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Abstract

We provide a new measure of sovereign country risk exposure (SCRE) to global sovereign tail risk based on information incorporated in 5-year sovereign CDS spreads. Our panel regressions with quarterly data from 53 countries show that macro risks have strong explanatory power for SCRE. Results show that SCRE increases for countries with less fiscal space, higher interest rates, and financial stability concerns. Exposure sensitivity to public sector leverage is shown to increase non-linearly with public debt and

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to decrease with central banks' sovereign debt programs. Our results imply that good forward-looking macro-finance fundamentals, such as high expected GDP growth and low credit-to-GDP ratios protect countries against sovereign risk especially in times of global distress.

JEL Classification: E43, F34, F36, G01, H63

Keywords: Sovereign Debt Crisis, Exposure, Panel Data Analysis

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1 Introduction

In times of global financial turmoil some sovereigns appear more vulnerable than others. Indeed, while investors seem to be reluctant to invest in certain national government bond markets, they can be eager to invest their savings in safe sovereign assets yielding almost zero interest rates. Understanding the key drivers of exposure to global sovereign distress is of utmost important for both monetary and fiscal authorities to inform policy shifts, as well as private investors to support portfolio allocation decisions. In this context, this paper tries to answer a very specific question: What macro-financial fundamentals make investors distrust some countries more than others in times of global sovereign debt crises?

The paper's first contribution is to derive a new measure of country-sovereign debt exposure to global-sovereign debt distress. This measure is obtained as the average of the country's 5-year sovereign debt credit default swap (CDS) spread associated with the *worst* realizations of global sovereign risk during each quarter at alternative significance levels. Global sovereign risk is in turn computed as the implied time-varying GDP-weighted average of 53 countries sovereign CDS spreads. Our measure is inspired in the methodology developed by Acharya, Pedersen, Philippon, and Richardson (2016) in the banking literature, in which banks' exposure to systemic risk is explained in terms of balance sheet determinants. Analogously, we control for the externalities of large countries on sovereign markets in the construction of our global risk measure in order to capture the exposure of country risk to global tail risk. A key contribution of the paper is to explain what macro-financial factors make such exposure more severe in a panel data setting.

Our results show that strong expected macro fundamentals decisively insulate countries from global sovereign risk. We find that countries with lower expected GDP growth, higher interest rates, and excessive credit growth are significantly more exposed to global risk. In contrast, sound monetary and fiscal policies are both key in reducing exposure: High fiscal space -lower debt to GDP ratio- and adequate monetary/financial policy stance prevent exposure against global sovereign risk. Overall, our empirical results present two novel insights with respect to the previous literature: First, forward-looking variables, such as expectations of GDP growth, the monetary policy stance and the credit-to-GDP ratio emerge as relevant drivers of sovereign exposure to global sovereign tail risk. Second, exposure to government leverage is clearly non-linear, as illustrated by our analysis. In particular, the relation between exposure and public debt is positive and non-linear with regard to the level of public debt. It also depends on policy messages and actions taken by monetary policy authorities to support specific sovereign debt markets. We show that these results are independent of the confidence level set for the global tail risk dependence measure (i.e. 1, 5 or 10%).

Recent literature also uses CDS spreads as a measure of sovereign credit risk.[1] In their regressions, Longstaff, Pan, Pedersen, and Singleton (2011) emphasize the key role of international factors in explaining credit risk differentials. While we also control for global factors, we find that local macro-financial variables are important in explaining these differentials. The focus of our study is also quite different. First, we construct a measure of country-sovereign exposure to global sovereign *tail* risk. In a second step, we identify what macro-financial factors directly influence such exposure. This novel approach to explain the factors behind global-to-local interdependence differentiates our analysis from that of Aizenman, Hutchison, and Jinjarak (2013). We also focus on a larger set of variables and perform a number of policy exercises showing non-linear effects of debt-to-GDP based on both its level and interactions with the monetary policy measures taken to support sovereign debt markets.

Beirne and Fratzscher (2013) carry out an analysis of sovereign risk during the recent crisis and conclude that poor fundamentals contributed to higher CDS spreads and yields during the recent financial crisis. Several important aspects differentiate our study from theirs. First, while they directly examine the impact of fundamentals on CDS spreads, we identify the impact of fundamentals on a novel measure of sovereign exposure to global tail risk. Second, we study a much larger set of explanatory drivers in order to draw policy recommendations. Some of the new indicators included in our analysis turn out to be crucial in driving sovereign market exposure, such as expectations of future macro variables, alternative debt thresholds and financial stability variables (loose/tight monetary policy, credit-to-GDP ratio). Third, our results capture the positive externality of accommodative post-July-2012 monetary policy by the ECB, which helped not only to compress sovereign spreads but to reduce the exposure sensitivity of Eurozone peripheral countries to government indebtedness.

There are other papers focused on disentangling idiosyncratic and common components in financial contagion episodes. Ang and Longstaff (2013) and Broto and Perez-Quirós (2015) estimate the exposure of US states and European Monetary Union countries to the systemic component of sovereign credit risk. Our results implicitly support some of their findings, as they also find that some countries suffer more than others in times of global turbulence. Our methodologies and analysis are however considerably different on many dimensions. The most important difference across studies is that they do not explain tail-risk exposure in terms of specific macro-financial fundamentals, as we do.

Another strand of the contagion literature focuses on correlations across alternative financial markets, distinguishing between quiet and turbulent times (see King and Wadhwani (1990), Longin and Solnik (2001) and Caporin, Pelizzon, Ravazzolo, and Rigobon (2013), among others). In contrast to these studies, we extract exposure measures based

[1] Earlier work focused instead on sovereign yield spreads across countries. Some examples are Edwards (1984), Edwards (1986), Berg and Sachs (1988), Duffie, Pedersen, and Singleton (2003).

on the CDS performance associated with global tail risk. In this way, we explicitly account for the impact of global distress on the home market and, at a later stage, relate exposure to macro-finance fundamentals. Bae, Karolyi, and Stulz (2003) develop the co-excedence measure, which captures coincidences in tail stock returns across markets. Based on this measure, they run multinomial logits of actual coincidences on regional volatilities, interest rates and exchange rates. In our approach we also focus on contemporaneous interactions, rather than on dynamic domino effects or international spillovers happening over time. However, there are some important differences in terms of markets (stocks v/s sovereign debt), sample (pre-2000 v/s post-2000) and econometric framework, among others. The two metrics of exposure are also quite different, since they count coincidences in two-sided tail returns while we capture CDS sovereign debt market spreads associated with global downside tail risk. Finally, our set of exposure macro-financial drivers is substantially larger, allowing us to provide richer policy implications.

Our results resonate well with the flight-to-quality international finance literature. Theoretical and empirical work has provided a good characterization of flight-to-quality events in the wake of financial crisis episodes (see Calvo (2005), Caballero and Krishnamurthy (2008), Krishnamurthy (2010) and Baele, Bekaert, Inghelbrecht, and Wei (2013), among others). The focus of our study is however to explain why some countries end up being more exposed than others. While our results are associated with the years around the recent 2008 financial crisis and its aftermath, this key event provides a very relevant episode to study the macro-financial drivers of portfolio flows to sovereign debt markets.

The paper proceeds as follows. In Section 2, we develop a measure of global sovereign debt distress and the associated exposure by country. Section 3 discusses our data selection whereas Section 4 derives our econometric methodology in order to identify the country exposure to global sovereign risk. Section 5 shows the empirical results, and performs a battery of policy and robustness exercises. Section 6 derives policy implications and concludes.

