J. Int. Financ. Markets Inst. Money xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

Journal of International Financial Markets, Institutions & Money

journal homepage: www.elsevier.com/locate/intfin

Using connectedness analysis to assess financial stress transmission in EMU sovereign bond market volatility

Fernando Fernández-Rodríguez [a], Marta Gómez-Puig [b], Simón Sosvilla-Rivero [c,*]

[a] Department of Quantitative Methods in Economics, Universidad de Las Palmas de Gran Canaria, 35017 Las Palmas de Gran Canaria, Spain
[b] Department of Economic Theory, Universitat de Barcelona, 08034 Barcelona, Spain
[c] Complutense Institute for International Studies, Universidad Complutense de Madrid, 28223 Madrid, Spain

ARTICLE INFO

Article history:
Received 27 August 2015
Accepted 19 April 2016
Available online xxxx

Keywords:
Sovereign debt crisis
Euro area
Connectedness analysis
Market linkages
Vector autoregression
Variance decomposition

ABSTRACT

We measure the connectedness in EMU sovereign market volatility between April 1999 and January 2014, monitoring stress transmission and identifing episodes of intensive spillovers from one country to the others. We first perform a static and dynamic analysis to measure the total volatility connectedness in the entire period using a framework recently proposed by Diebold and Yilmaz (2014). Second, we use a dynamic analysis to evaluate the net directional connectedness for each country and apply panel model techniques to investigate its determinants. Finally, we examine the time-varying behaviour of net pair-wise directional connectedness at different stages of the recent sovereign debt crisis.

1. Introduction

Regulatory convergence and the elimination of currency risk[1] are two of the reasons behind the significant increase in cross-border financial activity in the euro area since the beginning of the twenty-first century (see Kalemi-Ozcan et al., 2010 and Barnes et al., 2010). This effect has been even stronger in some of the EMU peripheral countries.[2] However, although cross-border banking clearly benefits risk diversification in businesses' portfolios and is considered by monetary authorities as a hallmark of successful financial integration, it also presents some drawbacks. First, foreign capital is likely to be much more mobile than domestic capital; in a crisis situation, foreign banks may simply decide to "cut and run". Moreover, in an integrated banking system, financial or sovereign crises in a country can quickly spill over into other countries. Indeed, given the high degree of interconnectedness in European financial markets, a major fear was that the default of the sovereign/banking sector in one EMU country could have spillover effects that might result in subsequent defaults in the euro area as a whole (see Schoenmaker and Wagner, 2013).[3]

* Corresponding author. Tel.: +34 913942342; fax: +34 913942591.
E-mail addresses: ffernandez@dmc.ulpgc.es (F. Fernández-Rodríguez), marta.gomezpuig@ub.edu (M. Gómez-Puig), sosvilla@ccee.ucm.es (S. Sosvilla-Rivero).

[1] The introduction of the Single Banking License in 1989 through the Second Banking Directive was a decisive step towards a unified European financial market, which led to a convergence in financial legislation and regulation across member countries.

[2] In particular, the sources of external financing for Portuguese and Greek banks radically shifted on joining the euro; traditionally reliant on dollar debt, their banks were subsequently able to raise funds from their counterparts elsewhere in the EMU (see Spiegel, 2009a,b).

[3] Theoretical research modelling various aspects of the costs and benefits of cross-border banking (e.g. Dasgupta, 2004; Goldstein and Pauzner, 2004; Wagner, 2010) concludes that some degree of integration is beneficial but that an excessive degree may not be.

http://dx.doi.org/10.1016/j.intfin.2016.04.005
1042-4431/

In this context, an important reason and justification for providing financial support to Greece in May 2010 was precisely the "fear" of contagion (see, for instance, Constâncio, 2012), not only because there was a sudden loss of confidence among investors, who turned their attention to the macroeconomic and fiscal imbalances within EMU countries which had largely been ignored until then (see Beirne and Fratzscher, 2013), but also because several European Union banks had a particularly high exposure to Greece (see Gómez-Puig and Sosvilla-Rivero, 2013 or Vuillemey and Peltonen, 2015).[4] As a matter of fact, tensions in EMU sovereign bond markets led to an increase in the cost of new loans and a contraction in credit which has been particularly strong in the countries most affected by the crisis. Neri and Ropele (2013) show that the higher cost of credit and the contraction in lending exerted a negative and significant effect on industrial production in both the peripheral and core countries.

Indeed, from late 2009 onwards, the demand for the German bund grew due to its safe haven status, and yield spreads of euro area issues with respect to Germany spiralled (see Fig. 1). Besides, since May 2010, not only has Greece been rescued three times, but Ireland, Portugal and Cyprus also needed bailouts to stay afloat.

