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THE DECOUPLING BETWEEN PUBLIC DEBT FUNDAMENTALS AND BOND SPREADS AFTER THE EUROPEAN SOVEREIGN DEBT CRISIS

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The Decoupling between Public Debt Fundamentals and Bond Spreads after the European Sovereign Debt Crisis*

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Abstract

This paper provides empirical evidence for the weakened relationship between public debt fundamentals and sovereign bond spreads in Spain, France, and Italy (versus Germany) after the 2010–2012 episode of sovereign debt markets' significant fragmentation. We build on the literature that combines the Value at Risk approach with the estimation of the correlation pattern of public debt dynamics' macroeconomic determinants via Vector Auto Regressions (VARs). Our measure of fiscal sustainability is based on a large number of Monte-Carlo debt trajectory simulations on the basis of such VAR models. This method allows to estimate the distribution of debt trajectories that the variables at each point in time imply, and takes into account their mutual dependence. Using this measure, we establish that the relationship between fundamentals and sovereign spreads: (i) differs across countries, and (ii) varies over time, and in particular, became weaker after the European sovereign debt crisis. We hypothesize this change might be related to bold actions that euro area policy makers took. First, governments acted to deepen the European Monetary Union, in particular in the fields of banking and capital markets' integration, and further supra-national oversight of fiscal policies. Second, the European Central Bank (ECB) acted strongly to restore the adequate functioning of the transmission mechanism of monetary policy in the euro area.

JEL Codes: H63, H68, E61, E62.

Keywords: Debt sustainability, fiscal policy, monetary policy, econometrics.

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1 Introduction

This paper investigates the changing link between fiscal fundamentals and market perceptions. It asks whether this link evolves over time in response to the transformation of the financial and monetary regime of the Eurozone. It provides empirical evidence that the relationship between public debt fundamentals (that determine long-run fiscal sustainability) and sovereign bond spreads of Spanish, French, and Italian bonds (with respect to the German Bund) became weaker after the 2010–2012 episode of sovereign debt markets' significant fragmentation[1]. While our data limitations preclude any strong causal claim, we hypothesize this change might be related to the bold actions Euro-area policy makers took: the steps the governments took to deepen the European Monetary Union, and the strong policy program the ECB launched to restore the transmission mechanism's adequate functioning of monetary policy in the euro area (Cour-Thimann & Winkler 2012, Lane 2020*a*).

The link between fiscal fundamentals and markets spreads is of crucial importance from a policy point of view. Weak fiscal fundamentals can translate into financial instability, or higher future inflation. Fiscal sustainability is therefore regarded as a precondition for sound monetary policy (Leeper & Walker 2011, Wallace 1981). However, the time-varying nature of this relationship has received much less attention. In spite of its relevance, little is known about how the institutional framework can condition the impact of monetary policy on fiscal sustainability. This neglect is partly due to two obstacles: that of measuring fiscal fundamentals over time, and how to incorporate institutional factors. The goal of this paper is to propose a perspective to overcome these two obstacles.

Our first originality is to use the Eurozone as a laboratory to understand the impact of institutional changes. The problem of studying institutional determinants arises from its low variability. Theoretically, the link between fiscal fundamentals and spreads should depend on the credibility of fiscal, monetary and financial authorities, which is in turn governed by the institutional setup. In practice, however, institutional variation is scarce, hard to measure, and difficult to disentangle from other country-specific effects.

From that perspective, the Eurozone experience provides a historically unique scenario that allows to explore the link between institutional developments and the link between fiscal fundamentals and market perceptions. In less than three decades, the fiscal and monetary regimes of the area exhibits enormous variation. In that period, it transitioned from a regime of adjustable exchange rate, to a single currency organized as a banking union. The European debt crisis acted as a game changer. Responding to rising sovereing spreads and financial fragmentation, the European Central Bank (ECB) announced its intention to preserve the transmission channel's adequate functioning (Lane

[1] Our choice of the German Bund is motivated by its safe asset status within the Eurozone. As a result, sovereign spreads can be used as a measure of market default-risk perceptions, as well as capital market fragmentation.

2020a), thus directly influencing the link between fiscal fundamentals and sovereign debt pricing. Similarly, the deepening of the euro area's institutional framework could also contribute to reducing the fundamental root of financial fragmentation within the euro area: re-denomination risk.

Similarly, many of those policy measures took place in the aftermath of the 2008–2009 global financial crisis and the 2010–2012 euro area's sovereign debt crisis: strengthened tools for economic policy coordination, with a stronger focus on the euro area as a whole; created supra-national advisory bodies (such as the European Fiscal Board); or adopted the important steps toward completing the Banking Union and Capital Markets Union (see Constâncio 2020, European Commission 2017). The literature has shown that such institutional advances and announcements exert a downward impact on sovereign bond spreads (Bergman et al. 2016, Kataryniuk et al. 2020).