2 A Measure of Exposure to Global Sovereign Debt Distress

This section proceeds in two parts. The first one develops a measure of global-sovereign risk while the second one derives a metric capturing the exposure of country-sovereign risk to global sovereign risk. We now explain in detail how we construct these two measures.

2.1 A Global Sovereign Debt Default Risk Index

In this paper, we use 5-year sovereign CDS spreads as a measure of sovereign risk. These CDS spreads are mid-market indicative prices for five-year CDS contracts. The CDS spread is the insurance premium for protection against default. At origination, this premium is set such that the CDS has a value of zero. During the life of the contract, when the credit risk of the underlying asset increases, CDS premiums tend to increase, thus hindering supply and demand in actual sovereign debt markets. CDS pricing also feeds into rating models and thus into both the issuance cost of sovereign debt and the willingness of market participants to hold sovereign paper (see Fitch (2007) and Rubia, Sanchis-Marco and Serrano (2016)).

The use of CDS spreads in our setting enhances the statistical power of the analysis because there are instances where a sovereign crisis could happen but does not. Thus CDS spreads capture the risk of a crisis even if the default event does not materialize. As a result, it gets around the small sample problem present in studies which only study actual crises. While CDS spreads are both a measure of probability of default and loss given default (Singh and Bilal (2012)), both dimensions translate into higher default-based expected losses for the investor. Finally, as in Aizenman, Hutchison, and Jinjarak (2013) and other studies, we measure CDS spreads in levels, which are comparable across countries and times. They are based on 5-year term contracts, since this is the most traded CDS in practice.

Due to data availability, the early literature –dating back to the 80s–, measured sovereign risk as the spread on sovereign long-term bonds. This spread is simply the difference between the long-term sovereign interest rate of a given country and the analog sovereign rate of a reference country with no default risk. The recent literature has emphasized the advantages of using CDS spreads instead whenever researchers are focused on default risk. As pointed out by Ang and Longstaff (2013), CDS spreads allow researchers to capture default risk more directly due to their very nature –they pay back to the buyer the face value of the debt contract in case of debt default–, thus abstracting from alternative macroeconomic risks (see Abbritti, Gil-Alana, Lovcha, and Moreno (2016) for an analysis of these alternative risks).

Our analysis focuses on the exposure of country-sovereign default risk to global-sovereign tail events. We thus take a global-to-local approach. Several recent papers have analyzed the global-to-local direction in debt markets and concluded that global shocks affect countries' sovereign debt markets (Csonto and Ivaschenko (2013), Arslanalp and Tsuda (2014) and Ebeke and Kyobe (2015)). In our analysis we are interested in identifying the factors driving the sensitivity of local sovereign default risk to situations where global sovereign markets are in distress. This framework gives policy makers valuable information to manage macro-financial risks and adopt policies to insulate their economies, at least partially, to future global turmoil.

In order to describe our empirical methodology, we first introduce a general real GDP-weighted measure of daily global sovereign risk based on the CDS spreads of all countries:

$$GSRI_t = \left(\sum_{i=1}^{N} GDP_{i,t}\right)^{-1} \sum_{i=1}^{N} GDP_{i,t} \times CDS_{i,t}, \tag{1}$$

where N is the total number of countries used in the construction of the index, $GDP_{i,t}$ and $CDS_{i,t}$ are the real GDP and the CDS spread of the i-th country on day t, respectively. Our sample includes N=53 countries, covering all continents (see Table 1). We work with daily CDS data, while the GDP weights are updated on a quarterly basis –they are thus invariant during quarter q–. Our GDP-weighted measure is motivated by the fact that larger countries create higher real and financial spillovers to the rest of the world. In short, when a relatively large country experiences higher sovereign default risk, its public finance solvency problems will transmit more strongly throughout the global economy. Larger countries have the potential to create damaging negative externalities in financial markets given their high sovereign debt loads and deep international trade relations. Stress in these countries can then induce a change in investor risk aversion, with an implied impact on other countries' sovereign default risk.

Second, the $GSRI$ index in (1) results from a weighted average of the CDS spreads in a sample of N countries. As a result, it emerges as a single global index, common to all individual countries in the sample. In order to avoid the mechanical effect of one country's risk on itself, we exclude that country from the computation of the global risk measure. So, we construct the daily global risk measure associated with each country j, excluding itself from the computation of global risk in the same spirit as López-Espinosa, Moreno, Rubia, and Valderrama (2012). Thus, for the j-th country in the sample, we can define a country-specific $GSRI$ index representative of the average risk profile in the remaining countries:

$$GSRI_{j,t} = \left(\sum_{i=1, i\neq j}^{N} GDP_{i,t}\right)^{-1} \sum_{i=1, i\neq j}^{N} GDP_{i,t} \times CDS_{i,t}. \tag{2}$$

2.2 A Measure of Exposure to Global Sovereign Default Risk

We now introduce the measure of local exposure to global risk, $SCRE$. Assume that one has computed the sequence $GSRI_{j,t}$ for a given country j given a sample of daily observations $t = 1, ..., T$ along Q quarters. Assume that the q-th quarter is formed by M_q daily observations and let $GSRI_{j,t,(m)}$ $m = 1, ..., M_q$ denote the m-th ordered observation of the $GSRI$ index at such quarter, noting, for instance, that $GSRI_{j,t,(1)}$ and $GSRI_{j,t,(M_q)}$ would correspond to the minimum and the maximum daily observation of the process within the quarter, respectively. For ease of exposition, assume that $M_q = 100$ and that $GSRI_{j,t,(m)}$ is monotonically increasing such that $GSRI_{j,t,(m)} < GSRI_{j,t,(m+1)}$.

In this context, the ordered observation $GSRI_{j,t,(m)}$ corresponds exactly to the m-th empirical quantile of the process. For an arbitrary shortfall probability α, the observation $GSRI_{j,t,(100(1-\alpha))}$ defines a risk threshold such that the empirical probability of observing a realization of the weighted-average global index higher than this level is only $100 \times \alpha$. Note that $GSRI_{j,t,(100(1-\alpha))}$ can be seen as the empirical daily Value-at-Risk (VaR)of the process at the α confidence level, i.e., since the underlying asset is the CDS spread, the (historical or realized) α VaR level is given by the $1-\alpha$ percentile in the sample.

Next, given the shortfall probability α and its complement $\lambda = 1-\alpha$, consider the ordinal set:

$$\mathcal{S}_q(\alpha) = \left\{ t : GSRI_{j,t} > GSRI_{j,t,(100\lambda)} \right\} \tag{3}$$

signaling the days within the q-th quarter in which the observed value of the $GSRI$ index exceeds the $100(1-\alpha)$ VaR threshold, i.e., the days in which a VaR violation (also known as a VaR exception in the related literature) occurred given the choice of α. Note that, by construction, the $\mathcal{S}_q(\alpha)$ set is composed of $100 \times \alpha$ observations, each one indicating a particular day within the quarter. Then, given the shortfall probability α, and in the same spirit as Acharya, Pedersen, Philippon, and Richardson (2016), we define $SCRE$ as:

$$SCRE_{j,q}(\alpha) = E\left(CDS_{j,t} \,|\, t \in \mathcal{S}_q(\alpha)\right), \tag{4}$$

measuring the expected value of the country-specific CDS spread during the days in which its related global CDS index was greater than the α VaR threshold.

