santamaría (1996) find long memory in the Greek Stock Exchange and Spanish Stock Exchange respectively. Cheung and Lai (1995) find empirical evidence of long memory in 5 out of 18 developed stock markets and Barkoulas and Baum (1996) do not find strong convincing evidence against the random walk model in US stock returns. In spite of the fact that fixed income instruments are very important in the composition of investment portfolios and in firm and government financing, they have been less studied than stocks. Carbone et al. (2004) find long memory in German stock and sovereign bond markets and McCarthy et al. (2009) find long memory in yields of corporate bonds and in the spread of returns of corporate bonds and treasury bonds.

Another issue in the literature is the time varying behavior of the market efficiency. The reasons for the varying memory remains a puzzle. In this aspect Ito and Sugiyama (2009) find that inefficiency varies through time in the US stock market. Bariviera (2011) finds that time varying long-range dependence in the Thai Stock Market is weakly influenced by the liquidity level and market size. Cajueiro et al. (2009) find that financial market liberalization increases the informational efficiency in the Greek Stock Market. Kim et al. (2011) find that return predictability is altered by political and economic crises but not during market crashes.

The aim of this letter is to analyze the evolution of the long memory in corporate and sovereign bonds indices of seven EU countries. This letter contributes to the literature in several aspects. First, it finds evidence of the influence of the financial crisis on the informational efficiency of the fixed income market. Second, it shows the different behavior of the sovereign and corporate bond markets since the inception of the Euro. Third, it expands the

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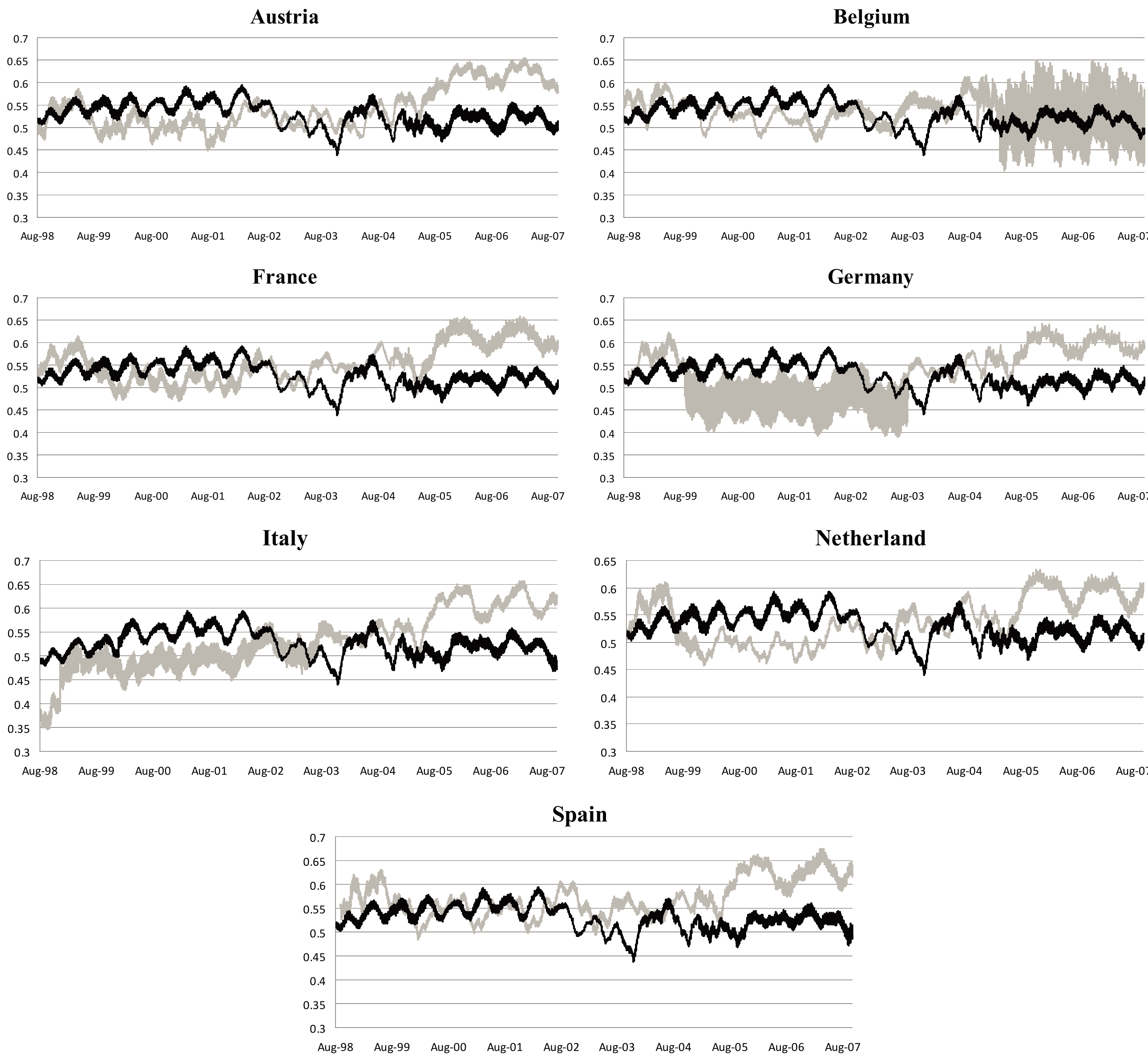

Fig. 1. Rolling Hurst exponent of sovereign bond indices (black) and corporate bond indices (gray).

empirical literature on the long-term dependence in fixed income markets.