The second originality of this paper is our method to study debt sustainability, based on (Alloza et al. 2020). Debt sustainability is a particularly difficult object to assess. The parameters that govern its future—primary balances, interest rates, GDP growth and inflation—cannot be assumed to be independent from each other. This paper addresses this obstacle by drawing from the literature that combines the Value at Risk approach with the estimation of the correlation pattern of the public debt dynamics' macroeconomic determinants via Vector Auto Regressions (VARs) (Polito & Wickens 2012, Alloza et al. 2020) to estimate the probability distribution of alternative debt trajectories. We use the parameters of the estimated VAR to construct a large number of Monte-Carlo simulations of the potential paths of public debt. Since we incorporate in the VAR new information in a sequential manner, we are able to retrieve time-varying probabilities that characterize the debt's expected behavior in some quarters ahead (e.g., we can estimate the probability that the debt-to-GDP reaches a level of, say, 100% in, say, 10 years). We then empirically confront such probabilistic indicators with market-derived sovereign bond spreads. We apply that approach to the four major euro area economies, and explore how the relationship between interest rates and debt projections evolved before and after 2012.[2]

The rest of the paper is organized as follows. In Section 2 we outline the basic elements of the methodology and data employed in the paper. In turn, in Section 3 we estimate the empirical models linking our measures of fiscal sustainability and the sovereign debt spreads, and discuss the main results. Finally, in Section 4, we provide a policy discussion to frame our empirical findings.

[2] A related, though different strand of the literature looks at the determinants of sovereign debt yields/spreads, as summarized, for example, in Afonso & Jalles (2016).

2 Methodology and Data

Methodology: VAR projections of debt dynamics. We estimate the probability distribution of public debt relying on Alloza et al. (2020)'s methodology. This approach allows us to estimate the probability the fundamentals imply that the debt-to-GDP ratio will be above a certain threshold for different horizons. The method relies on the sequential estimation of the VAR's parameters, using all available information up to that point. The model is then used to forecast the debt trajectories at different horizons.

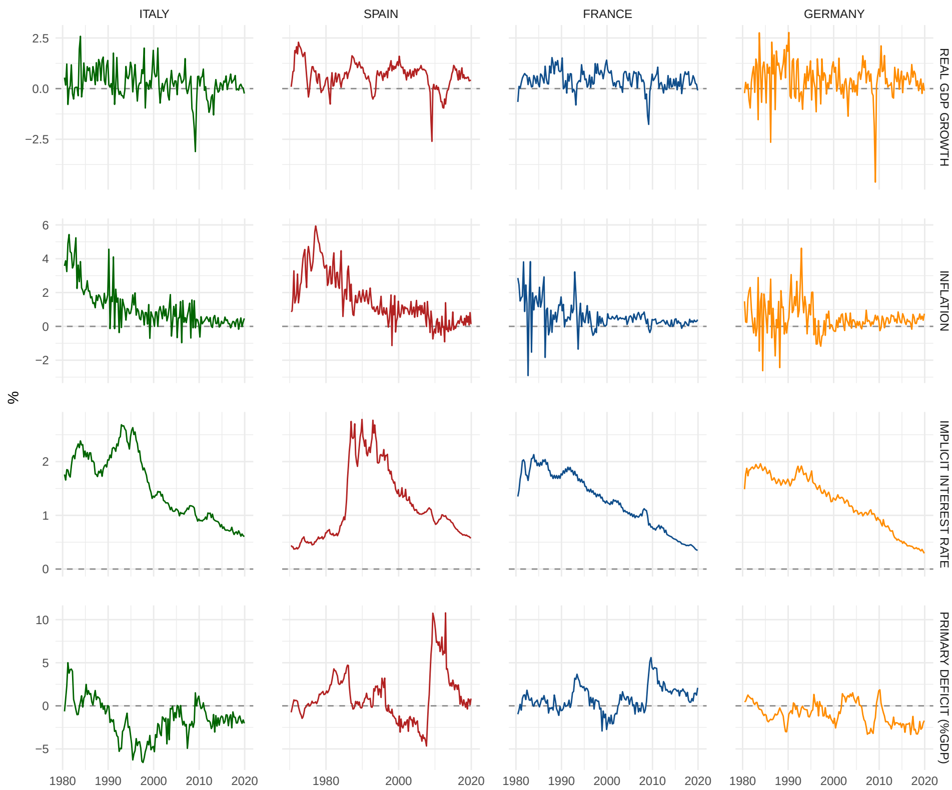
This method has three steps that are repeated sequentially at any point in time. Firstly, a VAR is estimated to forecast the fundamentals affecting the dynamics of debt (interest rates, GDP growth, primary deficit, inflation). Secondly, the parameters obtained in the first step are used to perform a large number of Monte-Carlo simulations to obtain the fundamentals' joint trajectories. Finally, the fundamentals' simulated paths are replaced in the debt equation to recover the trajectories of debt implied by each simulation, and thus the empirical probability distribution of debt is consistent with the information available in (pseudo-) real time.

Choosing this method allows us to overcome two obstacles of forecasting debt trajectories. Firstly, while the dynamics of debt are a deterministic function of its fundamentals (inflation, interest rates, GDP, primary deficits), a central challenge to forecast trajectories is how to project paths for these variables taking into account that these variables are mutually interdependent. The VAR method is a parsimonious method to forecast a multivariate distribution that is consistent with past observations. Its parameters capture all the information about the dynamics of fundamentals implied by history: the autoregressive coefficients link past observations to the future, and the covariance matrix ensures that innovations are consistent with historical variation. Secondly, while the VAR imposes weak parametric assumptions, the non-linearity of debt dynamics prevents including it in a VAR. However, given that the evolution of public debt is a deterministic function of fundamentals, the trajectory of the latter can be directly mapped on the evolution of public debt.