As a result, the $SCRE$ is an expected shortfall-type measure that can be proxied by the average value of the national CDS spread when the global debt market is in distress, this event being characterized by the occurrence of VaR exceptions in the global market. If the macro-financial fundamentals of a given country are such that the country is resilient against shocks originated in other economic areas, the $SCRE$ measure should not greatly differ from its unconditional values. Alternatively, if the local economy is vulnerable as a consequence of large exposures to other economies, $SCRE$ could considerably increase during these periods of global distress. Analyzing the empirical drivers of this variable is the main goal of this paper.

As an illustration of our exposure measure, Figure 1 plots the dynamics of the $SCRE$ index at the 1% level (alternative significance levels yield the same qualitative results) in 8 countries of our sample coming from the 6 different continents. The implied dynamics reveal several interesting facts. First, there is wide divergence in $SCRE$ across countries. Second, the fourth quarter of 2008 is the period in which most countries were exposed to global risk, coinciding with the aftermath of the Lehman Brothers collapse. Third, Turkey, Philippines, Peru and Mexico were most affected by this event. Fourth, France, a key European country, was the least affected by the 2008 crisis but ended up being the third most exposed to global risk during the 2011-2012 period, coinciding with the European sovereign debt crisis. Fifth, emerging markets, such as Turkey, Morocco, Peru and Philippines, exhibit an increase in exposure at the end of the sample (2015). Sixth, Australia is the least exposed country: While its exposure increased around 2008, it did so to a much lower level than most countries.

3 Data Selection

The dataset covers 53 countries across all continents including Europe (27), Americas (9), Asia (12), Africa (3), and Oceania (2) (Table 1). The sample includes 29 advanced economies and 24 emerging economies. Data spans from the first quarter of 2006 to the last quarter of 2015. In some countries or periods, CDS spreads did not exist during our data-span; in these instances, we drop those observations from the regression analysis. We use daily CDS spreads collected from Thomson Reuters Datastream. In our paper we focus on the explanatory power of macro-financial factors on the exposure of countries to global sovereign risk. Thus, we match CDS data with macro-financial data for all countries. Monthly forecast variables are sourced from Consensus Economics.[2] The data sources for all our variables are shown in Table 2.

The analysis follows a reduced form approach based on economic theory, empirical relevance, and policy impact, rather than a structural framework defined by the specification of a particular pricing model. Since sovereign CDS spreads reflect the risk that the country experiences a credit default event, the determinants of the sovereign exposure measure are closely linked to those underlying risks to debt sustainability. The set of debt sustainability factors include fiscal variables, economic fundamentals driving debt dynamics, rollover risk indicators, and the scope for contingent liabilities (International Monetary Fund (2013)). These variables inform our selection of exposure drivers to global sovereign default risk as we now describe.

Fiscal variables (debt-to-GDP and decit-to-GDP ratios) are key drivers of sovereign risk. A government is solvent if it is perceived to be able to generate sufficient primary budget surpluses to repay its outstanding debt. According to IMFs Debt Sustainability Analysis (DSA), the higher the level of public debt, the higher the probability that fiscal policy and public debt might become unsustainable. One of the implications in the theoretical work by Broner, Erce, Martin, and Ventura (2014) is that less public debt and strong institutions can help the economy avoid the risk of such self-fullling sovereign debt crises. Empirically, Heinz and Sun (2014) find that fiscal consolidation effort has a large effect on CDS spreads. A one percentage point increase in the fiscal deficit raised CDS spreads by 16 bps during the euro crisis episode, suggesting that, especially under market duress, markets perception of the fiscal consolidation path has a significant bearing on CDS spreads. High level of public debt also raises CDS spreads. They find

[2]Consensus Economics is the world's leading international economic survey covering estimates for the principal macroeconomic indicators including GDP growth, inflation, interest rates, and exchange rates, over 85 countries, as well as commodity prices.

that the norm CDS spreads for countries with debt exceeding 80 percent of GDP would be higher by 105 bps during the euro crisis compared to other countries. These results are supported by the findings in Cottarelli and Jaramillo (2012). Fiscal fundamentals (primary balances and public debt) are found to have a significant effect on CDS spreads in advanced economies: An improvement in the primary balance-to-GDP ratio would reduce spreads while an increase in debt to GDP would raise them.

Besides including fiscal variables in our work, we also explore several dimensions related to public debt overhang problems, as excessive public debt and higher fiscal decits may curtail investment and growth. This notion is linked to the fiscal space framework proposed by Ghosh, Kim, Mendoza, Ostry and Qureshi (2013), which determines a debt limit beyond which fiscal solvency concerns trigger expectations of future defaults. Reinhart and Rogoff (2010) also point to the 90 percent public debt cutoff and we devote a subsection to the non-linear effect of different levels of public debt on exposure to global turmoil. We also address the potential public debt non-linear effect on exposure within both the Eurozone and the peripheral European countries. Policy changes, such as the ECB announcement to buy unlimited amount of Eurozone government debt (Draghi (2012)) are also analyzed in our setting, since this could affect the sensitivity of exposure public debt levels.

Economic fundamentals matter with regard to sovereign risk and debt dynamics. If macroeconomic imbalances are not corrected in a timely manner, the materialization of country-specific risks to sovereign debt sustainability would have adverse implications not only for the country concerned, but also for countries with similar debt structure and economic environment. Deteriorating economic fundamentals, reflected in lower GDP growth, higher inflation, and increasing interest rates, worsen debt dynamics by implying a rising debt path which is considered a clear sign of unsustainability. It also increases the horizon needed to stabilize the debt ratio implying heightened uncertainty and higher debt sustainability risks. Another channel through which fundamentals (GDP growth, inflation rate and risk-free rates) might impact sovereign exposure to global turmoil is through financial frictions. Institutional frameworks with poorer fundamentals tend to display higher information asymmetries across financial markets (Greenwald, Stiglitz, and Weiss (1984), and Mishkin (1996)), leading to a more uncertain environment for investors and higher exposure to global financial turmoil, such as global sovereign risk. This channel is particularly relevant for developing countries as attested during the financial turmoil generated by the taper tantrum (International Monetary Fund (2014)). Although market reaction was indiscriminate during the initial bout of volatility in May-June 2013 triggered by the Federal Reserves tapering process, market differentiation occurred during the subsequent bouts of volatility. Investors focused particularly on emerging markets with larger external financing needs and macroeconomic imbalances. Our analysis enables to assess the impact of this channel since our sample covers both developed and developing countries.

Expected economic growth is particularly relevant for sovereign risk. It is a forward-looking variable, much like financial market variables, such as CDS spreads. Arguably it incorporates valuable information for investors. For instance, countries with weak fiscal/external/financial positions could be less exposed to global tail risk if GDP growth expectations are good as higher growth helps mitigate debt sustainability concerns. Classical theoretical models, such as Calvo (1988), and more recent ones, such as Nicolini, Teles, Ayres, and Navarro (2015), imply that some countries can experience higher tensions in sovereign debt markets due to negative agents expectations about their policies and fundamentals. Baseline expectations on macroeconomic projections for GDP growth, price stability assumptions, and risk-free rates are incorporated in the DSA benchmark simulations conducted by the European Commission in their fiscal sustainability assessment of member states (European Commission, 2017).

