Has the 2008 financial crisis affected stock market efficiency? The case of Eurozone

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HIGHLIGHTS

- We study the effect of the 2008 crisis on Eurozone stock market efficiency.
- The random walk hypothesis is tested via the Generalized Hurst Exponent analysis.
- Dynamic Hurst exponents are estimated through the rolling window technique.
- Statistical significance inference is based on Monte-Carlo sampling.
- We find significant mean-reverting patterns after the 2008 crisis.

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ABSTRACT

In this paper, the impact of the 2008 financial crisis on the weak-form efficiency of twelve Eurozone stock markets is investigated empirically. Efficiency is tested via the Generalized Hurst Exponent method, while dynamic Hurst exponents are estimated by means of the rolling window technique. To account for biases associated with the finite sample size and the leptokurtosis of the financial data, the statistical significance of the Hurst exponent estimates is assessed through a series of Monte-Carlo simulations drawn from the class of α-stable distributions. According to our results, the 2008 crisis has adversely affected stock price efficiency in most of the Eurozone capital markets, leading to the emergence of significant mean-reverting patterns in stock price movements.

1. Introduction

Following the bankruptcy of Lehman Brothers on the 15th of September 2008, the severe credit crunch, that was initially confined within the USA, rapidly transformed into the worst global recession since the Great Depression. The 2007–2008 financial crisis, henceforth referred to as the "2008 crisis", created a havoc of a unique scale that manifested itself through weakening of economic activity, decline of economic growth and considerable elevation of unemployment rates. As a matter of fact, Loser [1] conservatively estimated the worldwide loss of wealth to be approximately 1% of the global GDP.

Being critical events that generate adverse shocks to economies, financial crises constitute interesting laboratories for the assessment of stock price movements under increased market stress. In this respect, the 2008 crisis and its aftermath provide a suitable framework for investigating stock market efficiency. The aim of the present study is to examine empirically the weak-form efficiency of stock prices in the pre- and the post-2008 crisis eras in twelve Eurozone capital markets.

Table 1
Summary statistics for the twelve Stock Indices daily returns.

Country	Mean	St. Dev.	Skewness	Kurtosis	L–B (Q)	D–F	J–B	KPSS
Austria	0.0001	0.0161	−0.3095	9.47	52.8[*]	−46.1[*]	7893.8[*]	0.29
Belgium	0.0001	0.0126	−0.1792	10.00	46.5[*]	−49.3[*]	5669.7[*]	0.11
Finland	0.0001	0.0139	−0.0570	7.38	36.1[*]	−49.4[*]	2070.8[*]	0.10
France	0.0001	0.0141	0.0400	10.36	61.8[*]	−53.4[*]	4544.3[*]	0.11
Germany	0.0004	0.0135	0.0189	10.58	48.5[*]	−50.4[*]	3666.8[*]	0.13
Greece	−0.0003	0.0184	−0.0524	6.58	57.3[*]	−46.4[*]	2363.3[*]	0.16
Ireland	0.0000	0.0151	−0.6000	11.12	69.6[*]	−48.5[*]	9835.7[*]	0.20
Italy	−0.0001	0.0154	−0.0670	8.55	63.4[*]	−51.1[*]	3582.1[*]	0.10
The Netherlands	0.0001	0.0133	−0.2313	13.02	57.5[*]	−51.5[*]	6877.2[*]	0.13
Portugal	−0.0001	0.0122	−0.1851	11.17	59.0[*]	−47.1[*]	9353.9[*]	0.11
Spain	0.0001	0.0149	0.1242	10.34	48.2[*]	−49.8[*]	5391.7[*]	0.09
Luxembourg	0.0001	0.0132	−0.4076	10.75	46.4[*]	−49.9[*]	8355.8[*]	0.10

The mean, standard deviation, skewness and kurtosis are reported, along with results from the Ljung–Box (L–B) tests for serial correlation, the Augmented Dickey–Fuller (D–F) and the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) unit root tests, and the Jarque–Bera (J–B) normality tests.
[*] Denote significance at the 5% probability level.

Extant studies on the effect of financial crises on stock market efficiency have primarily focused on the empirical inves-tigation of the 1997 Asian stock market crash. For instance, Lim et al. [2] found that, despite government intervention in the form of imposition of restrictions to capital outflows and price limits to equities, the efficiency of Asian markets deteriorated within the crisis period, whereas equilibrium was restored in the long-run. By contrast, Kim and Shamsuddin [3] and Hoque et al. [4] showed that the Asian financial crisis barely affected the levels of stock market efficiency; the former study showed that stock prices exhibit weak-form efficiency, both before and after the crisis, whereas the latter study found significant mean-reverting patterns during these periods.

On the other hand, the investigation of stock price randomness in European Union markets with respect to the 2008 crisis has attracted less attention thus far. Katris and Daskalaki [5] examined the Greek and the German stock markets and found that they both remained efficient during the crisis period. Smith [6] studied the emerging European countries, including Turkey and Russia, and reported that the impact of the 2008 crisis on stock market efficiency is country-dependent. Furthermore, Sensoy and Tabak [7] found that stock market efficiency was negatively affected by the 2008 crisis in the majority of the European Union countries. Similarly, Horta et al. [8] examined several European markets, alongside US and Japan, and found that in the course of the 2008 crisis stock market efficiency deteriorated, whereas stock price movements became more random in the subsequent years.

Our study contributes to the existing stream of the literature that tests the random walk hypothesis in periods of financial instability. Moreover, by investigating the core of the Eurozone countries, we provide insight on stock price variations for economies that are interlinked via a currency union. Herein, inference on weak-form efficiency is based on the estimation of dynamic Hurst exponents using the Generalized Hurst Exponent (GHE) method, in conjunction with the rolling window technique. The Hurst exponent has been used in several studies in the past as a tool for detecting long-range deviations from the random walk hypothesis in financial returns (e.g., Refs. [9–19]). To this extent, an important aspect of the utilized methodology is that, to avoid potential finite sample biases, the statistical significance of the estimated Hurst exponents is assessed by means of Monte-Carlo sampling [8,20]. To this end, and in contrast to the traditional utilization of Monte-Carlo samples drawn from the standard normal distribution, we employ the class of α-stable distributions that encapsulates heavy tails and significant skewness and kurtosis, characteristics that usually typify financial data [21].

The rest of the paper is organized as follows: Section 2 presents the data and summary statistics. Section 3 describes the empirical methodology. Section 4 reports and discusses the empirical findings. Finally, Section 5 concludes.

2. Data and descriptive statistics

The data employed in this study are obtained from the Bloomberg system and consist of daily closing prices, spanning a period from 24/08/2004 to 15/09/2014, for Stock Market Indices of twelve Eurozone countries: Austria (ATX), Belgium (BEL 20), Finland (OMX), France (CAC 40), Germany (DAX), Greece (ACSPI), the Netherlands (AEX), Ireland (ISEQ), Italy (FTSE MIB), Luxembourg (LuxX), Portugal (PSI 20) and Spain (IBEX 35). The remaining Eurozone countries are excluded due to insufficient number of observations. We employ logarithmic returns,

$$r(t) = \log\left(\frac{I(t)}{I(t-1)}\right), \tag{1}$$

where $\{I(t)\}_{t=1}^{T}$ is the Index price time-series of length T.

To provide insight into the data at hand, Table 1 reports summary statistics for the twelve daily logarithmic return series. It can be readily inferred that the twelve distributions are rather leptokurtic, a typical characteristic in financial data. The Jarque–Bera test statistics are significant at the 5% level in all cases, indicating that the return series are clearly non-normal.