A natural limitation of the VAR forecast is linked to the stationarity assumption. This assumption is not problematic for the second step, since the trajectory of debt is a deterministic function of inflation, interest rates, GDP, and primary deficits, and therefore forecasting the trajectory of these macroeconomic variables is enough to forecast debt. On the other hand, the trajectory of fundamentals could be affected by other variables, whose omission could bias of the debt forecast. Similarly, it is possible to think that structural changes could make the past an imprecise guide for the future. However, from the point of view of our exercise, we do not see these limitations as a major challenge. On the one hand, small sized VAR's are commonly regarded as reasonable proxies for cyclical fluctuations, and while other macroeconomic shocks (e.g., change in commodity prices) could have a substantial impact on future evolution, these are likely to be unforecastable, given the information about fundamentals. On the other hand, our goal is to assess the debt trajectory implied by the present history macroeconomic variables, and to use it as a benchmark for other structural changes, such as the shifts in monetary policy implied by the formation of the Euro. We therefore want to exclude the impact of those changes, and restrict ourselves to the future evolution of a small set of variables.

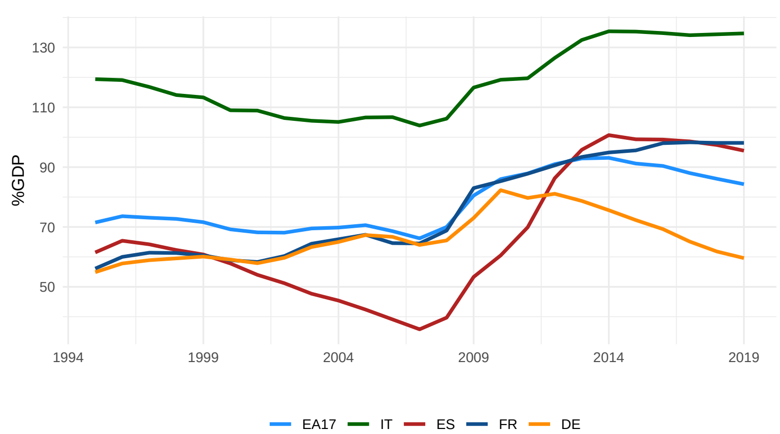
The Data. We use quarterly data for the four euro area countries starting in 1980 (Germany, France, Italy) and 1970 (Spain) up to last quarter of 2019. We use quarterly data from the first quarter of 1970 to the fourth quarter of 2019 of the following variables: the the stock of public debt, the government primary deficit over GDP, the inflation rate, the implicit interest rate (computed as the ratio between the interest payments in a quarter and the stock of public debt of the previous period), and the growth rate of GDP in real terms. Concerning the spread, the data used covers the period from 1980Q1 to 2019Q4 and it is computed as the difference between the Italian/Spanish/French 10-year government bond yield and the German one, in both cases averaged over the quarter from daily data, taken from Bloomberg. The database is the result of combining current Eurostat fiscal and macroeconomic time series, with the database assembled by Alloza et al. (2020). For the case of Spain, we use the database from Alloza et al. (2020), which is itself the result of combining national time series from the Spanish National Statistical Institute (INE), with fiscal variables taken from de De Castro et al. (2018). Figure (1) provides a visualization of the main time series used in the estimation of the VAR. For a glimpse on public debt trajectories see Figure (2).

Figure 1: Macroeconomic variables' time series used for VAR estimation



Notes: The figure depicts the data used in the simulations for Italy, Spain, France and Germany. The source used is the dataset assembled by Alloza et al. (2019).

Figure 2: Public debt



Notes: The figure depicts the debt-to-GDP ratios for Spain, Germany, France, Italy and the aggregate of the Euro-zone (17). The source used is the Eurostat database.

VAR Model. In the first step, a standard VAR is estimated sequentially for each forecast origin:

$$Y_t = \mu_y + \beta t + B(L)Y_{t-1} + U_t, \tag{1}$$

where:

$$Y_t = (gdp_t,\ \pi_t,\ i_t,\ def_t)\,, \tag{2}$$

μ_y and t are constants and trends, and U_t is the vector of reduced-form residuals which are assumed to be distributed according to a multivariate normal distribution $U_t \sim N(0, \Omega)$. The model is estimated with all past available information at each point in time, starting with the creation of the EMU in 1998, and the procedure is repeated sequentially quarter by quarter until the end of the sample (2019Q4). The model is set to be first order autoregressive for all countries and horizons. Our goal is to have a measure that is comparable across countries and time horizons, and therefore ensures that changes in the specification are not behind changes in the estimates.

In a second step, the parameters retrieved from the VAR are used to perform a large number of Monte-Carlo simulations for the fundamentals of debt dynamics. For each country and horizon t, we simulate 7000 draws from a multivariate normal distribution fed by the covariance matrix of past residuals. The autorregresive parameters of the VAR are used to recursively predict the trajectory of fundamentals up to ten years ahead. Finally, for each path of fundamentals, the trajectory of public debt is obtained from the debt dynamic equation. As a result, at each point in time, the evolution of public debt can be monitored, as we compute the moments of the distribution for the desired horizon.