Rollover risk indicators stemming from the economy-wide net financial position and external competitiveness also impact sovereign debt sustainability concerns. A country more open to trade could weather a crisis better, due to the diversication of its external sector. In turn, a country with high external debt could suffer more during global turmoil due to capital outows and to rollover problems (Diaz-Alejandro (1985) and McKinnon and Pill (1996)). Yet external debt could also lead to growth and a less probable exposure to global risk if stable foreign funding is allocated to productive investment projects. Among the external vulnerability indicators with the highest predictive power for sovereign crises identified by the European Commission's early warning framework, are current account balance indicators as well as a country's net international investment position (NIIP) are ranked as key determinants of sovereign distress (European Central Bank (2017)). We include the trade-to-GDP ratio (export plus imports) to proxy openness and the external-debt-to-GDP ratio to capture risks from the external indebtedness of the economy, including from the net financial position of the government. A higher external-debt ratio captures greater financing needs from external sources which exposes the sovereign to rollover risk.

Indicators of contingent liabilities can play a role in sovereign default risk exposure. The financial crisis has shown that fiscal costs can stem from contingent liabilities related to weak banks or private sectors indebtedness. Ratings agencies regularly incorporate an uplift from government support into banks credit rating assessment linked to changes in sovereign ratings. This captures the extent to which risks to bank creditors are mitigated by public support through the expectation of public guarantees and the bail-out of systemic banks (Moody's (2015)). At the same time, government support puts additional strain on public finances, rising the likelihood of future sovereign defaults. In light of the adverse sovereign-bank feedback loop, the rating agencies' methodological approach is typically based on joint default analysis based on the dependence between the sovereign capacity to provide support and the bank unsupported creditworthiness. This approach is examined empirically by the systemic contingent claims analysis ('Systemic CCA') framework which helps quantify the magnitude of general solvency risk and government contingent liabilities by combining the individual risk-adjusted balance sheets of financial institutions and the dependence between them. Sectoral interlinkages are illustrated by the significant fiscal costs and the materialization of contingent liabilities for governments triggered during the European sovereign debt crisis linked to the burst of unsustainable credit-financed booms and asset bubbles.

Excessive credit growth relative to GDP (measured by the credit-to-GDP ratio) emerges as a key driver to the formation of bubbles in credit and asset prices. Basel III uses the gap between the credit-to-GDP ratio and its long-term trend as a guide for setting countercyclical capital buffers aimed at strengthening banks resilience against the build-up of systemic vulnerabilities (Basel Committee on Banking Supervision (2010)). Fernández-Villaverde, Garicano, and Santos (2013) elaborate a theoretical model where weak corporate governance frameworks have a negative influence on saving banks by promoting too much credit. Thus, there is over-lending, bubbles and rising non-performing loans. Borrowers creditworthiness is also included in the set of contingent liabilities indicators used to assess sovereign-debt-related vulnerabilities and risks (European Central Bank (2017)). Gray, Gross, Paredes, and Sydow (2013) calibrate a global model to capture interlinkages between sovereign credit spreads, banking system credit risk, corporate credit risk, economic growth, and credit growth. They show that credit growth acts as a conduit of crisis propagation of distress in the sovereign, banking and corporate sector.

To capture lending conditions in credit markets, we also include the difference between the Taylor-implied interest rate and the 3-month rate.[3] This latter variable captures how loose/strict monetary policy is or has been in the past. As emphasized by the literature, countries with loose monetary policy can also experience over-lending and bubbles (Maddaloni and Peydró (2011)). The reinforcing effect between monetary policy stance and credit growth is illustrated by the series of targeted longer-term refinancing operations (TLTRO II) launched by the ECB in March 2016 to reinforce ECBs accommodative monetary policy stance and foster new credit.

Finally, we control for liquidity conditions in global money markets. Liquidity risk can undermine the sovereign's ability to refinance its maturing debt in funding markets, increasing the cost of servicing the debt and amplifying debt sustainability concerns. Fontana and Scheicher (2010) argue that liquidity shortages in money markets prompted investors' flight to liquidity behavior, which limited arbitrage across markets and contributed to a rise in sovereign CDS spreads during the European debt sovereign crisis. To control for global liquidity, we include the US TED spread difference between the 3-month unsecured inter-bank interest rate and the 3-month Treasury bill rate, as a proxy for global liquidity conditions. Hong, Huang and Wu (2014) show that systemic liquidity risk measured by the TED spread was a major predictor of default risk during the financial crisis.

[3] Since different countries -especially emerging ones- may have different inflation targets and natural real rates, we also calibrated alternative values to the ones originally proposed by Taylor (1993) for these variables with very similar subsequent results.

4 Econometric Approach

The goal of the present paper is to explain the country exposure to global tail sovereign risk in terms of macro-financial fundamentals. In order to uncover potentially significant relations and derive the associated policy implications, we work in the following panel data setting with country fixed effects:

$$SCRE_{j,q}(\alpha) = \gamma_j(\alpha) + \beta'(\alpha)Z_{j,q} + \epsilon_{j,q}, \tag{5}$$

where $\gamma_j(\alpha)$ is a country specific fixed effect for a given significance level α, controlling for unobserved heterogeneous country effects. $Z_{j,q}$ is the set of time-varying (quarterly) macro variables for country j, which act as predictors of exposure to financial risk, and $\epsilon_{j,q}$ is a random term with mean zero and assumed to obey standard assumptions.

The expected value that characterizes the $SCRE$ measure is computed as the sample mean of the country-specific CDS spreads over the days in which the values of the related $GSRI$ index exceeds the α VaR threshold in a given quarter. Note that this approach is entirely model-free as it does not build on any parametric assumption. As a result, it ensures robustness and consistency under fairly general conditions on the (formally unknown) data generating process that features ($SCRE_{j,q}(\alpha)$). In order to gauge the robustness of our results, we consider three different statistical significance levels (shortfall probabilities), namely, 10%, 5% and 1%.

In the estimation, we test for both potential multi-collinearity and endogeneity concerns. Economic growth is highly correlated with expectations of growth (0.70) and inflation is highly correlated with expectations of inflation (0.94). When applying the condition index, we find that the largest condition number is 32.31. Following Besley, Kuh, and Welsch (1980), and given that the condition number is larger than 30, multicollinearity is a very serious concern when we include both the actual variables (growth and inflation) and the expectations of their future values. Thus, we do not include these variables and their expectations jointly in our regressions. Given that expectations include information of both current and expected future events, we estimate our model with GDP growth expectations as a driver. We now explain how we use inflation (its first lag) as an instrument for the interest rate in our regressions (the first lag of expected inflation is also used as an instrument in some of the robustness exercises).

Preliminary analyses suggested that the interest rate variable could lead to endogeneity problems in our analysis. Consequently, we estimate model (5) using instrumental variable 2SLS regressions, where we instrument the interest rate with lagged inflation. The correlation between the interest rate and the first lag of inflation is quite high (62%) and there is also a pass-through of past inflation to the current interest rate given both the inflation persistence and the relation between inflation and the interest rate via Fisher effect and standard monetary policies, such as inflation targeting. Importantly, the inflation lag should not be correlated with the error term in the main equation, given that the right hand side variables (such as expected growth or monetary policy stance, among others) should capture information on past inflation, thus yielding an error term orthogonal to past inflation.

