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## Abstract

While the pandemic was an exogenous shock leading to increasing sovereign debt across the board, the dynamics of sovereign risk premiums has been heterogeneous in the Euro Area (EA). We estimate the determinants of sovereign bond spreads in the EA during the pandemic from January 2 2020 to May 25 2020. We find that: 1) resiliency to COVID shock depended on initial fiscal situation, robustness of the banking sector and healthcare capacity; 2) during the crisis, ECB speeches were a game changer and had a much larger contribution than actual securities purchase programs; 3) the coordination of the European Council also contributed to narrow down the spread but the effect was partly compensated by the implementation of financial assistance based on loans which contributed to increase the spreads.



JEL Classification: F30, F45, H63

Keywords: sovereign risk, European Monetary Union, COVID, Event studies



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# Covid 19: a new challenge for the EMU? *

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**Abstract**: Although the pandemic was an exogenous shock, it triggered portfolio rebalancing in the Euro Area (EA) implying a divergence of sovereign risk premia in the first phase of the crisis eventually followed by a narrowing of the spreads. We estimate the determinants of sovereign bond spreads in the EA during the pandemic from January 2 2020 to May 25 2020. We find that: 1) the countries' resilience to the COVID shock depended on healthcare capacity, the strength of the banking sector and the fiscal outlook; 2) during the crisis, ECB speeches were a game changer and made a much greater contribution than securities purchase programs; 3) the Italian spread benefited most from the interventions of the European institution; 4) markets did not consider loans-based financial assistance program as working adjustment mechanisms as fiscal transfers would.

**Keywords**: Sovereign risk; European Monetary Union; Covid; Public Policy.

**JEL Code:**: F30, F45, H63

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# 1 Introduction

The Italian bond spread relative to Germany's has increased by 43% between January, 2 and May, 25 2020 from 164 bps to 236 bps; other members of the Euro Area (EA) have also experienced dramatic increase in their spreads.[1] Although the pandemic was an exogenous shock leading to real damages and a surge of private and sovereign debt across the board (Baldwin and Weder di Mauro, 2020), it triggered portfolio rebalancing implying a divergence of sovereign risk premia in the EA. The geography of this episode recalls the one in 2011-2012 when a massive sell-off of peripheral bonds put the euro area at risk of disruption (Aizenman, Binici, and Hutchison, 2013). However, after a sharp increase at the beginning of the pandemic, peripheral spreads have been on a downward trend, with the result that 2020 levels are dwarfed by those of 2011-2012.[2] First, the difference between the two episodes may be due to significant reforms over the last decade (Baldwin and Giavazzi, 2015); second, there were swift policy reactions at the European level in 2020 compared to the previous 2010-2012 episode, by the European Central Bank and by euro-area leaders, all of whom announced major monetary and financial assistance packages as early as in March and April 2020 (see more below). What drove the EA sovereign risk premium during the pandemic crisis? What explains heterogeneity across members? Did the stabilization of spreads reflect investor confidence in the capacity of the EA institutions to sustain the euro? It is important to address these issues as they inform the functioning of the European Monetary Union (EMU) and can hopefully contribute to improve its resiliency to future shocks.

In this paper, we find that the countries' resilience to the COVID shock depended on the health-care capacity, the strength of the banking sector and the fiscal outlook; a large heterogeneity of these factors in the zone explains why EU members absorbed the shock differently. During the crisis, ECB speeches were a game changer and made a much greater contribution than securities purchase programs. Coordination by the European Council also helped to reduce the

1. The bond spreads of Spain, Portugal and Greece have increased by 93%, 119% and 65% resp.
2. See the spreads plot in the online Appendix.

spreads, but the effect was partly offset by loan-based financial assistance programs.

