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The euro area sovereign debt crisis: Can contagion spread from the periphery to the core?

Denis Gorea [a], Deyan Radev [b,*]

[a] Goethe University Frankfurt, GSEFM, Grüneburgplatz 1, 60323 Frankfurt am Main, Germany
[b] Faculty of Law, Management and Economics, Johannes Gutenberg University Mainz, Jakob-Welder-Weg 4, 55128 Mainz, Germany

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ABSTRACT

We examine the determinants of joint default risk of euro area countries during 2007–2011. To accomplish this, we recover joint default probabilities from individual CDS contracts. In contrast to earlier theoretical studies, we find that financial linkages are an active contagion transmission channel only in the case of the troubled periphery euro area economies. During the current sovereign debt crisis, real economy linkages play a more important role in transmitting shocks from the euro area periphery towards its core. Countries that have stronger trade interconnections with troubled economies tend to have a higher expected joint default risk.

1. Introduction

The economic problems of Greece, Ireland, Italy, Portugal and Spain have sparked the fear of contagion that could threaten the sustainability of the euro area (EA). This raises the question of how to measure the degree of vulnerability of sovereigns to default. In this paper, we derive the perceived joint probability of default (JPoD) for EA country pairs, that is, the market consensus regarding the likelihood of extreme negative events to spread among EA countries. Furthermore, we identify the main determinants of increases in the joint probability of sovereign default. We also document what transmission channels might facilitate contagion across the troubled EA periphery and the healthy core during the recent crises.

In our setting, contagion is defined as an increase in the joint probability of default after a shock to one country. For most of our analysis, we implicitly assume that the shock originates in the periphery of the EA which consists of Greece, Ireland, Italy, Portugal and Spain. The rest of EA countries are characterized as being part of the EA core. We focus mainly on two potential transmission channels through which shocks from the periphery can transmit to the core: through financial linkages and through real economy interconnections. Financial linkages, defined as the banking claims to and by foreign residents within a country couple, can serve as a transmission channel when banks of one sovereign fall victim to a shock and cannot repay their obligations towards banks of another sovereign. In this case, the latter sovereign might have to step in and recapitalize its banks, incurring immediate losses and damaging its fiscal stance. Real economy interconnections have a similar impact; namely shocks to one country could transmit through the trade credit associated with firms exporting to another country. In this case, firms would incur losses if their counterparts in the other country were to renege on their obligations due to some shock. This would imply lower tax revenues for the sovereigns and decrease their capability of repaying debt.

* Corresponding author at: Center for Financial Studies, Goethe University Frankfurt, Grüneburgplatz 1, 60323 Frankfurt am Main, Germany. Tel.: +49 69 798 33699; fax: +49 69 798 33901.
E-mail addresses: denis.gorea@hof.uni-frankfurt.de (D. Gorea), radev@safe.uni-frankfurt.de (D. Radev).

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In our measurement of the joint probability of default, we depart from ex-post definitions of default and focus on market expectations regarding such events. In this sense, the sovereign will be considered distressed in our setting whenever the market believes that the sovereign's unobserved assets are below a certain threshold. We recover these expected joint default probabilities from the credit default swap (CDS) spreads of 13 EA countries between January 2007 and August 2011. Our results reveal considerable heterogeneity in the levels of perceived joint default risk across the country pairs that we investigate. However, two events seem to be of major importance for the overall JPoD dynamics: Lehman Brothers' filing for bankruptcy in September 2008 and the Greek government's announcement of its fiscal problems in early November 2009. The subsequent empirical analysis allows us to identify whether shocks were spread through real economy or through financial channels.

We find that real economy interconnections (proxied by bilateral trade flows) seem to play a significant role in forming the market perceptions about sovereign default risk, as countries that trade intensively tend to have a higher JPoD during the sovereign debt crisis. Moreover, this channel facilitates the transmission of shocks both within the group of troubled economies mentioned above and from the troubled economies to the rest of the EA countries. We also find that financial linkages are an active contagion transmission channel only in the case of the troubled economies, in contrast to the existing literature suggesting that such interconnections could transmit shocks between EA periphery and core (see e.g. Bolton & Jeanne, 2011). Our results also suggest that stronger and larger economies with a low debt-to-GDP ratio seem to have a lower perceived joint probability of default. Furthermore, we find evidence for changes in the magnitude and significance of these effects across different subgroups of countries, both before and after the aforementioned major events. Regional factors, such as EA market illiquidity and uncertainty, also seem to be important determinants of JPoD across all our specifications.