Regarding the statistical validity of our instrumental variables approach, we report at the bottom of each table the p-values associated with two tests. We report the p-values associated with testing whether the interest rate is exogenous (under header "Exogeneity" in the tables) following the method in Wu (1974) and Hausman (1978). We also show the p-values associated with testing whether the instruments are weak (under header "Instrument" in the tables), following Stock and Yogo (2005). p-values across the tables reported in the paper reveal rejections that the interest rate is exogenous (always at the 5% significance level and often at the 1%), and rejections that lagged inflation is a weak instrument for the interest rate (always at the 1% significance level). We thus find that the first lag of inflation is a valid instrument for the interest rate. We also found that results are robust to the inclusion of alternative valid instruments (see online Appendix). In particular, we have found that using the lag of expected inflation also delivers very similar results. Moreover, the combination of the following two or three instruments for the interest rate also delivered very similar results: Lagged interest rate and lagged inflation; lagged interest rate and lagged expected inflation; lagged interest rate, lagged inflation and lagged output growth.

In the next section we report the main paper results, a series of robustness exercises and discuss the associated policy implications.

5 Results

We organize our results section as follows. First, we show the benchmark results with our fixed effects panel regressions for the different significance levels in our exposure variable and the CDS mean/median spreads. In this way, we try to uncover differences in terms of pricing: Do macro-finance variables influence CDS spreads, exposure or both? Second, we refine our results based on alternative debt-to-GDP thresholds. Third, we study the contribution of the Eurozone (peripheral countries) problems and policy actions to the sensitivity of our exposure measure to fiscal variables. Finally, we report a series of robustness exercises.

5.1 Baseline Results

The first three columns of Table 3 show the parameter estimates of our panel regressions with country fixed-effects for our exposure variable and for three different significance levels (10, 5 and 1% in columns (1), (2) and (3), respectively). We obtain robust errors corrected for clustering at the quarter (time) dimension (similar results were obtained clustering at the country dimension). Results are similar across significance levels. We find the following statistically significant effects: Countries with lower expectations of GDP growth, higher interest rates (instrumented with lagged inflation), a higher debt-to-GDP ratio, lax monetary policy, low trade-to-GDP ratio and high credit-to-GDP ratio are significantly more exposed to global sovereign risk. These results highlight the overall importance of high productivity, sound fiscal policy and financial stability, and capture the main message of the paper: Good macro-financial policies and fundamentals act as insulators against global sovereign debt stress. With respect to previous related empirical studies (Aizenman, Hutchison, and Jinjarak (2013) and Beirne and Fratzscher (2013)), our paper underscores the role of low GDP growth expectations, lax monetary policy and high credit-to-GDP as important drivers of high sovereign debt exposure.

The last two columns ((4) and (5), respectively) of Table 3 show the results with the mean and median of the CDS values over the quarter as left-hand side variables, respectively. While results are similar to those of the exposure variables in terms of coefficient signs, a key difference emerges. It is often the case that the size of the exposure regression coefficients is higher than in mean/median CDS regressions. While this is expected to a certain extent –the exposure measures tend to include the worst realizations of the sovereign CDS spreads– the result is economically significant, as it implies that the macro prices of risk associated with many variables are higher in turbulent than normal times. Hence the policy implications for policy makers are especially relevant for stressful times in global sovereign markets.

The literature on sovereign credit pricing has emphasized the importance of liquidity in driving both cross-country and time series variations. Indeed some papers highlight flight-to-liquidity patterns in sovereign debt markets (Beber, Brandt, and Kavajecz (2009)). Notice, however, that our analysis substantially differs from these studies, as we try to explain exposure to global sovereign turmoil. In Table 3 -and subsequent tables- we control for the US TED spread (the difference between the 3-month interbank rate and the 3-month Treasury Bill rate), as a proxy for the ease of credit in a key financial market reflecting global liquidity conditions. Results for this variable are marginally significant, implying a negative relation between this spread and sovereign exposure. While this result runs counter to intuition, we note two things. First, the US TED spread measures liquidity in the US and may not capture local financial conditions in many of the countries in our sample. Second, the European debt crisis started to grow at a time when the TED spread was decreasing. Indeed, we have performed several unreported exercises showing that while American countries exposure increased with the TED spread, the opposite was the case for Eurozone countries. In the robustness exercise, we go back to illustrate this point.[4]

[4]The online Appendix shows that results are robust to the inclusion of the macro-finance drivers with one lag instead of contemporaneous values.

5.2 Debt Threshold Levels

One of the most important variables discussed in policy and academic circles is the level of debt-to-GDP and its relation with the capacity to grow. Indeed, Reinhart and Rogoff (2010) ignited an important debate by pointing at a 90% debt over GDP threshold level –via descriptive analysis– over which GDP growth levels begin to suffer. However, in a recent paper, Herndon, Ash, and Pollin (2014) have challenged their results. Our analysis already showed the significant predictive power of debt-to-GDP on exposure. We can shed some additional light on the issue but from a completely different perspective. We can check whether exposure of countries to global sovereign risk is affected by alternative debt-to-GDP thresholds.

Table 4 shows the results of panel regressions allowing for potential non-linear effects and split the contribution of the debt-to-GDP on exposure by countries/quarters with a debt-to-GDP ratio lower/higher than 90% (ie., we multiply the debt-to-GDP observations by two dummies, adopting values of one whenever debt-to-GDP is lower/higher than 90%). Table 4 shows these results for the alternative exposure confidence levels and the mean (median) CDS spreads. Baseline results are unaltered, with both debt-to-GDP variables being statistically significant. The sensitivity of CDS spreads to debt-to-GDP is higher for high debt-to-GDP countries.

We further investigate the debt non-linearities and endogenously estimate the thresholds themselves. We consider the possibility that the effect of debt changes in country exposure may non-linearly depend on the level of debt over GDP. Thresholds have been estimated endogenously from data, as in the threshold model literature, among others, by Tong (1983), Tong (1990), Chan (1993), Hansen (1999), Hansen (2000) and Caner and Hansen (2004). The two thresholds can be inferred similarly using sequential estimation as in the change-point literature; see Hansen (1999) for details. Our experiment shows that the best fitting model includes two thresholds, which are 106.59% and 157.44% The results in Table 5 are very interesting.[5] In this panel regression, the only segment of debt-to-GDP which remains statistically significant is that above 156.04%, with an economic value well above the other two segments. This points at an important role for fiscal non-linear effects on exposure variables. Furthermore, the deficit-to-GDP variable now becomes statistically significant, with higher deficit levels leading to higher sovereign exposure.

[5] In Table 5, low debt-GDP is associated with countries with less than 106.59% debt-to-GDP, int debt-GDP is for countries between 106.59 and 157.44% debt-to-GDP, while high debt-GDP is for countries above 157.44% debt-to-GDP. Endogenous thresholds are the same across regressions.

5.3 Eurozone Debt Crisis

Our sample includes the European sovereign debt crisis –a fallout of the 2008 global financial crisis–, affecting many Eurozone countries, especially those often called peripherals (Italy, Spain, Ireland, Portugal and Greece). At the same time, we recognize the potential importance of the July 26, 2012 speech by European Central Bank President, Mario Draghi, stressing the eagerness of the ECB to buy unlimited amounts of all Eurozone countries public debt and to save the euro. We now study the effects of this policy action on the exposure of peripheral countries to global sovereign tail risk.

In our reported exercise, we control for the effects of this promised policy action by adding both a dummy for Eurozone peripheral countries in the pre-2012:Q4 period and an interaction term between the public-debt-to GDP ratio and this dummy. In this way, we account for the potential different sensitivity of peripheral countries to public debt levels before and after the policy action. Results are reported in Table 6. Even accounting for the fact that peripherals' fundamentals were not good, non-linear effects emerge as important. The dummy on the interaction between peripherals and pre-2012:Q4 is positive and large, pointing at an extra exposure of peripherals to global sovereign tail risk before Draghi's July 2012 speech. Interestingly, results also show a stark decrease in terms of exposure sensitivity to public debt levels for peripheral countries since the 4th quarter of 2012 (note that the positive interaction term is for the pre-2012:Q4 quarter). Thus, this policy action had an important positive and differential effect for Eurozone peripheral countries, which saw their exposure substantially reduced.

