Efficiency or speculation? A time-varying analysis of European sovereign debt

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HIGHLIGHTS

- We apply a sliding windows DFA for European sovereign debt.
- We analyse interest differentials and interest spreads regarding to Germany.
- Sovereign debts show evidence of long-range dependence.
- In the case of spreads, an increase of dependence started before the crisis.

ARTICLE INFO

ABSTRACT

The outbreak of the Greek debt crisis caused turmoil in European markets and drew attention to the problem of public debt and its consequences. The increase in the return rates of sovereign debts was one of these consequences. However, like any other asset, sovereign debt returns are expected to have a memoryless behaviour. Analysing a total of 15 European countries (Eurozone and non-Eurozone), and applying a time-varying analysis of the Hurst exponent, we found evidence of long-range memory in sovereign bonds. When analysing the spreads between each bond and the German one, it is possible to conclude that Eurozone countries' spreads show more evidence of long-range dependence. Considering the Eurozone countries most affected by the Eurozone crisis, that long-range dependence is more evident, but started before the crisis, which could be interpreted as possible speculation by investors.

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1. Introduction

Since 2010, with the outbreak of the Greek debt crisis, later extending to other countries, European citizens have become more alert to the problem of public debt. However, the evolution of European Union (EU) debt shows a sharp increase over time, including the years before the beginning of the crisis. In fact, according to Eurostat, in 2000 the European debt was about 5781 billion euros, reaching about 12,440 billion euros in 2015, i.e., a mean growth of more than 5% per year. During the same period, the real GDP of the EU had a mean growth of less than 1.5% per year.

Accumulated debt can be a problem, since its payment may be unsustainable. In addition, as with any loan, it is also necessary to pay interest, so this variable becomes crucial for countries as higher rates imply they will find it more difficult to fulfil their obligations.

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However, sovereign bonds are not only important for issuer countries, but also for investors, because they are also assets. So analysis of sovereign rates' behaviour remains interesting, particularly if they behave efficiently. According to the Efficient Market Hypothesis (EMH), a given financial asset is efficient if it has a memoryless behaviour. In other words, returns' time series should not exhibit any predictable memory content.

The study of financial assets' memory is not new. In fact, over a century ago, Bachelier [1] analysed the probability distribution of French bonds, concluding that they followed a normal distribution. After the developments of Samuelson [2], Fama [3] formalizes the EMH, considering efficiency in three different categories: weak, semi-strong and strong efficiency, according to the amount of information reflected in price formation. Particularly, the weak form of efficiency states that all past information is contained in prices, which means that, as mentioned above, return rates should have no memory.

The memoryless nature of a financial asset is synonymous with its efficient behaviour. Nevertheless, the existence of memory could be linked to some market imperfections such as illiquidity, the existence of risk or even the existence of some speculation in markets. In the context of the European debt crisis, it was usual to hear politicians (and public opinion) complaining about the possibility of speculation. Indeed, this possibility was raised in some studies, although no definite conclusions were reached (see, for example, [4]).

Considering this possibility, the purpose of this paper is to analyse the behaviour of EU sovereign bonds. We analyse data from 15 different countries: Austria, Belgium, the Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Spain, Sweden and the UK, since 1st January 1999, when the Euro was created. We will analyse the behaviour of individual countries' bonds, as well as the behaviour of each bond's spread, in relation to Germany, due to this country's major role in the Eurozone. Since we have data available from both Eurozone and non-Eurozone countries, it is possible to compare the behaviour of these two groups of countries. We apply a time-varying detrended fluctuation analysis (DFA), which allows us to determine the existence or not of long-range dependence in data. So we are able to analyse the efficiency dynamics of EU sovereign debt. Like any financial asset, it is expected to show efficient behaviour, at least in the long run. If markets show a continuous dependence pattern, it could be a sign of inefficiency or some speculative behaviour by agents.

Our main results point to evidence of long-range dependence in sovereign bonds' return rates in almost all countries, especially in those countries most affected by the Eurozone crisis. When we analyse the behaviour of spreads, this dependence is more evident. But we find differences when comparing Eurozone with non-Eurozone countries, with countries sharing the common currency showing more evidence of long-range dependence. Furthermore, considering Eurozone countries, those which faced severe debt problems show more evidence of long-range dependence, with an increase before the start of the crisis, which could indicate the existence of speculation by investors.

The remainder of the paper is organized as follows. Section 2 presents a brief literature review on the topic. Section 3 explains the data and methodology. Section 4 contains the results and Section 5 concludes.

2. Literature review

The analysis of dependence in financial markets is a very common topic in the literature. The most common subject is stock markets, but other financial assets are also studied. As mentioned previously, this started over a century ago with the work of Bachelier [1]. Curiously, the author analysed the behaviour of bonds, concluding on the normality of prices (as expected).

The first analyses of financial markets were made using basically linear approaches, which confirm the random behaviour of financial markets and the non-dependence of financial data. These conclusions are found in older studies (see, for example, [5,6] or [7], among others), as well as in more recent work (see, for example, [8,9]). It is this random behaviour that is the basis of several models and hypotheses of financial markets, including the Efficient Market Hypothesis proposed by Fama [3].

Even when the random walk is evident, some studies find frequent characteristics of financial markets, named in the literature as stylized facts. The most common stylized facts are the existence of fat tails in returns, asymmetries in gains and losses, volatility clustering, leverage effect, correlation between trading volumes and volatility, and autocorrelation in the variance (see, for example, [10], or [11]).

The evolution of econometric and mathematical techniques allowed authors to use other approaches, namely non-linear ones. This allows deeper analysis of financial markets, because the existence of non-linear dependences could also make markets inefficient, even in the absence of linear autocorrelations [12,13]. So non-linear approaches have become more usual. Studies such as those by Mandelbrot [14], Barkoulas and Baum [15], Sadique and Silvapulle [16], Di Matteo et al. [17] or Christodoulou-Volos and Siokis [18] and Ferreira [19], among many others, show evidence of long-range dependence in financial markets.

The common characteristic of these studies is that they concern mainly stock markets. The analysis of bond market efficiency is less common and mainly focused on corporate bonds. Older studies are found, like the previously mentioned work of Bachelier [1] and others such as Katz [20] or Brennan and Schwartz [21] but also more recent studies, such as Ronen and Zhou [22], Bariviera et al. [23] or Das et al. [24]. Nevertheless, some studies about the efficiency of sovereign debt are also identified.

Jointly with other financial markets, Carbone et al. [25] find evidence of long memory in German sovereign bond. In a study comparing the spreads between corporate and sovereign bonds, McCarthy et al. [26] find long memory in those