On the one hand, sanitary, macroeconomic and banking conditions have been heterogeneous across the E.A. as a whole, as can be observed from Table 1 which reports summary statistics of several factors in EA member countries. First, Covid 19 pandemic hit EMU members very differently from 0.5 to 81.1 Covid deaths and 26.8 to 656.7 COVID cases per 100,000 inhabitants across the E.A.; countries were differently equipped to deal with this shock, with health expenditures as a percentage of GDP varying from 6.2% to 11.5% throughout the zone; in order to mitigate casualty, countries have implemented heterogeneous lock-down policies as measured by the Stringency Index computed by Hale, Petherick, Phillips, and Webster (2020) which period average by member varies between 34.6 to 55.2 (on a scale from 0 to 100). This could have affected spreads: the more stringent the isolation measures, the more severe the expected negative effect on activity and thus on public debt. Another important source of heterogeneity is the level of debt because the higher the burden of the debt of a country, the higher investors price the risk of repudiation (Calvo, 1988). Public debt as a percentage of GDP at the onset of the crisis and its projection for 2020 vary between 8.4% and 179.2% and between 20% and 200.8% across members; this heterogeneous fiscal situation may well have led to amplification dynamics for largely indebted countries: four out of the five stressed countries over the last crisis stand out, Italy, Spain, Portugal and Greece. An additional source of heterogeneity comes from the fiscal responses that countries have implemented in order to mitigate macroeconomic consequences of isolation and that vary between 0.7% and 7.2% of GDP across the E.A.. banking situations in the euro area were very heterogeneous, as evidenced by the non-performing loans ratio in the domestic banking sectors, which varies between 0.6% and 33.4% in the area as a whole. Despite the prudential reforms since the Euro crisis, vulnerabilities in the banking sector of some countries remain and investors could well price them in, expecting that they could ignite a new doom loop (Schularick and Steffen, 2020).[3]

3. Graphs and maps illustrating cross-country heterogeneity are compiled on the Online Appendix as well as the companion website of this paper.

On the other hand, it is remarkable that compared to 2011-2012 episode, members have benefited from swift and sizeable common policy responses by supranational institutions and from inter-governmental arrangements.[4] Table 1 reports the EUR amount of the different programs over the period. On the monetary side, after an initial announcement that disappointed the market on March 12, the European Central Bank announced the Pandemic Emergency Purchase Program (PEPP) on March 18, consisting in EUR 750 billion program of private and public securities purchase with flexible capital keys as part of the Asset Purchase Program; EUR 220 billions securities were purchased within the first two months under the PEPP. In addition, the ECB eased further collateral eligibility rules to enable banks to mobilise more collateral.[5] And in fact, sovereign spreads narrowed down after March 18 announcement. On the financial assistance side, there was a series of announcement by the European Commission and euro-area leaders at the occasion of European Councils. In total, EUR 580 billion of loans and EUR 40 billion of budget line have been mobilized and discussions of additional EUR 750 billion of budget are ongoing at the time of writing this paper. In the meanwhile, the European Commission lifted the budgetary rules of the Stability and Growth Pact on March 20, 2020. And indeed, data speak for themselves: the standard deviation of bond spreads of all EA members is larger on days of common policy announcement than on non-announcement days, stressing the importance of ECB and European Executive announcements on spreads.[6]

In this paper, we explore the dynamics of EMU members' sovereign spreads between January, 2 and May 25 2020 by testing potential drivers of sovereign risk premium. We create a balanced data panel including sanitary, financial and macroeconomic variables for 14 EA members and we construct original variables to capture the different common policy announcements and the monetary and financial assistance packages.[7] In addition, our specification allows nonlinearity

4. We highlight some important dates of the crisis later in the paper and we provide a detailed timeline in the companion website of this paper

5. See PEPP announcement and collateral easing measures.

6. We compute the standard deviation of daily spread (in basis points) for announcement and non-announcement days over January, 2 to May 25 2020: it is 75 and 65 respectively.

7. All data and codes are available on github

across EA members along the initial level of public debt to match the result of the literature that high debt burden potentially amplifies the effects of a shock on prices.