5.4 Robustness Exercises

We carefully designed our methodology in the construction of the global measure to exclude mechanical effects from local to global credit risk. Nevertheless, it could be argued that the home country influences our global measure indirectly, through contagion to other countries. During our sample period, and as mentioned in previous subsections, some countries have been key originators of global risk. In particular, starting in 2010, the peripheral countries (Portugal, Italy, Ireland, Greece, Spain) were instrumental to increase European and global risk. To control for this potential effect and as a robustness analysis, we drop these countries from our estimation, but not from the computation of the global sovereign risk measure.

Table 7 excludes the five peripheral countries in the regression analysis. Three main findings are worth highlighting. First, dropping these countries result in a clear improvement in the fit of the model, with much higher R^2s, sometimes increasing to 52%. This is probably due to the fact that we removed some of the countries with higher exposure and thus more difficult to fit (see also Aizenman, Hutchison, and Jinjarak (2013)). Second, most of the previous results still hold under these specifications, but two new significant coefficients emerge. First, higher fiscal deficits significantly increase exposure to global tail risk. Second, removing the peripheral countries, higher external debt-to-GDP reduces exposure to global sovereign risk. So, for the remaining countries, external debt seems to have supported productive investment and economic growth, potentially enhancing their fiscal position. In turn, the TED spread is no longer significant when we exclude the peripherals, pointing at a key negative relation between peripherals and the TED spread driving the negative coefficient in the benchmark estimation.

As a last reported analysis, we perform an out-of-sample exercise based on our baseline specification. We estimate the model from 2006:Q1 to 2011:Q4. Based on the parameters estimated in this subsample and on the post-2012 right-hand side variables, we construct the out-of-sample predicted values and compare them with the post-2012 exposure values. Figure 2 plots these predicted values against the actual values for the regressions with exposure at the 1% confidence level. Our benchmark linear model predicts the exposure quite well for prices from 0 to 1,000, with errors being significant when the CDS price is above 5,000. However, we only have seven observations, after 2011:Q4 above this value (2 for Argentina and 5 for Greece). We also report in the graph the observations with large errors. For exposure at the 10%, the average of residuals is -35.76, -30.47 for exposure at 5%, -31.99 for exposure at 1%, -0.60 when we use the average CDS and 2.93 when median CDS is used. Overall, forecast errors are not statistically significantly different from zero.

6 Conclusions, Policy Implications

We study the exposure of national sovereign debt markets to global sovereign distress using a broad sample of advanced and emerging economies. The analysis explores a particularly relevant direction of international financial interdependence: From global to country risk in sovereign debt markets. National sovereign risk, captured by shifts to CDS spreads is in turn related to country macro-financial variables. Our battery of regressions shows that good macro fundamentals are key to understand why some countries are more affected by global risk than others. Thus, having good fundamentals is just not something good in itself but happens to be key in order to insulate countries from global turbulence episodes.

Our careful, if straightforward, analysis identified exposure to global sovereign risk. We first constructed a measure of global sovereign risk and then selected the country-sovereign risk observations associated with global distress over each quarter. We also removed the effect of a given country on global sovereign risk in order to avoid mechanical transmission from country sovereign risk. To shed additional insights on sovereign risk inter-dependences, we further refined our analysis along some dimensions, such as exploring non-linearities based on debt-to-GDP levels and focusing on specific countries belonging to the Eurozone. Across exercises, these regressions basically reinforced the baseline results. Interestingly, our exercises illustrated the positive impact that monetary policy makers had in the embattled Eurozone fiscal sectors. Indeed, we showed that sovereign debt exposure significantly and substantially decreased in these countries when the ECB announced they were going to be accommodative and to buy unlimited levels of sovereign debt.

In times of distress money flees problematic countries. This is the main tenet of the "flight to quality" literature (see Calvo (2005)). Our paper confirms this point and reveals a crucial amplification channel through national sovereign exposure to global tail risk. While the quantification of the implied borrowing costs under global tail risk is outside the scope of the paper, our results clearly show that poor fundamentals exacerbate sovereign distress by increasing the cost of insurance against credit risk.

These results have important policy implications at both the country and the multinational level. At the country level, fiscal, monetary and regulatory authorities should focus on good fundamentals not only to improve the current economic environment, but because these act as an insurance against global turmoil in sovereign debt markets. On the cross-sectoral dimension, given the interplay of risks across the sovereign, banking, and corporate sectors typically revealed in times of stress,[6] easing sovereign risk can also reduce the risk of spillovers to the financial sector and to the broader economy. On the time dimension, our results suggest that building economic buffers matter most in times of global distress. This points at the benefits of a framework for countercyclical macroeconomic policy which takes into account the global business cycle.

Our work also has implications for the work of international financial institutions (IFIs), aimed at preventing global financial crises. IFIs provide strong support for policies aiming at enhancing macro-financial stability. Our results provide support to the early warning exercise conducted by the IMF to strengthen surveillance of cross-sectoral and cross-border externalities triggered by economic, financial, and fiscal risks. As macro fundamentals grow more stable across countries, the likelihood that a crisis-like scenario materializes clearly diminishes. Our work can be used to complement the recent proposal formulated by Van Riet (2017) at the European Systemic Risk Board to encourage the issuance of national GDP-linked bonds against sovereign credit risk in the Eurozone.

An alternative interesting route of analysis would be to study the contribution of particular countries to global sovereign crises.[7] It may be that a country has been especially exposed to the crisis even if it has not contributed to the crisis at all. While

[6]See Gray, Gross, Paredes, and Sydow (2013) for an integrated macroeconomic systemic risk framework that draws on the advantages of forward-looking contingent claims analysis (CCA) risk indicators for the banking systems in each country, forward-looking CCA risk indicators for sovereigns, and a GVAR model to combine the banking, the sovereign, and the macro sphere for 15 European countries and the United States.

[7]Our exposure approach can be seen as complementary to the contribution approach, also present in the systemic risk literature, and developed in Adrian and Brunnermeier (2016) and López-Espinosa, Moreno, Rubia, and Valderrama (2012).

disentangling exposure and contribution in sovereign debt markets remains a challenge from both conceptual and technical viewpoints, it definitely deserves further research.

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Table 1: **List of countries in the sample**

Africa	Asia	America	Europe	Oceania
Egypt	China	Argentina	Austria	Australia
Morocco	Hong-Kong	Brazil	Belgium	New Zealand
South Africa	Indonesia	Canada	Croatia	
	Israel	Chile	Czech Republic	
	Japan	Mexico	Denmark	
	Malaysia	Colombia	Estonia	
	Pakistan	United States	Finland	
	Philippines	Venezuela	France	
	South Korea	Perú	Germany	
	Saudi Arabia		Greece	
	Thailand		Hungary	
	Turkey		Iceland	
			Ireland	
			Italy	
			Lithuania	
			Netherlands	
			Norway	
			Poland	
			Portugal	
			Romania	
			Russia	
			Slovakia	
			Slovenia	
			Spain	
			Sweden	
			Switzerland	
			United Kingdom	

Table 2: **Variables, Abbreviations and Datasources**

Variable	Abbreviation	Source
Credit Default Swap	CDS	Thomson Reuters Datastream
3-month Sovereign Interest Rate	int-rate	World Economic Outlook
GDP Growth Expectation (1-year)	E(growth)	Consensus Economics Forecasts
CPI Inflation Expectation (1-year)	E(growth)	Consensus Economics Forecasts
Taylor rule - 3-month Interest Rate	MP stance	World Economic Outlook
Government Debt to GDP	debt-gdp	World Economic Outlook
Government Deficit to GDP	def-gdp	World Economic Outlook
External Debt to GDP	ext-gdp	World Economic Outlook
Exports + Imports to GDP	trade-gdp	World Economic Outlook
Credit to GDP	credit-gdp	International Financial Statistics, Haver Analytics
3 month interbank rate - 3 month US T-Bill rate	ted	Bloomberg

This table shows variables used in our estimation exercises together with the abbreviations used in the forthcoming tables and the data sources.

Table 3: **Benchmark Parameter Estimates**

	(1)	(2)	(3)	(4)	(5)
int-rate	134.94***	135.41***	136.21***	119.69***	128.35***
	(3.42)	(3.43)	(3.45)	(3.54)	(3.17)
E(growth)	-149.56***	-149.26***	-148.44***	-141.25***	-148.39***
	(-4.08)	(-4.03)	(-3.96)	(-4.13)	(-4.13)
MP stance	38.52**	38.64**	38.22**	32.95**	38.39**
	(2.26)	(2.27)	(2.25)	(2.17)	(2.19)
debt-gdp	8.82***	8.98***	9.20***	8.31***	7.93***
	(4.82)	(4.78)	(4.69)	(4.37)	(4.70)
def-gdp	-8.40	-8.35	-8.40	-11.57*	-11.11*
	(-1.21)	(-1.17)	(-1.15)	(-1.82)	(-1.71)
ext-gdp	-0.05	-0.01	-0.02	0.52	0.46
	(-0.05)	(-0.00)	(-0.02)	(0.49)	(0.43)
trade-gdp	-1.48*	-1.51*	-1.53*	-1.23	-1.40*
	(-1.85)	(-1.90)	(-1.93)	(-1.61)	(-1.76)
ted	-148.22*	-142.06*	-140.01*	-144.85**	-164.65**
	(-1.85)	(-1.75)	(-1.72)	(-2.12)	(-2.02)
credit-gdp	5.08***	5.11***	5.24***	4.69***	4.36***
	(3.12)	(3.10)	(3.05)	(2.81)	(2.85)
Observations	2,001	2,001	2,001	2,001	2,001
R-squared	0.407	0.403	0.400	0.381	0.398
Exogeneity	0.018	0.018	0.017	0.016	0.024
Instrument	0.000	0.000	0.000	0.000	0.000

This table shows the IV 2SLS estimates of our econometric model (see equation (5) in the text) with quarterly data (from 2006:Q1 to 2015:Q4) and country-fixed effects (the associated t-statistics appear in parentheses). Lagged CPI inflation is used as instrument for the 3-month interest rate. Results in columns (1), (2) and (3) are those associated with exposure at the 10, 5 and 1% confidence level, respectively. (4) and (5) are results with the mean and median of the CDS values. Three, two and one star(s) imply statistical significance at the 1, 5 and 10% confidence level. Robust standard errors (corrected by time/quarter clustering) are employed.

Table 4: **Parameter Estimates: Threshold on 90% of Debt-To-GDP**

	(1)	(2)	(3)	(4)	(5)
int-rate	134.22***	134.70***	135.49***	118.99***	127.67***
	(3.40)	(3.41)	(3.43)	(3.52)	(3.15)
E(growth)	-151.73***	-151.41***	-150.61***	-143.33***	-150.41***
	(-4.08)	(-4.03)	(-3.96)	(-4.13)	(-4.13)
MP stance	38.34**	38.47**	38.05**	32.78**	38.23**
	(2.25)	(2.26)	(2.24)	(2.17)	(2.19)
low debt-gdp	7.30***	7.48***	7.68***	6.85***	6.51***
	(3.39)	(3.39)	(3.36)	(3.21)	(3.26)
high debt-gdp	8.67***	8.84***	9.06***	8.17***	7.80***
	(4.68)	(4.65)	(4.56)	(4.27)	(4.56)
def-gdp	-7.78	-7.74	-7.79	-10.98*	-10.54*
	(-1.15)	(-1.11)	(-1.09)	(-1.77)	(-1.66)
ext-gdp	0.06	0.11	0.10	0.64	0.57
	(0.05)	(0.09)	(0.08)	(0.59)	(0.52)
trade-gdp	-1.33*	-1.36*	-1.39*	-1.09	-1.26
	(-1.67)	(-1.71)	(-1.74)	(-1.42)	(-1.59)
ted	-148.95*	-142.78*	-140.74*	-145.55**	-165.33**
	(-1.86)	(-1.76)	(-1.74)	(-2.13)	(-2.03)
credit-gdp	4.96***	4.99***	5.12***	4.57***	4.25***
	(3.01)	(3.00)	(2.95)	(2.73)	(2.76)
Observations	2,001	2,001	2,001	2,001	2,001
R-squared	0.408	0.404	0.401	0.382	0.399
Exogeneity	0.018	0.018	0.017	0.017	0.025
Instrument	0.000	0.000	0.000	0.000	0.000

This table shows the IV 2SLS estimates of our econometric model (see equation (5) in the text) with quarterly data (from 2006:Q1 to 2015:Q4) and country-fixed effects (the associated t-statistics appear in parentheses). Lagged CPI inflation is used as instrument for the 3-month interest rate. The debt/GDP threshold applied is 90%. Results in columns (1), (2) and (3) are those associated with exposure at the 10, 5 and 1% confidence level, respectively. (4) and (5) are results with the mean and median of the CDS values. Three, two and one star(s) imply statistical significance at the 1, 5 and 10% confidence level. Robust standard errors (corrected by time/quarter clustering) are employed.

Table 5: **Parameter Estimates: Endogenous Thresholds**

	(1)	(2)	(3)	(4)	(5)
int-rate	123.38***	123.75***	124.33***	107.65***	117.26***
	(3.14)	(3.16)	(3.17)	(3.22)	(2.91)
E(growth)	-164.32***	-164.16***	-163.66***	-156.80***	-162.62***
	(-4.34)	(-4.28)	(-4.22)	(-4.47)	(-4.41)
MP stance	42.97**	43.12**	42.81**	37.76**	42.72**
	(2.56)	(2.57)	(2.56)	(2.54)	(2.48)
low debt-gdp	-0.49	-0.40	-0.36	-1.47	-1.03
	(-0.22)	(-0.17)	(-0.15)	(-0.70)	(-0.48)
int debt-gdp	1.38	1.49	1.52	0.26	0.70
	(0.65)	(0.68)	(0.69)	(0.13)	(0.34)
high debt-gdp	16.10***	16.30***	16.69***	16.31***	15.04***
	(4.90)	(4.85)	(4.75)	(4.32)	(4.75)
def-gdp	6.48*	6.63*	6.89*	4.38	3.30
	(1.69)	(1.69)	(1.72)	(1.28)	(0.94)
ext-gdp	-0.22	-0.18	-0.20	0.32	0.30
	(-0.22)	(-0.17)	(-0.19)	(0.35)	(0.32)
trade-gdp	-0.81	-0.83	-0.84	-0.52	-0.75
	(-1.02)	(-1.05)	(-1.07)	(-0.67)	(-0.95)
ted	-150.51*	-144.43*	-142.44*	-146.92**	-166.77**
	(-1.83)	(-1.74)	(-1.71)	(-2.10)	(-2.00)
credit-gdp	0.11	0.11	0.13	-0.63	-0.46
	(0.07)	(0.06)	(0.07)	(-0.42)	(-0.28)
Observations	2,001	2,001	2,001	2,001	2,001
R-squared	0.468	0.464	0.460	0.451	0.460
Exogeneity	0.007	0.007	0.007	0.006	0.010
Instrument	0.000	0.000	0.000	0.000	0.000

