



Sovereign public debt crisis in Europe. A network analysis



David Matesanz^{a,*}, Guillermo J. Ortega^{b,1}

^a Applied Economic Department, University of Oviedo, Avda. Cristo s/n, 33003, Oviedo, Spain

^b Science and Technology Department, Universidad Nacional de Quilmes and CONICET, R.S. Pena 180, 1876 Bernal, Buenos Aires, Argentina

HIGHLIGHTS

- Dynamical networks of government debt as a percentage of GDP; quarterly, 2000–2014.
- Cophenetic correlation to analyse persistency of hierarchical trees during the financial crisis.
- High synchronicity and connectivity and low number of communities at the time of the crisis.
- Less diversification and more centralized network arrangements.
- New network organization after the financial crisis arranged by public debt levels.

ARTICLE INFO

Article history:

Received 13 February 2015

Received in revised form 26 March 2015

Available online 22 May 2015

Keywords:

Correlation networks

European debt crisis

Network stability

Communities

ABSTRACT

In this paper we analyse the evolving network structure of the quarterly public debt-to-GDP ratio from 2000 to 2014. By applying tools and concepts coming from complex systems we study the effects of the global financial crisis over public debt network connections and communities. Two main results arise from this analysis: firstly, countries public debts tend to synchronize their evolution, increasing global connectivity in the network and dramatically decreasing the number of communities. Secondly, a disruption in previous structure is observed at the time of the shock, emerging a more centralized and less diversify network topological organization which might be more prone to suffer contagion effects. This last fact is evidenced by an increasing tendency in countries of similar level of public debt to be connected between them, which we have quantified by the network assortativity.

© 2015 Elsevier B.V. All rights reserved.

1. Introduction

The bursting of the US housing bubble triggered the bankruptcy, or the need to be rescued, of large and well reputed banks and insurance companies in many developed countries. Especially since the collapse and bankruptcy of Lehman Brothers on September 2008, credit flows dried up, lender confidence dropped with investors repatriating funds to domestic markets and world economies dipped into recession because of international and domestic aggregate demand plummeted [1,2]. Regardless of policy action, especially in the US, had treated to contain the symptoms of the financial turmoil, the crisis spillovered from “Wall Street to Main Street” [3]. At the beginning of the financial crisis however the focus was on the actions of Central banks to address the financial shock and expansionary measures to reactivate the economies, while there was little concern about public debts. In late 2009, it was clear that the scale and length of the recession increased the perspectives of banking losses on bad loans and also had a negative impact on sovereign debts values [4]. Additionally, some countries

* Corresponding author. Tel.: +34 985104847; fax: +34 985105050.

E-mail addresses: matesanzdavid@uniovi.es (D. Matesanz), gortega@unq.edu.ar (G.J. Ortega).

¹ Tel.: +54 11 4365 7100x5602; fax: +54 11 4365 7100x4132.

reported larger-than-expected increases in fiscal deficits, Ireland and Spain for instance. After October 2009, the new Greek government recognized larger fiscal deficit for previous years than those previously announced and a new budget deficit forecast for 2009. This combination of facts definitely moved the focus of the crisis to European sovereign debts from 2010 onwards [5].²

Since the beginning of the financial crisis the euro area as a whole elevated its public debt ratio from 67.4% in the first quarter of 2008 to 93.9% of their Gross Domestic Product (GDP) in the first quarter of 2014. In the same period, Greece went from 107.9 to 174.1%. Most striking, Ireland increased this ratio from 27.5 to 123.7%³ in this short period of time. Other countries such as Italy, Belgium, Spain or France have observed high and increasing levels of public debts-to-GDP ratios as the crisis was going on. On the other side, Finland, Germany or Austria experienced softer deterioration on their public debt positions while other European countries such as Norway experienced a reduction in its public debt from almost 43% during 2008 to 29% at the end of the period. However, from the beginning of 2000 till the end of 2007 debt-to-GDP ratios were more stable and slightly decreasing in most countries of Europe (see Fig. 1). As Lane [5] claims European countries have quite different debt histories.