3 Results

3.1 Debt Fundamentals over Time

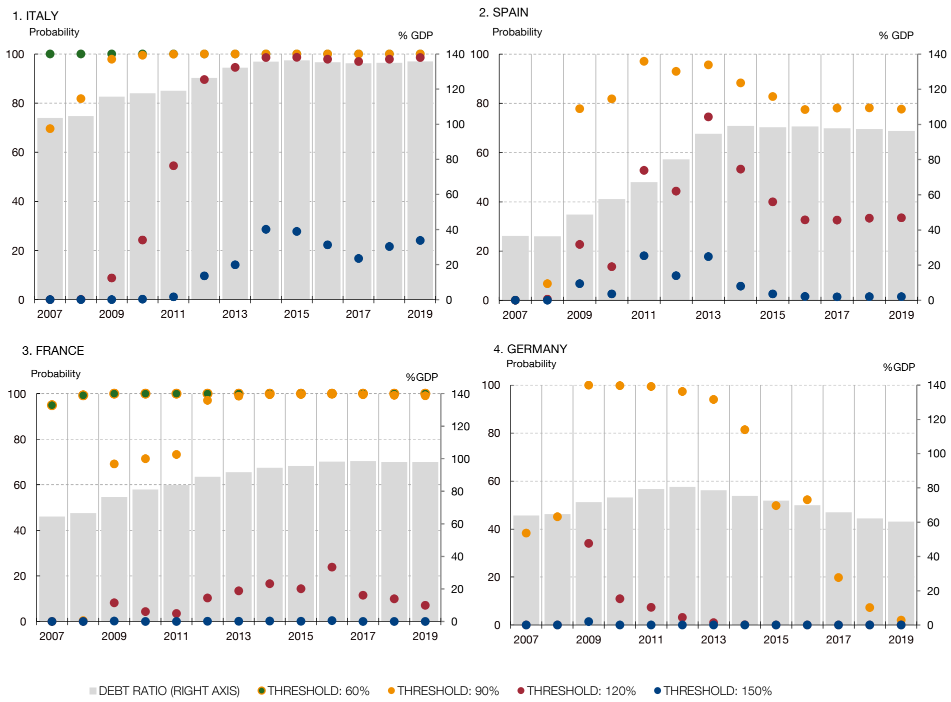
Debt Threshold Probabilities. We can calculate the probability that the debt will be above threshold θ, T periods ahead, based on the data available at some point in time denoted as I_{t-1}. We do this to compute at each point in time t the probability:

$$p^T_{t/t-1}(\theta) = P(d > \theta \mid I_{t-1}) = 1 - F^T_t(\theta \mid I_{t-1}), \tag{3}$$

and the sequence of probabilities is denoted $\{p^T_{t/t-1}(\theta)\}$ calculated a each point.

The result of this exercise is shown in Figure (3). For each of the four countries, it shows the debt-to-GDP ratio, the probability of which as being above the 60%, 90%, 120%, and 150% thresholds in ten years. Firstly, it illustrates that debt probabilities are parallel to the evolution of current debt, confirming that the debt forecast shows substantial inertia over time. As a result of this inertia, certain probability thresholds are flat for prolonged periods of time, and then become relevant. For instance, in the case of Italy, the probability that its debt will be above 60% ten years ahead never goes below one in the period considered, while for Germany, the probability that the debt is above 150%, is never different from zero. Moreover, the thresholds' variability also changes over time. While the 150% threshold was flat for most countries before the sovereign debt crisis, this threshold exhibits variability thereafter.

