



DCCA cross-correlation in blue-chips companies: A view of the 2008 financial crisis in the Eurozone

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HIGHLIGHTS

- We analyze by DCCA cross-correlation coefficient the blue-chips companies in the Eurozone.
- With the DCCA coefficient, we qualify and quantify how each blue-chip is adherent to its country index.
- From this analysis, we can construct an adhesion map of each company with respect to the global index.

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ABSTRACT

In this paper we analyze the blue-chips (up to 50% of the total index) companies in the Eurozone. Our motivation being analysis of the effect of the 2008 financial crisis. For this purpose, we apply the DCCA cross-correlation coefficient (ρ_{DCCA}) between the country stock market index and their respective blue-chips. Then, with the cross-correlation coefficient, we qualify and quantify how each blue-chip is adherent to its country index, evaluating the type of cross-correlation among them. Subsequently, for each blue-chip, we propose to study the 2008 financial crisis by measuring the adherence between post and pre-crisis. From this analysis, we can construct an adhesion map of each company with respect to the global index. Our database is formed of 12 Eurozone countries.

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1. Introduction

The economy can be understood as a complex system. Complex systems are dynamic, non-linear, adaptive, non-deterministic, and can create emergent behavior with self organized criticality [1–4]. Knowing that we have economic data as a time series, one way to study those time series is by trying to understand auto and cross-correlations arising from these systems [5]. Considering that in general, the relations that move financial markets are still mysterious, cross-correlation analysis between financial time series can be of great importance in understanding the links between these different markets [6–10].

When we have different financial time series, it is possible to analyze their individual behavior. For example, this analysis allow us to identify the dependence of a given time series. This could be done through linear or non-linear approaches. [11]

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applied different methodologies for this purpose. In the presence of many series, it is possible to study the relationship between them. In this particular context, one possible topic of study is the analysis of market integration between those series. The occurrence of market integration could have some consequences. Clearly, it means that the considered assets are more related. Increase market integration could have positive impacts on economies, namely on growth and on better allocation of savings, due to specialization (see, for example, [12] or [13]). In the context of the analysis between individual shares and the respective indexes, it means that the behavior of both series become more similar. This feature implies the reduction of diversification possibilities which could be understood as an increase in risk (see, for example, [14]).

Using data from 12 of the 19 Eurozone countries, we analyze the cross-correlation between Eurozone blue-chips and the respective national index. The sample was divided into before and after the Euro debt crisis. The objective is to analyze how the blue-chips behave between these two different periods. A decrease in the correlation implies that the blue-chips and the index are less integrated. On the contrary, an increase in the correlation implies that the individual share is more integrated with the respective market which, as previously referred, could be risky.

The Eurozone indexes used are the following:

- **Austria—ATX** Vienna Stock Exchange Index, is a major stock market index which tracks the performance of all companies listed in Austria, representing around 60% of Austrian stock trade.
- **Belgium—BEL20** is the benchmark stock market index of Euronext Brussels. It tracks the performance of the 20 most capitalized and liquid stocks traded in Belgium.
- **Finland—OMX Helsinki** is a major stock market index which tracks the performance of the 25 most heavily traded companies in the Helsinki Stock Exchange. It limits each company to a maximum weight of 10%.
- **France—CAC40** the most widely used indicator of the Paris market, reflects the performance of the 40 largest equities listed in France, measured by free-float market-capitalization and liquidity.
- **Germany—DAX30** German Stock Index, is a total return index of 30 selected German blue-chip stocks traded on the Frankfurt Stock Exchange. The equities use free float shares in the index calculation.
- **Greece—ATHEX** Athens Stock Exchange General Index, is a major stock market index which tracks the performance of Greece stocks listed on the Athens Stock Exchange.¹
- **Ireland—ISEQ20** Ireland Stock Exchange Overall Index (ISEQ), is a major stock market index which tracks the performance of all (excluding UK registered) companies listed on the Irish Stock Exchange.
- **Italy—FTSEMIB30** is a major stock market index which tracks the performance of the 40 leading and most liquid and companies listed in Milano (Italy).
- **Luxembourg—SELUXX** The LuxX Price is the main stock market index of the Luxembourg Stock Exchange, the stock exchange based in Luxembourg City, in southern Luxembourg.
- **Netherlands—AEX** is a major stock market index, which tracks the performance of the leading stocks traded on the Amsterdam Exchange.
- **Portugal—PSI20** Portuguese Stock Index, is a benchmark stock market index which tracks the performance of the 20 companies with the largest market capitalization and share turnover in the Euronext Lisbon Stock Exchange.
- **Spain—IBEX35** is a benchmark stock market index which tracks the performance of the 35 most liquid stocks traded on the Continuous market in Madrid (Spain).

The paper is organized as follows. In Section 2, we apply the methodology, in Section 3 we show data and results, while in Section 4 presents the conclusions. References and Appendix are found at the end of the paper.

2. Methodology

Initially, we take the closing index of the Eurozone countries as a function of time. In Fig. 1 the period is divided into three parts, which are:

- Before—from the start of Eurozone (January/01/1999) to December/31/2007, with 2346 observations;
- 2008—for the whole of 2008, with 262 observations. It includes the moments associated with the Lehman Brother crisis;
- After—from January/01/2009 to March/11/2016, with 1877 observations.

Independent of the country, the index in 2008 (red line) shows a great decline, which justified our choice of the crisis period (see Fig. 1). We can see in this figure that Germany (DAX) was the only country to recover the pre-crisis index value. For Greece (ATHEX) and Portugal (PSI-20) the indexes are still in decline. Note that these two countries suffered severe crisis, requiring international financial aid. Other countries, like Belgium (BEL-20), France (CAC-40), and Ireland (ISEQ) show an increase in the post-crisis.

We know that each index is composed of a set of companies that reflect the most heavily traded ones on the respective stock exchange. On this list there are also the blue-chips, companies with greater importance for the final value of the index, with excellent reputation, high liquidity and high degree of reliability [9]. In this paper we will consider as blue-chips the set of companies with 50% of the index (see Table 3).

¹ Greece only joined the Euro formally in 2001. However, it is used from the beginning of the sample.

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