**Related literature.** This paper is related to papers examining the determinants of the sovereign bond spread in the euro area (Costantini, Fragetta, and Melina (2014), Favero and Missale (2012), Aizenman, Binici, and Hutchison (2013), Manganelli and Wolswijk (2009), Delatte, Fouquau, and Portes (2017)). To the best of our knowledge, we are the first paper dealing with the drivers of the sovereign risk during the pandemic of Covid 19. A finding very specific to the pandemic is that healthcare capacity did affect the sovereign risk. Beyond the specifics of the pandemic, we find that initial conditions regarding budget and banking sector made countries differently vulnerable to the shock; and that policy announcements managed to smooth the heterogeneous effect of the shock. The paper is related to the literature on sovereign debt crises, self-fulfilling dynamics and the role of Central Banks (Bocola and Dovis (2019)) ; it also relates to the works assessing the role of monetary policy (Afonso and Jalles (2019), Krishnamurthy, Nagel, and Vissing-Jorgensen (2018) Falagiarda and Reitz (2015), Altavilla, Giannone, and Lenzaa (2016)) and inter-governmental announcements on sovereign spreads (Afonso, Jalles, and Kazemi (2019)). We differ from them by bringing the role of Central Bank and of the executive body together during a specific crisis episode. Our findings emphasize the great contribution of speech over deeds on the one hand and the ambiguous effect of loans-based financial assistance programs. Several empirical papers found a regime switch in the spread determination model for EA peripheral sovereigns during the last crisis (Aizenman, Binici, and Hutchison (2013), Delatte, Fouquau, and Portes (2017)). Here we take a different perspective by focusing on a short period of time starting with the virus outbreak in order to better understand the factors influencing countries' resiliency during the crisis. We allow geographic heterogeneity and we find that policy measures at the European level affect groups of countries differently. Heterogeneous dynamics after common policies in a monetary union is an important lesson for the theory of optimal currency area that we discuss in this paper. Next Section presents the empirical strategy and the data and Section 3 our findings. Section 4

discusses the lessons for the EA. We provide a broad exercise of robustness estimates and tests in Section 5.

## 2 Empirical strategy

We regress the sovereign bond yield spread relative to Germany's on the following vectors of determinants:

$$Spread_{it} = \beta_1 X_{it}^{San} + \beta_2 X_t^{Fin} + \beta_3 X_{it}^{Pol} + \beta_4 X_t^{Pol} + \gamma_1 Z_i^{Fund} + \gamma_2 Z_i^{Health} + \varepsilon_{it} \qquad (1)$$

where $Spread_{it}$, is the difference between the 10-year German Bund and the 10-year Treasury bill of country $i$, $X_{it}$ are country-and-time variables, $X_t$ are time-varying variables common to every countries in the sample, $Z_i$ are pre-conditions at the country-level. All variables are in logarithm (or log differential when we compute daily variation) except Spreads that take a few negative values.

$X_{it}^{San}$ includes the time-varying country-specific $StringencyIndex$, a nine-point aggregation of social isolation measures compiled by Hale, Petherick, Phillips, and Webster (2020).[8] $X_t^{Fin}$ includes RVol, the time-varying realized volatility of Euronext price index, i.e. the daily difference of Euronext index return. $X_{it}^{Pol}$ includes $FiscalStim$ a time-varying country-specific variable measuring the domestic fiscal stimulus program as a percentage of GDP; $X_t^{Pol}$ is a vector of time-varying variables capturing European policy interventions.[9] First, it includes $EUBudget$, the cumulative Euros amounts of existing and additional EU budget funds to be distributed by the European Commission and $EULoans$, the cumulative Euros amount of loans distributed by the European Investment Bank on March 16 and the loans confirmed by the European Council on April 9 2020 to support member states; second, it includes the monetary policy package

8. Computation and sources of all variables are detailed in the Online Appendix.

9. The *timeline of the crisis* is available on the companion website of this paper where we detail the different interventions including amounts and market reactions.

$PSPP$, $PEEP$ and $RemAPP$, the daily variation of ECB asset securities purchase under the Public Sector Purchase Program, the Pandemic Emergency Purchase Program and the rest of the Asset Purchase Program respectively; in addition we test the contribution of different announcements on the spreads: $D0312$, $D0318$, $D0407$ are three dummies capturing the days the ECB announced additional purchase programs (March 12 and March 18) and the easing of collateral requirement rules (April 7);[10] $D0320$ is a dummy equal to one the day the European Commission announced the lifting of budgetary rules of the Stability and Growth Pact and zero instead (March 20); $D0409$ a dummy equal to one the day the Eurogroup announced the EUR 540 billion safety net and zero instead (April 9); $D0505$ is a dummy equal to one the day the German Court of Justice ruled on the PSPP program and declared it illegal and zero instead (May 5); $D1805$ is equal to one the day Angela Merkel and Emmanuel Macron announced a proposal of EUR 500 bn EU recovery fund to be discussed at the following European Council and zero instead (May 18). In total, all dummies are blip dummies with the exception of $D0318$ that is equal to one after the PEPP announcement on March 18, 2020 in order to test the contribution of the policy announcement on the trend of the spreads.