Figure 3: Debt thresholds: ten years ahead probabilities

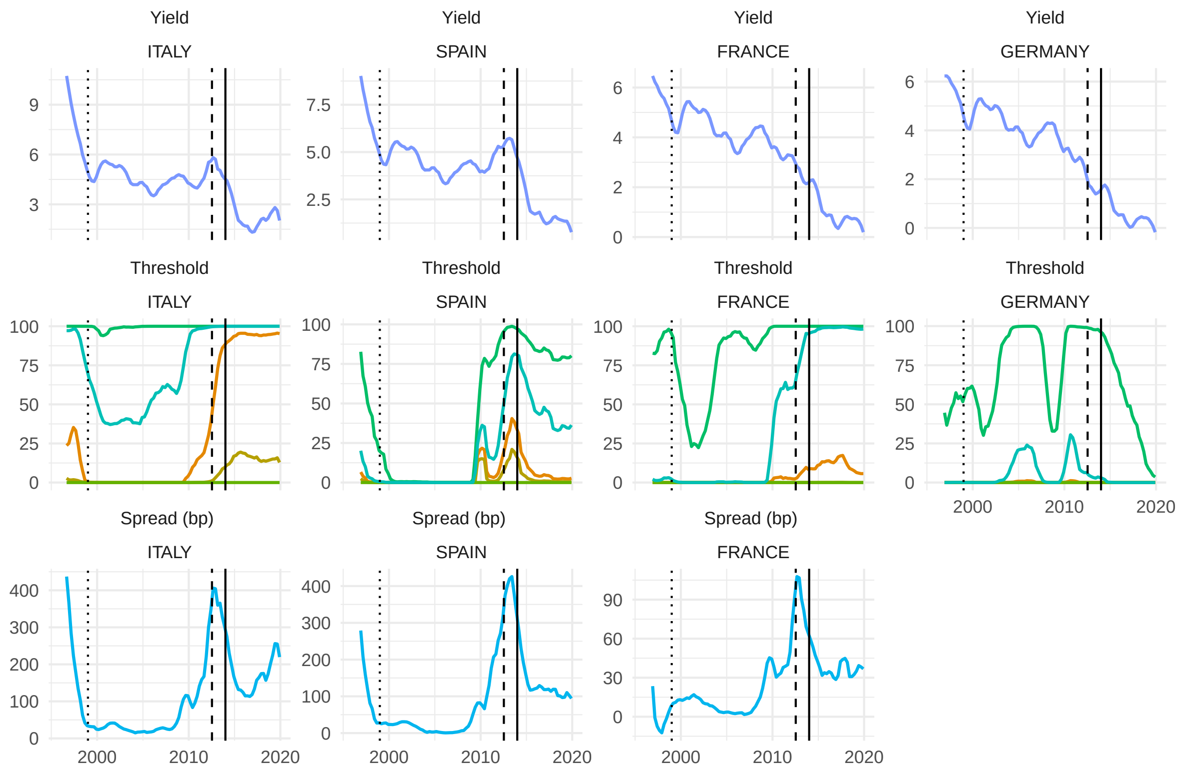


Notes: For each country, the graphs depict the probability that the debt-to-GDP ratios will be above the 60%, 90%, 120%, and 150% thresholds 10 years ahead.

3.2 Threshold Probabilities and the Spread

We now turn to assess how debt probabilities are related to sovereign spreads, and whether this relationship changes across countries and over time. This comparison between debt thresholds and spreads is shown in Figure (4), in which three periods are distinguishable. The creation of the single currency is preceded by a decline in threshold probabilities, paralleled by a decline in the spreads; in the period after the creation of the single currency, debt probabilities decreased in line with sovereign spreads, and this trend was reversed around 2008. Interestingly, the parallelism between threshold probabilities and spread changes around 2012. Similarly, there was a substantial country specific heterogeneity, as spreads barely react for France, compared to Italy and Spain. These patterns suggest that we need to understand which debt threshold is more appropriate for each country, and whether this changed after the 2012 policy announcement.

Figure 4: Debt threshold and the spread



Notes: The figure shows the relationship between debt thresholds and spreads across countries and over time. Vertical lines show the ECDF of future debt-to-GDP ratios (horizontal axis) evaluated at different points (left to right): (1) Creation of the Single Currency; (2) Mario Draghi's "whatever it takes" (2012-07); and (3) the beginning of of the ECB's sovereign debt purchases. "Thresholds" show the probabilities for debt-to-GDP being above 30%, 60%, 90%, 120%, 150%.

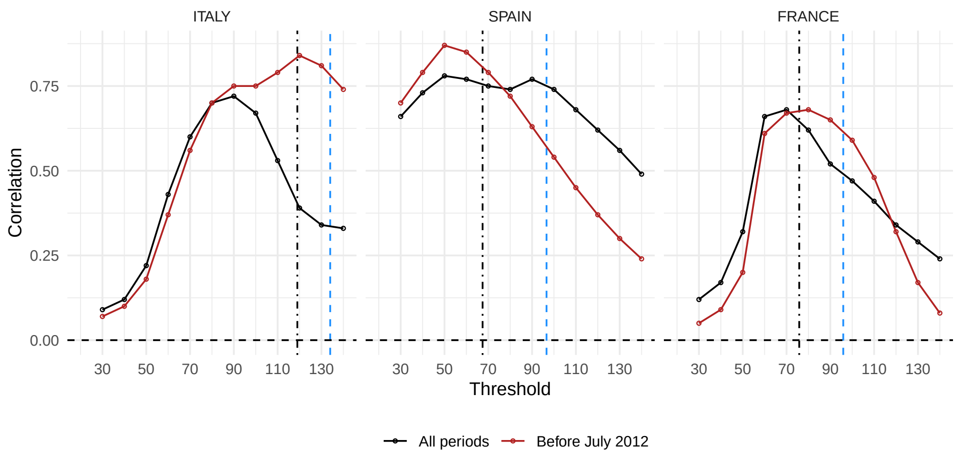
Debt Thresholds and Sovereign Risk. Which debt threshold best reflects the perception of market participants? As shown in Figure (3), threshold probabilities have flat regions, depending on the period and the country at hand. To determine which threshold best reflects sovereign risk we follow Alloza et al. (2020), and calculate the threshold that maximizes the correlation between our risk measure and the sovereign bond spread with respect to German bonds. This establishes which of these measures is most consistent with market expectations approximated by the spread. Formally,

$$\theta^* = \arg\max_{\theta} corr(P^T_{t/t-1}(\theta), S_t), \tag{4}$$

i.e., conditional on the information set available at t, I_{t-1}, we solve equation (4) to obtain the debt threshold, θ^*, relevant for market participants that use as a reference the time horizon T. This debt threshold θ^* can be interpreted as the one that shapes market participants expectations about the evolution of public finances and then as a market-based index of debt sustainability.

In the previous paragraph, we documented that the link between $P^T_{t/t-1}(\theta)$ and S_t seems to change over time, and across country. To examine this heterogeneity, we calculate the correlation between the two over a grid of 10% intervals. We do this for Italy, France and Spain, and then compare the result for the full sample, and excluding the period after the selected 2012 date. This exercise is shown in Figure (5). Country heterogeneity is visible in the figure, showing that the correlation between threshold probabilities and spreads varies across countries. For Spain, we find that the maximum correlation is attained around 50% or 60%. However, for the other two countries, the threshold that maximizes the correlation is sharply defined, around 90% for Italy, and around 70% for France.