Recently, a few papers have focused on the European debt crisis by analysing the dynamics of daily government bond yields (e.g., Refs. [17–19]) and the network topology of the public debt itself [20].

Dias [19,18] uses maximum spanning trees to analyse the topological properties of government bond rates' markets in different periods including the European debt crisis. In their paper, Kantar et al. [20] investigate hierarchical and topological structures by using the minimum spanning tree (MST) approach in public debt as a percentage of the gross domestic product from 2000 to 2011. These papers have shown that European countries have formed different clusters regarding the dynamics of their public debts during the global and financial current crisis. The most and the less affected countries form groups during the sovereign crisis but they do not do so before with respect to government bond yields [20,19,17]. Especially the group of the most affected countries (the so called PIGS—Portugal, Ireland, Greece and Spain) get closer in their government bond yields dynamics. Additionally, these groups have moved away from each other as the crisis moves on [18,19]. These results suggest different network dynamics related to government debt position as crises events affect the economies involved in the system. All of these works are in line with recent advances in the econophysics field in which tools and concepts from complex systems have been applied to different economic issues. For instance: finance ([21–24], among hundreds of studies), economic growth dynamics [25,26], commodity prices [27,28], interest rates (e.g., Refs. [19,18]), trade (e.g., Refs. [29,30]) and exchange rates (e.g., Refs. [31,32]).

Within the above framework we construct a network of public debt-to-GDP quarterly ratios from 2000 to 2014, belonging to 29 European countries. We study networks dynamics by means of sliding windows forward in time. We extend previous works on this issue (e.g., Refs. [20,19,17]) by analysing the temporal stability of the debt-to-GDP network.

As the financial and European debt crisis is included in our sample, this paper contributes to understand the dynamics of the public debt evolving network in times of crisis. Three conclusions arise from this analysis. Firstly, we observe during the crisis that countries' public debts tend to synchronize their changes, increasing global synchronization and hence dramatically decreasing the number of communities in the network. Secondly, as a result, a disruption in the previous structure is observed at the time of the financial crisis, giving rise to a homogenization in the member's co-movements, producing in this way a network topological organization highly susceptible to spread the effects of the crisis among the countries. Finally, at the onset of the financial crisis the new network arrangement that appears seems to be directly related to the debt-to-GDP level itself which clearly puts into difficulties for controlling the public debt dynamic.

Next section presents the dataset and numerical methods employed in the analysis. Section 3 presents the main results and, finally, Section 4 summarizes and discusses previous results. At the end of the paper, a supplementary section have been included providing methodological details, additional figures and a summary of findings (see Appendix A).

2. Methodology

2.1. Data

The dataset, borrowed from the Eurostat statistics database (<http://ec.europa.eu/eurostat>), consists of quarterly public debt as percentage of country GDP, encompassing the period 2000 (Q1) to 2014 (Q1). We have included 29 European countries; 28 members of the European Union at the beginning of 2014 and Norway. Croatia was the last country joining the European Union on the first of July 2013. However, at the beginning of entire period, Q1 of 2000, only fifteen were members of the European Union. Eighteen countries shared the Euro at the beginning of 2014, including Latvia which joined the first of January 2014 (Lithuania joined the Euro on January 2015). At the time of launching the Euro in 1999 just eleven countries

² Economic literature on different topics of the financial crisis and debt crisis is vast. Among other topics we can find the accumulation of macroeconomic, fiscal and financial vulnerabilities prior to the financial crisis itself [6,7], aspects related to what happened in different asset markets ([3,8], among others), policy studies, transmission of shocks and asset pricing [9,10,2], the European debt crisis [5,4,11]. On the other side, econophysics literature has analysed different aspects such as: the structure and resilience of financial networks affected by extreme event [12–14], the network structure and systemic risks [15,16].

³ Data from last quarter 2013.

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات