



# A sliding windows approach to analyse the evolution of bank shares in the European Union



Paulo Ferreira<sup>a,b,c,\*</sup>, Andreia Dionísio<sup>a</sup>, Everaldo Freitas Guedes<sup>d</sup>,  
Gilney Figueira Zebende<sup>e</sup>

<sup>a</sup> CEFAGE-UE, IIFA, Universidade de Évora, Largo dos Colegiais 2, 7000 Évora, Portugal

<sup>b</sup> Departamento de Ciências Agrárias e Veterinárias, Escola Superior Agrária de Elvas, Instituto Politécnico de Portalegre, Portugal

<sup>c</sup> Universidade Europeia, Laureate International Universities, 1500-210 Lisboa, Portugal

<sup>d</sup> Computational Modeling Program, SENAI CIMATEC, Bahia, Brazil

<sup>e</sup> Department of Physics, State University of Feira de Santana, Bahia, Brazil

## HIGHLIGHTS

- We use DFA with sliding windows to analyse European Union Banks.
- We use two different crisis periods to compare the evolution of efficiency.
- Most banks changed from an anti-persistent to a persistent behaviour.
- Some Non-Eurozone banks show the same results than Eurozone banks.

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## ABSTRACT

Both sub-prime and Eurozone debt crisis problems caused severe financial crisis, which affected European markets in general, but particularly the banking sector. The continuous devaluation of bank shares in the financial sector caused a great decrease in market capitalization, and in citizen and investor confidence. Panic among investors led them to sell shares, while other agents took the opportunity to buy them. Therefore, the study of bank shares is important, particularly of their efficiency. In this paper, adopting a sliding windows detrended fluctuation approach, we analyse the efficiency concept dynamically with 63 European banks (both in and outside the Eurozone). The main results show that the crisis had an effect on changing the efficiency pattern.

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## 1. Introduction

Firstly, the sub-prime crisis and secondly, the Eurozone debt crisis caused turmoil in the European financial markets and particularly in the banking sector, due to many Eurozone banks' excessive exposure to public debt. Besides affecting the financial markets, that crisis also brought severe consequences for the economic wealth of European countries, mainly for those countries directly involved in excessive public debt (see, for example, [1] or [2], among others).

As a direct result of the crisis, the financial system as a whole came to be seen with some distrust by investors. Some banks suffered bankruptcy processes and those which remained in the market saw their share prices suffer severe devaluation. As

\* Corresponding author at: CEFAGE-UE, IIFA, Universidade de Évora, Largo dos Colegiais 2, 7000 Évora, Portugal.  
E-mail address: [pjsf@uevora.pt](mailto:pjsf@uevora.pt) (P. Ferreira).