In this scenario, where we have seen how crisis episodes in a given EMU sovereign market affect other markets almost instantaneously, some important questions have emerged that economists, policymakers, and practitioners need to address urgently.[5] To what extent was the sovereign risk premium increase in the euro area during the European sovereign debt crisis due only to deteriorated debt sustainability in member countries? Did markets' degree of connectedness play any significant role in this increase?

The literature includes two groups of theories of contagion which, though not necessarily mutually exclusive (see Dungey and Gajurel, 2013), have fostered considerable debate. On the one hand, since fundamentals of different countries may be interconnected by their cross-border flows of goods, services, and capital, or common shocks may adversely affect several economies simultaneously, transmission between countries may occur. These effects are known in the literature as "spillovers" (Masson, 1999), "interdependence" (Forbes and Rigobon, 2002), or "fundamentals-based contagion" (Kaminsky and Reinhart, 2000). On the other hand, financial crises in one country may conceivably trigger crises elsewhere for reasons unexplained by macroeconomic fundamentals – perhaps because they lead to shifts in market sentiment, change the interpretation given to existing information, or trigger herding behaviour. This transmission mechanism is known in the literature as "pure contagion" (Masson, 1999).

In the European context, recent events have encouraged a new discussion of contagion. Unlike previous crises, in which the country responsible for spreading the shock was relatively clear, in the euro sovereign debt crisis several peripheral countries entered a fiscal crisis at roughly the same time. Actually, when a group of countries share an exchange rate agreement (a common currency in the case of the EMU countries), crises tend to be clustered. Thus, it seems reasonable that, since the economic fundamentals of euro area countries are interconnected by their cross-border flows of goods, services, and capital, other variables beyond deteriorated debt sustainability might also be at the origin of financial stress transmission.

Researchers have already studied transmission and/or contagion between sovereigns in the euro area context using a variety of methodologies (correlation-based measures, conditional value-at-risk (CoVaR), or Granger-causality approach, among others)[6]: Kalbaska and Gatkowski (2012), Metieu (2012), Caporin et al. (2013), Beirne and Fratzscher (2013), Gorea and Radev (2014), Gómez-Puig and Sosvilla-Rivero (2014) or Ludwig (2014) to name a few.

Nevertheless, in this paper we will focus on the interconnection between EMU sovereign debt markets by applying a methodology which has not been widely used in this area. Specifically, we will make use of Diebold and Yilmaz's (2014) measures of connectedness (both system-wide and pair-wise) in order to contribute to the literature on international transmission mechanisms that the sovereign debt crisis in the euro area has rekindled, and to be able to answer some of the previously posed questions.[7] Diebold and Yilmaz's (2014) connectedness framework is closely linked with both modern network theory (see Glover and Richards-Shubik, 2014) and modern measures of systemic risk (see Ang and Longstaff, 2013 or Acemoglu et al., 2015) and has been used by Diebold and Yilmaz (2015) for defining, measuring, and monitoring connectedness in financial and related macroeconomic environments (cross-firm, cross-asset, cross-market, cross-country, etc.). The

[4] The latter authors explore risk transmission in the euro area by examining the inter-linkages between sovereign and banking risk in EMU countries caused by the high sovereign bond holdings of European banks.

[5] In the mid-2000s, capital flows into the euro area were particularly large and the share of foreign holdings of euro area securities increased substantially between the introduction of the euro and the outbreak of the global financial crisis. In that context, some authors (Carvalho and Fidora, 2015, among them) show that the increase in foreign holdings of euro area bonds in that period is highly associated with a reduction of euro area long-term interest rates. Conversely, in crisis times, the important decrease in foreign holdings of sovereign debt triggered a sudden rise of their yields. This is the reason why the analysis in this paper is focused in long-term sovereign bond yields, although short-term capital is usually more volatile than the long one.

[6] See Billio et al. (2012) for a review of the measures proposed in the literature to estimate those linkages.

[7] The connectedness methodology has several advantages over the alternative approach of focusing on contemporaneous correlations (corrected or not for volatility). First, while correlation is a symmetrical measure, connectedness is an asymmetrical one, so the procedure provides information on the direction and magnitude of the volatility transmission (from country A to country B, from country B to country A, or both). Second, by investigating dynamic connectedness through a rolling window, we can evaluate how the strength of the connectedness evolves over time, allowing us to detect episodes of sudden and temporary increases in volatility transmission.

Please cite this article in press as: Fernández-Rodríguez, F., et al. Using connectedness analysis to assess financial stress transmission in EMU sovereign bond market volatility. J. Int. Financ. Markets Inst. Money (2016), http://dx.doi.org/10.1016/j.intfin.2016.04.005