The letter is organized as follows. Section 2 presents the data and methodology. Section 3 shows the results. Finally Section 4 presents the main conclusion of our analysis.

2. Data and methodology

We used daily data for sovereign bond indices (WBGI, Citigroup) and corporate bond indices (Euro Aggregate Corporate, Barclays) of seven European Union countries: Austria, Belgium, France, Germany, Italy, Netherlands and Spain. All data used in this paper was retrieved from DataStream. The period under examination is from 31/07/1998 to 04/11/2011, except for government bond indices for Germany and Spain which begins on 03/09/1998, for a total of 3460 observations. The period under analysis is relevant because it includes a major financial turmoil.

The Hurst exponent H characterizes the scaling behavior of the range of cumulative departures of a time series from its mean. Since the seminal paper of Hurst (1951), several methods (both parametric and non-parametric) have been developed to calculate the Hurst exponent. For a survey on the different methods for estimating long range dependences see Taqqu et al. (1995), Montanari et al. (1999) and Serinaldi (2010). We use the Detrended Fluctuation Analysis (DFA) method developed by Peng et al. (1994) because, as highlighted by Grau-Carles (2000), it avoids the spurious detection of long-range dependence due to nonstationary data. The algorithm is described in detail in Peng et al. (1995).

Departing from daily returns[1], and following Cajueiro and Tabak (2004), we estimate the Hurst exponent using a four year sliding window (1024 datapoints). This rolling sample approach works as follows: we compute the Hurst exponent for the first 1024 returns, then we discard the first return and add the following return of the time series, and continue this way until the end of data. Thus, each H estimate is calculated from data samples of the same size. The last H estimate covers the period from 04/12/2007 until 04/11/2011. We obtained an average of 2430 Hurst estimates. In Fig. 1 we can observe the evolution through time of the Hurst exponents of sovereign and corporate indices.

[1] As usual, daily returns are the logarithmic difference of two consecutive indices

Table 1
Efficiency t-test of the Hurst estimates of corporate bond indices.

Country	Before crisis			After crisis		
	H_{mean}	s.d.	t	H_{mean}	s.d.	t
Austria	0.516	0.025	0.649	0.600	0.033	2.997***
Belgium	0.535	0.027	1.299	0.505	0.067	0.078
France	0.534	0.029	1.170	0.598	0.034	2.883***
Germany	0.494	0.058	−0.105	0.585	0.028	3.070***
Italy	0.495	0.042	−0.099	0.599	0.034	2.846***
Netherlands	0.518	0.033	0.565	0.579	0.031	2.537**
Spain	0.553	0.027	1.975**	0.607	0.035	3.064***

** Null hypothesis rejection significant at the 5% level.
*** Null hypothesis rejection significant at the 1% level.

Table 2
Efficiency t-test of the Hurst estimates of sovereign bond indices.

Country	Before crisis			After crisis		
	H_{mean}	s.d.	t	H_{mean}	s.d.	t
Austria	0.536	0.026	1.360	0.516	0.018	0.898
Belgium	0.536	0.027	1.347	0.515	0.017	0.888
France	0.535	0.026	1.331	0.513	0.016	0.821
Germany	0.534	0.026	1.310	0.510	0.015	0.652
Italy	0.531	0.028	1.085	0.516	0.018	0.906
Netherlands	0.535	0.026	1.351	0.515	0.016	0.909
Spain	0.535	0.027	1.313	0.518	0.018	1.026

3. Results

From a simple visual inspection of Fig. 1 we detect diversity in the behavior of the Hurst estimates of sovereign and corporate bonds indices. The time series of Hurst exponents can be divided into two subperiods: before and after August 2004. The change begins when the Hurst exponent incorporates returns that corresponds to year 2008, just at the beginning of the financial turmoil.[2] This is a breaking point in both markets. In order to verify this assertion, we performed a t-test on the Hurst estimates (see Tables 1 and 2). Regarding corporate bonds, the Hurst exponent is not significantly different from 0.5 in the first subperiod, except for Spain. In the second subperiod the Hurst exponent is greater than 0.5, which is an evidence of non-random behavior. With respect to the sovereign market, we observe that for both subperiods we cannot reject the null hypothesis that $H = 0.5$. However, we observe that in the second subperiod the standard deviation is smaller. This is reflected, graphically, in a more compact and synchronized evolution of the Hurst exponents for all countries.

Our results show that the 2008 financial crisis affected differently both markets, enhancing the efficiency of sovereign bonds and deteriorating the informational efficiency of corporate bonds. This finding could be a consequence of several concurring forces. First, the behavior of market participants during the financial turmoil, in which they prefer safer and more liquid financial instruments. These effects are commonly known as flight to quality and flight to liquidity. Second, the asymmetric integration of fixed income markets within the monetary union, since the sovereign market seems to couple after the crisis. Third, sovereign bonds are more homogeneous in issuance characteristics than corporate bonds, which are different not only in the quality of the issuer but also in the characteristics of the each bond.

4. Conclusions

This paper sheds light on the informational efficiency of the corporate and sovereign bond markets of seven EU countries. In particular, we study the evolution over time of the Hurst exponent as a measure of long-range memory using the DFA method. We detect different memory dynamics in corporate and sovereign bond series after the financial crisis. In particular, the crisis deteriorates the informational efficiency of corporate bonds and enhances the efficiency of the sovereign bond markets. More research on this topic could be of interest for policy makers.

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[2] The sliding window is approximately 4 years