Figure 5: Correlation between debt thresholds and the sovereign spread



Notes: We calculate the correlation between debt thresholds and the sovereign spread over a grid of 10% intervals for each country. Then, we compare the result for the full sample excluding the period after 2012. The black vertical line shows the country's mean debt-to-GDP ratio for all periods, while its ratio for the 2012-2019 period is shown by the blue vertical line.

Similarly, our calculations reveal that the relationship between the threshold and the spread changes in the period after 2012. The threshold that maximizes the correlation is similar for Spain and France, but was substantially higher (110% vs 90%) for Italy. Similarly, the correlation defined at the maximum was is higher in these cases. The drivers of this result are, on the one hand, that spreads decreased substantially after the policy announcements and actions, and on the other hand, that certain probability thresholds exhibit flat regions (thus weakening the correlation).

Granger-Causality Tests. We dig further into the correlation between threshold probabilities and sovereign spreads by looking at whether or not the probability measure Granger causes the market risk indicator, S_t. We run regressions of the kind:

$$S_t = \Gamma(L)\ S_{t-1} + \Phi(L)\ P^{T}_{t/t-1}(\theta) + \epsilon_t, \tag{5}$$

where $\Gamma(L)$ and $\Phi(L)$ are lag polynomials.

We run this exercise for the candidate correlation maximizing thresholds 60%, 70%, 90%, 120%, and each of the three countries. In addition, we consider the tests for $P^{10y}_{t+1/t}(\theta)$, i.e., forwarding $P_{t/t-1}(\theta)$ one period in equation (5). This is warranted as the leaded variable is contemporaneous with respect to S_t from the point of view of the moment in time in which the analyst comes to know it. The results are shown in Table (1) and suggest that the relationship goes in both directions. While changes in spreads seem to incorporate information that anticipates the realization of higher debt forecasts, changes in the threshold probabilities are also causally connected with spreads. Moreover, Table (1) reflects that the relevant debt threshold is country-specific, and that its relationship changed after the 2012 period, especially for Spain. This is consistent with the argument that monetary policy played a central role affecting the pricing of sovereign risk, and this information was reflected in the nature of the correlation.

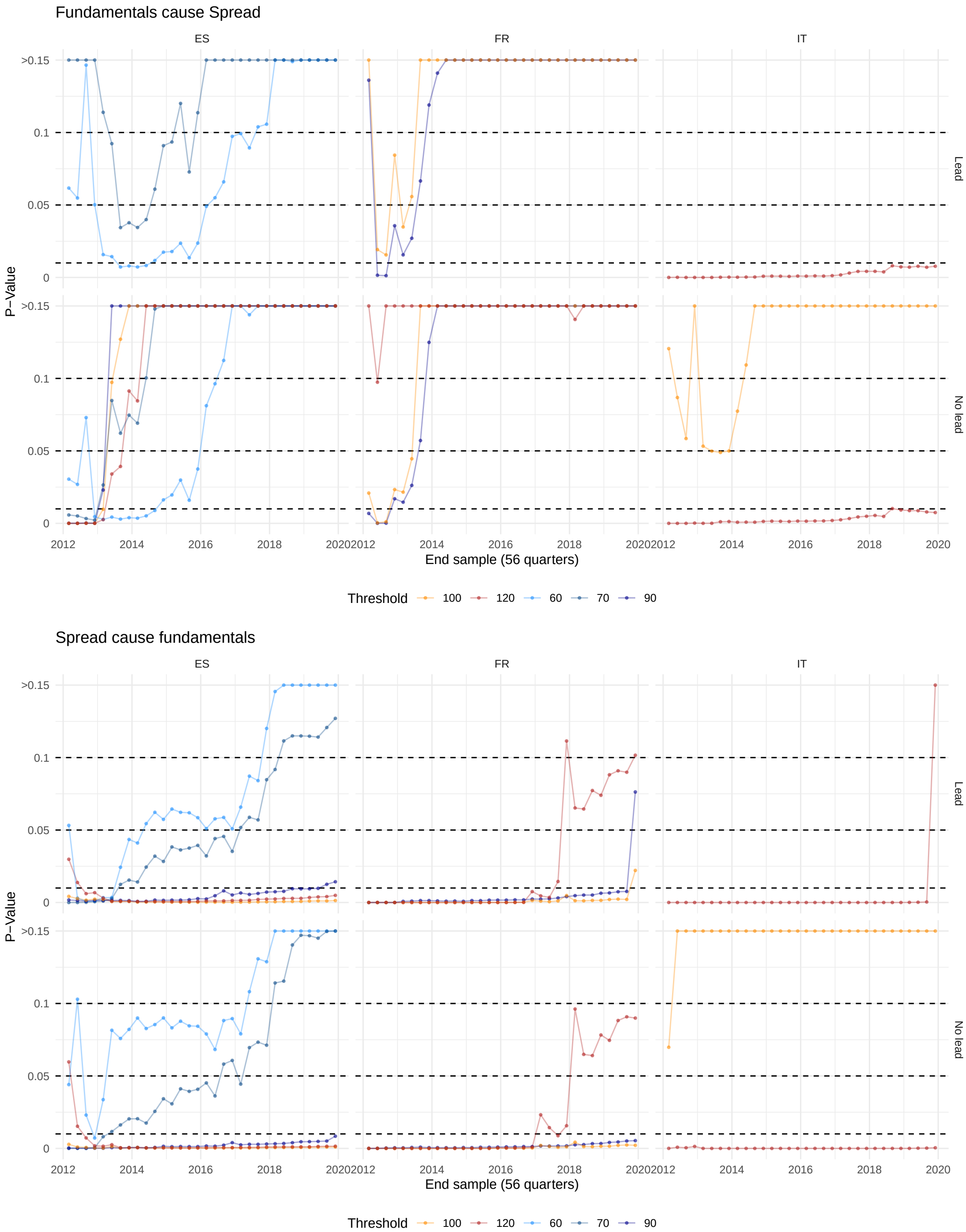
The above evidence is comforted by Figure (6), which depicts the information from Table (1) on a 56 quarters rolling sample, starting in 1998Q1-2012Q1. The figure shows how the value of the p-value increases for most countries and thresholds as the sample includes more observations after the 2012 announcement, indicating the weakening of the statistical relationship between spreads and fundamentals.