Before getting further, we point that the inclusion of policy variables raises the question of endogeneity. Indeed, a part of the ECB and the European executive bodies intervention is a reaction to the evolution of the sovereign spreads, a fact that potentially inverses the causality direction and could bias our coefficient estimates. However first and foremost, there is more inertia in the reaction of the political bodies than in the market dynamics, i.e. policy reacts after a while, whereas spreads move overnight, especially during the crisis episode; second, the sovereign spreads are one component of the reaction function of European bodies only (real variables and international developments are probably other elements).

In addition, we test whether spreads co-variate with pre-crisis conditions. More precisely, $Z_i^{Fund}$ is a vector of time-invariant country-specific variables including $Debt19$, the public debt in 2019

10. The easing includes a derogation from the minimum credit quality requirement for marketable debt instruments issued by the Hellenic Republic to be accepted as collateral in Eurosystem credit operations.

in percentage of GDP and $NPL$ the rate of non performing loans in the domestic banking sector at the onset of the pandemic outbreak; this is to test to which extent fiscal situation and banking sector solidity are priced in by investors; $Z_i^{Health}$ includes health expenditures as a percentage of GDP to test whether investors factor in the fact that healthcare capacity of a country potentially affect their macroeconomic recovery outlook after a pandemic. The inclusion of pre-crisis conditions variables is to inform the drivers of countries resiliency.

Last, we mentioned in introduction that four out of the five peripheral countries most stressed over the last decade entered the pandemic crisis with unfavorable fiscal situation; the literature on sovereign debt crisis suggests that it may have triggered amplification dynamics; in fact Italy, Spain, Greece and Portugal recorded a public debt-to-GDP ratio of 134%, 95%, 179% and 117% respectively. And indeed, we observe that the standard deviation of their bond spreads is larger than the rest of the sample (65.2 versus 45.5). Therefore, in addition to the linear equation specified in Eq.1, we allow heterogeneity by interacting time-varying variables with a dummy $South$ equal to one for Italy, Spain, Greece and Portugal and zero instead:[11]

$$\begin{aligned} Spread_{it} = \beta_1 X_{it}^{San} + \beta_2 X_t^{Fin} + \beta_3 X_{it}^{Pol} + \beta_4 X_t^{Pol} + \gamma_1 Z_i^{Fund} + \gamma_2 Z_i^{Health} \\ + \delta_1 South * X_{it}^{San} + \delta_2 South * X_t^{Fin} + \delta_3 South * X_{it}^{Pol} + \delta_4 South * X_t^{Pol} + \varepsilon_{it} \end{aligned} \tag{2}$$

We run the regression using a pooled OLS estimate with clustered standard errors at the country level.

# 3 Results

Table 2 displays the estimate results of Eq. 1 and Eq. 2. The linear and nonlinear estimates yield similar results on the estimated coefficients of variables common to both specifications; in the nonlinear specification, several interacted variables are significant and the AIC and BIC

11. We do not interact time-invariant variables to avoid producing a point estimate on four observations only

information criteria both indicate that the nonlinear specification is a better fit. In sum, the estimates suggest heterogeneity across the EA so we only comment on the nonlinear specification in what follows.

Table 2 indicates that several factors have contributed to the spreads including financial volatility, several policy announcements, securities purchase programs and financial assistance packages with a differentiated contribution of these factors to the spreads of largely indebted countries. The estimated results also suggest that fundamental preconditions and health capacity have influenced the spreads. What is the relative economic contribution of these different factors to the spreads? To answer the question, we compute the contribution on spreads of one standard deviation change of continuous explanatory variables (interacted and non-interacted) and of a change from 0 to 1 for dummy variables.