This table shows the IV 2SLS estimates of our econometric model (see equation (5) in the text) with quarterly data (from 2006:Q1 to 2015:Q4) and country-fixed effects (the associated t-statistics appear in parentheses). Lagged CPI inflation is used as instrument for the 3-month interest rate. Estimation considering the optimally selected endogenous two debt-to-GDP threshold levels (106.59% and 157.44%). Results in columns (1), (2) and (3) are those associated with exposure at the 10, 5 and 1% confidence level, respectively. (4) and (5) are results with the mean and median of the CDS values. Three, two and one star(s) imply statistical significance at the 1, 5 and 10% confidence level. Robust standard errors (corrected by time/quarter clustering) are employed.

Table 6: **Parameter Estimates: Peripheral Dummies Previous to 2012:Q4**

	(1)	(2)	(3)	(4)	(5)
int-rate	129.74***	130.23***	130.79***	114.34***	124.18***
	(3.31)	(3.32)	(3.34)	(3.43)	(3.08)
p-D	882.63***	880.85***	917.61***	903.72***	730.19***
	(3.49)	(3.38)	(3.42)	(3.06)	(2.80)
E(growth)	-147.17***	-146.88***	-145.94***	-138.79***	-146.49***
	(-4.28)	(-4.22)	(-4.16)	(-4.32)	(-4.27)
MP stance	39.63**	39.75**	39.37**	34.07**	39.38**
	(2.33)	(2.34)	(2.32)	(2.25)	(2.25)
debt-gdp	3.84***	3.99***	4.10***	3.33**	3.24**
	(2.63)	(2.70)	(2.75)	(2.34)	(2.22)
debt-gdp*p-D	21.37***	21.36***	22.05***	21.62***	18.86***
	(5.90)	(5.80)	(5.77)	(4.98)	(5.04)
def-gdp	-13.23*	-13.16*	-13.45*	-16.55**	-14.96**
	(-1.83)	(-1.76)	(-1.77)	(-2.46)	(-2.20)
ext-gdp	-1.10	-1.06	-1.11	-0.54	-0.46
	(-1.05)	(-0.99)	(-1.01)	(-0.54)	(-0.45)
trade-gdp	-1.52*	-1.54*	-1.58**	-1.28*	-1.39*
	(-1.88)	(-1.93)	(-1.98)	(-1.68)	(-1.74)
ted	-164.34**	-158.20*	-156.54*	-161.01**	-179.62**
	(-2.01)	(-1.91)	(-1.88)	(-2.30)	(-2.17)
credit-gdp	5.55***	5.59***	5.71***	5.14***	4.86***
	(3.12)	(3.11)	(3.08)	(2.75)	(2.82)
Observations	2,001	2,001	2,001	2,001	2,001
R-squared	0.436	0.431	0.428	0.410	0.421
Exogeneity	0.018	0.017	0.017	0.015	0.023
Instrument	0.000	0.000	0.000	0.000	0.000

This table shows the IV 2SLS estimates of our econometric model (see equation (5) in the text) with quarterly data (from 2006:Q1 to 2015:Q4) and country-fixed effects (the associated t-statistics appear in parentheses). Lagged CPI inflation is used as instrument for the 3-month interest rate. Estimation includes one dummy for Eurozone peripheral countries (Italy, Spain, Ireland, Portugal, Greece) during the pre-2012:Q4 quarters (p-D) and an interaction term between government debt-to-GDP ratio and the Eurozone peripheral countries dummy during the pre-2012:Q4 quarters (debt-GDP*p-D). Results in columns (1), (2) and (3) are those associated with exposure at the 10, 5 and 1% confidence level, respectively. (4) and (5) are results with the mean and median of the CDS values. Three, two and one star(s) imply statistical significance at the 1, 5 and 10% confidence level. Robust standard errors (corrected by time/quarter clustering) are employed.

Table 7: **Parameter Estimates: Without Peripherals**

	(1)	(2)	(3)	(4)	(5)
int-rate	123.97***	124.33***	124.08***	107.55***	120.22***
	(3.19)	(3.21)	(3.21)	(3.29)	(3.02)
E(growth)	-110.88***	-112.10***	-113.14***	-98.72***	-104.98***
	(-3.92)	(-3.96)	(-4.00)	(-3.71)	(-3.64)
MP stance	42.39**	42.58**	42.31**	37.05**	42.32**
	(2.28)	(2.29)	(2.29)	(2.24)	(2.22)
debt-gdp	4.54***	4.68***	4.66***	4.03***	4.31***
	(4.45)	(4.46)	(4.45)	(4.71)	(4.37)
def-gdp	5.89*	6.09*	6.03*	4.57*	4.27
	(1.90)	(1.92)	(1.91)	(1.72)	(1.49)
ext-gdp	-2.37***	-2.38***	-2.37***	-2.02***	-2.21***
	(-3.33)	(-3.35)	(-3.34)	(-3.41)	(-3.05)
trade-gdp	-1.58*	-1.60*	-1.62*	-1.35*	-1.49*
	(-1.86)	(-1.89)	(-1.93)	(-1.71)	(-1.76)
ted	-129.71	-121.76	-118.84	-125.55*	-149.27*
	(-1.47)	(-1.36)	(-1.32)	(-1.66)	(-1.67)
credit-gdp	2.79***	2.84***	2.79***	2.35***	2.59***
	(2.97)	(3.02)	(3.01)	(3.10)	(2.82)
Observations	1,806	1,806	1,806	1,806	1,806
R-squared	0.514	0.516	0.520	0.528	0.487
Exogeneity	0.008	0.008	0.008	0.005	0.008
Instrument	0.000	0.000	0.000	0.000	0.000

This table shows the IV 2SLS estimates of our econometric model (see equation (5) in the text) with quarterly data (from 2006:Q1 to 2015:Q4) and country-fixed effects (the associated t-statistics appear in parentheses). Lagged CPI inflation is used as instrument for the 3-month interest rate. Five peripheral countries (Italy, Spain, Ireland, Portugal and Greece) are excluded from the sample. Results in columns (1), (2) and (3) are those associated with exposure at the 10, 5 and 1% confidence level, respectively. (4) and (5) are results with the mean and median of the CDS values. Three, two and one star(s) imply statistical significance at the 1, 5 and 10% confidence level. Robust standard errors (corrected by time/quarter clustering) are employed.

Highlights

We provide a new measure of sovereign country risk exposure to global sovereign tail risk based on sovereign CDS spreads.

We estimate the drivers of sovereign exposure with data from 53 countries.

High expectations of GDP growth and low debt-to-GDP reduce sovereign exposure.

Lax monetary policy stance and high credit-to-GDP growth increase sovereign exposure.

Exposure sensitivity to fiscal leverage is shown to increase non-linearly with public debt and to decrease with the European Central Bank sovereign debt programs.