**Table 1**  
Bank shares and starting date.

Eurozone banks			Non-Eurozone banks		
Bank	Code	Start date	Bank	Code	Start date
ErsteGroupBank	AUT01	4-Jan-1999	Central CooperativeBank	BUL01	11-Oct-2000
KBC Group	BEL01	4-Jan-1999	KomerčniBanka	CZE01	3-May-2004
Nordea Bank	FIN01	4-Jan-1999	Erste Group Bank	CZE02	3-May-2004
BNP Paribas	FRA01	4-Jan-1999	DanskeBank	DEN01	4-Jan-1999
SocieteGenerale	FRA02	4-Jan-1999	Nordea Bank	DEN02	19-Apr-2000
CreditAgricole	FRA03	14-Dec-2001	JyskeBank	DEN03	4-Jan-1999
Natixis	FRA04	4-Jan-1999	OTP Bank	HUN01	3-May-2004
DeutscheBank	GER01	4-Jan-1999	FHB	HUN02	3-May-2004
Commerzbank	GER02	4-Jan-1999	PKO Bank	POL01	9-Nov-2004
AlphaBank	GRE01	4-Jan-1999	BANK Pekao	POL02	3-May-2004
NationalBankofGreece	GRE02	4-Jan-1999	BankZachodni	POL03	3-May-2004
EurobankErgasias	GRE03	4-Jan-1999	MBank	POL04	3-May-2004
Bankof Piraeus	GRE04	4-Jan-1999	Banca Transilvania	ROM01	1-Jan-2007
BankofIreland	IRE01	4-Jan-1999	BRD Group	ROM02	1-Jan-2007
IntesaSanpaolo	ITA01	4-Jan-1999	Nordea Bank	SWE01	4-Jan-1999
Unicredit	ITA02	4-Jan-1999	Sewdbank	SWE02	4-Jan-1999
UnionediBancheltalian	ITA03	1-Jul-2003	Handelsbanken	SWE03	4-Jan-1999
Mediobanca	ITA04	4-Jan-1999	SEB	SWE04	4-Jan-1999
Banco Popolare	ITA05	4-Jan-1999	Lloyds	UK01	4-Jan-1999
Banca Popolare di Milano	ITA06	4-Jan-1999	HSBC	UK02	4-Jan-1999
Banca PPO EmiliaRomagna	ITA07	4-Jan-1999	RoyalBankScotland	UK03	4-Jan-1999
Banca Monte dei Paschi	ITA08	25-Jun-1999	StandardChartered	UK04	4-Jan-1999
Banca Mediolanum	ITA09	4-Jan-1999	Barclays	UK05	4-Jan-1999
IngGroep	NET01	4-Jan-1999	SiauliuBankas	LIT01	4-Jan-1999
BCP	POR01	4-Jan-1999	VseobecnaUverovaBanka	SLK01	4-Jan-1999
BPI	POR02	4-Jan-1999	OTP BankaSlovensko	SLK02	4-Jan-1999
Banco Santander	SPA01	4-Jan-1999			
BBVA	SPA02	4-Jan-1999			
Banco Sabadell	SPA04	18-Apr-2001			
Banco Popular Español	SPA05	4-Jan-1999			
Bankinter	SPA06	4-Jan-1999			
BankofCyprus	CYP01	2-Jan-2008			
HellenicBank	CYP02	2-Jan-2008			
BankofValletta	MAL01	2-Jan-2008			
HSBC Bank Malta	MAL02	2-Jan-2008			
Fimbank	MAL03	2-Jan-2008			
LombardBank	MAL04	2-Jan-2008			

usual, in these cases some agents try to seize the opportunity to gain profits in their investment strategies. In this aspect, it is interesting to analyse how shares behave, aiming to determine their continuous efficiency.

The financial literature contains many studies on the efficiency of financial markets. After the seminal work of Fama [3,4] devoted to the efficiency of financial markets, when he identified the Efficiency Market Hypothesis (EMH), many studies analysed the behaviour of stock markets. The development of econometric and statistical methodologies also led to the appearance of many studies, some devoted to general markets (for example, using stock market indices), others dedicated to specific sectors.

Regarding the particular case of the banking sector, the study by Ferreira [5] is probably the only example of more recent work. In this study, the author analysed the cross-correlations between Eurozone banks and the respective national stock markets. Dividing the sample before and after the Eurozone crisis, the author found that most of the banks changed their correlations with national indices. More than half of the analysed banks showed an increase in the correlation, interpreted as an increase in market risk, if another crisis occurs.

With data about Eurozone banks, here we perform a different analysis. We will continue to observe the evolution of the efficiency of European bank stocks, which will enable us to analyse whether both crises had any effect on the efficiency pattern of those shares. In this context, we use Detrended Fluctuation Analysis (DFA), because its exponent is able to capture the existence of long-term memory of a given time series. According to theory, financial assets should not show any kind of memory, so this methodology is suitable for the purpose. Because we want to analyse the continuous existence of efficiency, we apply a sliding windows analysis.

As explained in the next section, some studies apply DFA sliding windows, but none to this specific topic, which makes this study innovative. Furthermore, the study is important because banking is one of the most important economic sectors, as the recent European crisis proved.

Therefore, this paper is organized as follows: Section 2 presents the methodology and data used in our analysis, Section 3 shows the results, and Section 4 concludes the paper.

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