Table 1: Granger-causality tests: probability measures and sovereign spread

		$\theta = 60$	$\theta = 70$	$\theta = 90$	$\theta = 120$
Panel A. ITALY					
Sample 1998Q1-2019Q4	$P^T_{t/t-1}(\theta)$ does not Cause S_t	0.988	0.811	0.247	0.000***
Sample 1998Q1-2019Q4	S_t does not Cause $P^T_{t/t-1}(\theta)$	0.848	0.831	0.473	0.000***
Sample 1998Q1-2019Q4	$P^T_{t+1/t}(\theta)$ does not Cause S_t	0.993	0.833	0.189	0.000***
Sample 1998Q1-2019Q4	S_t does not Cause $P^T_{t+1/t}(\theta)$	0.863	0.829	0.791	0.000***
Sample 1998Q1-2012Q2	$P^{10y}_{t/t-1}(\theta)$ does not Cause S_t	0.997	0.931	0.315	0.000***
Sample 1998Q1-2012Q2	S_t does not Cause $P^{10y}_{t/t-1}(\theta)$	0.963	0.941	0.525	0.000***
Panel B. SPAIN					
Sample 1998Q1-2019Q4	$P^T_{t/t-1}(\theta)$ does not Cause S_t	0.132	0.486	0.777	0.16
Sample 1998Q1-2019Q4	S_t does not Cause $P^T_{t/t-1}(\theta)$	0.088**	0.024**	0.000***	0.000***
Sample 1998Q1-2019Q4	$P^T_{t+1/t}(\theta)$ does not Cause S_t	0.028**	0.217	0.946***	0.634
Sample 1998Q1-2019Q4	S_t does not Cause $P^T_{t+1/t}(\theta)$	0.146	0.007***	0.000***	0.000***
Sample 1998Q1-2012Q2	$P^{10y}_{t/t-1}(\theta)$ does not Cause S_t	0.02**	0.003***	0.01***	0.001***
Sample 1998Q1-2012Q2	S_t does not Cause $P^{10y}_{t/t-1}(\theta)$	0.029**	0.000***	0.000***	0.005***
Panel C. FRANCE					
Sample 1998Q1-2019Q4	$P^T_{t/t-1}(\theta)$ does not Cause S_t	0.581	0.162	0.192	0.05*
Sample 1998Q1-2019Q4	S_t does not Cause $P^T_{t/t-1}(\theta)$	0.954	0.561	0.000***	0.006***
Sample 1998Q1-2019Q4	$P^T_{t+1/t}(\theta)$ does not Cause S_t	0.554	0.075*	0.153	0.073*
Sample 1998Q1-2019Q4	S_t does not Cause $P^T_{t+1/t}(\theta)$	0.941	0.49	0.000***	0.006***
Sample 1998Q1-2012Q2	$P^{10y}_{t/t-1}(\theta)$ does not Cause S_t	0.068**	0.096***	0.000***	0.038**
Sample 1998Q1-2012Q2	S_t does not Cause $P^{10y}_{t/t-1}(\theta)$	0.923	0.33	0.006***	0.000***

Notes: We run a Granger causality test in both directions (fundamentals cause spread and spread causes fundamentals) for each threshold (60%, 70%, 90%, 120%) and for each country (Italy, Spain, and France) with a 10 year horizon in a one year period forwarding. The tests suggests causality in both directions. ***: null hypothesis rejected at the 1% level, **: 5%, *: 10%. 4 lags; $T = 10$ years.

Figure 6: Granger causality test on a rolling sample



Notes: P-values capped at 0.15 of the Granger causality test are shown for the empirical link between spreads and fundamentals on a rolling retrospective sample of 56 quarters from 2012-03-01 to 2019. We consider the test for $P^{10y}_{t+1/t}(\theta)$ (Lead) and for $P^{10y}_{t/t-1}(\theta)$ (No Lead). Only P-Values which are below 0.1 in at least one period are shown.

4 Policy Discussion

We show empirical evidence of a weakened relationship between public debt fundamentals and sovereign bond spreads in Spain, France, and Italy (versus Germany) after the episode of significant fragmentation of sovereign debt markets of 2010-2012. Given the data available to us, we can not make a strong claim about the particular cause behind this change. However, the clear discontinuity around that date suggests a link with the bold actions taken by euro area policy makers. First, governments took action to deepen the European Monetary Union, in particular in the fields of banking and capital markets' integration, and further supra-national oversight of fiscal policies. Second, the ECB acted strongly to restore the adequate functioning of the transmission mechanism of monetary policy in euro area. We infer from our evidence that these actions might have influenced investors' views on the solidity of the euro area project, thus leading them to shift part of their focus from national to supra-national fundamentals when assessing national developments. In the following paragraphs we provide a more detailed discussion of why we think this is a plausible explanation.