Most recent studies on sovereign distress analyze the linear dependence between countries, instead of focusing on tail risk measures. Longstaff, Pan, Pedersen, and Singleton (2011) conclude that sovereign debt returns are more correlated than equity returns, based on a sample of 26 countries. Pan and Singleton (2008) study the linear dependence of five-year CDS contracts on the sovereign debt of Korea, Turkey and Mexico and find a high level of co-movement between these instruments. Moreover, Reinhart and Rogoff (2011) find that linear dependence during extreme events in sovereign markets seems to be as strong as in normal times.

In contrast to these previous studies, we argue that the event of an advanced economy defaulting should be considered a tail event. A well-known fact in the economics and statistics literature is that linear dependence measures such as the correlation coefficient fail to capture the dependence structure in the tail of the joint distribution.[1] Therefore, they are inadequate for investigating the current sovereign debt crisis. To overcome this deficiency, we employ a procedure that models the tail behavior of sovereign assets, compatible with the literature on contagion. Our approach is based on the Consistent Information Multivariate Density Optimizing Methodology (CIMDO) developed by Segoviano (2006). This methodology has recently been used by Segoviano and Goodhart (2009) to construct banking stability measures. Under this framework, we view the EA as a joint distribution of its individual constituents. To account for the fat-tail characteristic of financial assets, the CIMDO approach adjusts the probability mass in the tail regions of this distribution with information derived from market data.

The benefit of this methodology is that it allows us to model nonlinearities in the multivariate distress–dependence structure, making it more flexible in capturing joint extremes compared to the usual Pearson's correlation coefficient. Furthermore, the CIMDO approach is specifically designed to make efficient use of a limited amount of publicly available time-varying country-specific information. Due to the dynamic updating of the joint density with new empirical information, the underlying dependence structure of the CIMDO distribution is intrinsically time-varying. With the help of this approach, we derive the joint distribution of EA sovereign assets. Focusing on the tails of this distribution yields our sovereign JPoD measure.

Sovereign defaults, however rare, entail serious welfare costs not only for the parties involved in the debt contract, but also for third parties if the default risk spreads. On one side, we have the loss of reputation and limited future access to international debt markets of the defaulted sovereign (see Panizza, Sturzenegger, & Zettelmeyer, 2009). On the other side, sovereign defaults have direct negative effects on domestic firms and foreign creditors (see Arteta & Hale, 2008). Thus, sovereign default shocks could easily transmit throughout the EA's financial system due to the complex trade and banking links between EA sovereigns, EA banks and between EA sovereigns and banks. Our country-pair setup allows us to test the importance of financial and trade interconnections in transmitting shocks across countries.

After deriving investors' perceptions about joint sovereign default, we undertake an empirical analysis to investigate which of these interconnections are of importance to international investors when analyzing contagion risks. Such an analysis has strong implications for policymakers and regulators alike for a number of reasons. First, policymakers are interested in the level of systemic risk, that is, the risk of a particular negative event to lead to the collapse of the entire financial system. In this respect, our measure of joint default risk provides an estimate of the vulnerability of the EA to a sovereign default event. Other things equal, the higher the (unconditional) joint default probability, the higher the probability of a sovereign to default is, given that another sovereign defaults.[2] Second, analyzing market expectations can provide important insights and recommendations for policymakers when deciding which measures should be undertaken to defuse contagion risks. In this context, it is essential to know whether investors perceive the real

[1] See Embrechts, McNeil, Straumann (1999) for several examples of improper inference using the correlation coefficient. In the case of the debt markets discussed in this paper, interpreting a high correlation coefficient as an indicator for high joint probability of default would be an example of erroneous inference.

[2] Note that JPoD is an unconditional probability measure and therefore it reflects the contagion potential. At first sight, this measure does not reflect fully our definition of contagion. The reason not to rely on conditional measures is that a rise in the individual probability of default has an ambiguous effect on the conditional probability of default, as can be seen from the Bayes rule: $PoD(x|y) = JPoD(x,y)/PoD(y)$. Here the direct effect of a rise in $PoD(y)$ is a decrease in $PoD(x \mid y)$. However, there is a positive indirect counter effect on $PoD(x|y)$ through the rise in $JPoD(x,y)$ (assuming a positive correlation between assets X and Y). Therefore, any hypothesis based on controlling for individual effects would be difficult to evaluate. This is not the case when we consider $JPoD(x,y)$.