The two decades that followed the creation of the euro were marked by a substantial stabilization in public debt trajectories in the main countries of the union.[3] As monetary integration became a reality, markets started to perceive the debt of all countries in the union as equally safe, and sovereign spreads converged close to historically low levels. Nevertheless, with the outbreak of the global financial crisis, public debt-to-GDP ratios increased for all euro area economies between 2008 and 2013/2014, following, in any case, heterogeneous paths in terms of the intensity of such increase, depending on the extent to which they were affected by the double-dip recessions (the financial crisis of 2008-2009 and the sovereign debt crisis of 2010-2012). Fragmentation in sovereign debt markets skyrocketed. The subsequent intervention of the ECB to preserve the monetary transmission channel marked a critical point in the evolution of the crisis, after the famous ECB's president's *"Whatever it takes"* speech on July 26 2012, and the deployment of additional monetary policy actions (Cour-Thimann & Winkler 2012, Lane 2020*b*).

The ECB intervention coincided with the stabilization of sovereign debt market, but it also coincided with a relative stabilization of fiscal fundamentals. This coincidence raises the question of whether the improvement in fiscal fundamentals, or the influence of monetary policy was responsible for the resolution of the sovereign debt crisis, and to what

[3]The institutions created by the Maastricht Treaty (1992) that launched the single currency were developed to minimize debt externalities (Brunnermeier et al. 2018). From that point of view, an unsustainable debt path in one country could result in debt externalities on its neighbors, leading to fragmentation of financial markets and preventing the proper functioning of monetary policy. The Treaty established a strict separation between fiscal and monetary policy, with the later devoted to maintaining price stability in the medium-run, and the former disciplined by a fiscal framework. The Maastricht fiscal-monetary policy mix was criticized on several fronts (Eichengreen et al. 1998), and subsequently made more flexible.

extent did monetary policy affect macro-fiscal fundamentals. The role of monetary policy was one of the key debates around the resolution of the European debt crisis (De Grauwe 2011). As discussed before, notwithstanding the (potentially key) role of monetary policy, other policy actions could have played a role to stabilize fiscal fundamentals and the credibility of the European project, in particular those that strengthened the economic and fiscal framework, and the advances in the Banking Union and Capital Markets Union, that contributed to risk-sharing within the euro area (European Commission 2017) .

A first obstacle to understand the role of pan-European policy actions, and in particular, monetary policy ones, in the resolution of the debt crises is theoretical. It is unclear through which channel these policy could affect asset prices without changing fundamentals. We therefore need to clarify how debt sustainability is related to sovereign spreads.

Sovereign spreads are the premium demanded by investors to hold public debt instead of a genuine safe asset. They reflect market perceptions on fiscal and macroeconomic fundamentals, and are therefore an indicator of debt sustainability. In turn, debt is sustainable if its stock is smaller than the present value of future primary surpluses. *Debt fundamentals* can therefore be captured by the current level of debt, and the path followed by the variables affecting the government budget constraint: primary balances, inflation, growth, interest rates. From this reasoning, sovereign spreads are likely to reflect fiscal and macroeconomic variables by market perceptions.

In a monetary union, the link between sovereign spreads and fundamentals is complicated by two additional factors. Firstly, sovereign spreads partly reflect re-denomination risk: the possibility that a country will leave the monetary union and redenominate its debt in a different currency. The decision to leave the Euro could become more likely as debt becomes unsustainable, but other factors, such as political factors, are also likely play a role. Secondly, markets will also discount the implicit commitment of the members of the monetary union to support each other under fiscal stress. In that case, the relevant fiscal fundamentals may not be only those of each individual country, but also those of other members, and a change in the perception of these commitment could then blur the connection between country fundamentals and sovereign spreads.

As a result, while country debt fundamentals will be reflected in sovereign spreads, in a monetary union other factors could modulate this relationship. In particular, there are two possible channels through which pan-European/monetary policies could affect sovereign spreads. Firstly, such policies could affect spreads by changing the tolerance to the risk implied by certain fundamentals. While central banks can influence most variables of the government budget constraint–output, inflation, interest rates–, it is theoretically unclear how it can persistently affect fundamentals, in equilibrium (Wallace 1981, Leeper & Walker 2011, Cochrane 2018), monetary policy can only affect real fiscal variables if backed by changes in fundamentals. By extension, given certain fundamentals, monetary policy can only affect spreads if it changes market perceptions about the risk of default implied by those fundamentals. This would be the case in a multiple equilibria framework (De Grauwe 2011), in which debt markets would be moved by news unrelated to fundamentals into sunspot equilibria. In that environment, monetary policy could anchor market expectations away from the bad equilibrium environment.

Secondly, while both re-denomination risk and contingent cross-country fiscal support depend on individual country choices, pan-European/monetary policies could alter the incentives behind them. In particular, the publicly expressed willingness to act at the supra-national level would be seen as a means to increase the degree of economic integration, in a way that reduced the significance of national fiscal fundamentals for market perceptions.

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