Fig.1 plots the standardized coefficients which represent the contribution of the associated factor to the spreads in basis points (b.p).[12] Note that we plot the standardized coefficients separately for largely indebted countries from the rest of the sample. First, it is striking that all preconditions highly contributed to the spreads: an increase of one s.d. of $NPL$ is associated with an increase by 25.4 bp of the spreads, a result that suggests that investors have paid attention to banking fragility despite the reforms implemented to neutralize the doom loop (Schularick and Steffen (2020), Couppey-Soubeyran, Perego, and Tripier (2020)); health expenditures also contributed significantly to the variation of the spreads (-21.2 bp), suggesting that investors anticipated that healthcare capacity would influence the recovery outlook; last a variation of one s.d. of the level of debt-to-GDP increases the spreads by 17.8 bp. In sum, these three pre-conditions have been key to determine countries' resiliency to the pandemic shock.

If we turn to developments after the beginning of the crisis, our results suggest that: 1) aggregate financial volatility (RVol) has contributed to increase the sovereign spreads across the board while largely indebted countries suffered more from aggregate financial volatility than the

12. The coefficient values and p-values are reported in the online Appendix.

rest of the sample (+7.1 b.p. versus +1.4 b.p.); 2) the first announcement of the ECB on March 12 (D0312) widened the spread by 7.9 b.p;[13] 3) financial assistance programs based on loans (LoansEU) have contributed to widen the spreads of largely indebted countries (+36 bp) i.e. wiping out the positive March 18 effect. A reason for this may be that investors considered that loans would add to what are already substantial sovereign debt burdens. We will get back to this in the next Section; 4) May 5 ruling of the German Court (D0505) widened the spreads by +7.5 b.p. Nevertheless, several subsequent policy announcements partly offset the widening of the spreads : 5) March 18 PEEP announcement (D0318) was the most powerful to reduce spreads (-18.1 b.p.), with even larger contribution to largely indebted countries (-53.4 b.p.); 6) April 9 European Council coordination (D0409) made also a large contribution on largely indebted countries (-25.2 b.p.) and milder on the rest of the sample ( -6.1 b.p.); 7) May 18 Franco-German proposal (D0518) contributed to reduce the spreads of largely indebted countries by -5.9 b.p.; 8) our results suggest that both securities purchase programs had an effective but more modest contribution on the spreads of largely indebted countries (-2.1 b.p. for PSPP and -1.7 b.p. for PEPP) and no significant contribution on the rest of the sample.

It is also informing to mention the factors that are not significant in our estimates: $StringencyIndex$ is not significant on average, suggesting that the isolation measures have not contributed to widen the spreads. However this may be due to co-linearity with other factors at the country-level as suggested by our finding below of a significant contribution when we examine individual country cases; to be sure we use an alternative measure based on the number of COVID death and we find a nonlinear effect (see Table 3 in the Robustness Section); the estimated coefficient of the domestic fiscal package is significant but with a positive sign contrary to expectations. To be sure, we test one alternative domestic policy measure in the Robustness Section and we confirm that the estimated coefficient is not significant.[14] The estimated coefficients of the

13. During March 12 press conference, President Lagarde stated that it was not the role of the ECB to "close spreads". While she rectified this quickly after the press conference, her comment cast doubt about her commitment. See A dangerous slip-up from Lagarde, by Claire Jones, March 12, Financial Times

14. We find it however tricky to conclude the absence of contribution of domestic packages; it will be worth testing alternative variables when we have enough solid data in the future.

remaining APP package (excluding PEEP and PSPP) is not significant, a result that suggests that PEPP and PSPP are the spreads movers in the asset purchase program; last, our results suggest that the lifting of budgetary rules on March 20 was not associated with a reduction of spreads across the board.

**Individual factors contribution by country**

Now that our estimates confirm that factors have made a differentiated contribution to the spreads across the Euro Area, we could learn more about the crisis by getting the individual contribution for each largely indebted countries. To do so, we amend Eq. 2 in two ways: 1) we replace the dummy $South$ by four different dummies equal to one for Italy, Spain, Greece or Portugal respectively and zero instead ; 2) we use fixed-effects in order to absorb all cross country heterogeneity at the beginning of the crisis.[15]

Fig 2 plots the standardized coefficients of each significant factor for each largely indebted country as well as the mean Spread over the period and the associated fixed effect that we interpret as pre-conditions contribution to the spreads. In general, we note that: 1) countries with larger spreads have consistently experienced larger contribution of each factor; 2) Greece and Italy entered the crisis with unfavorable conditions which contribute to an increase of their spread by 115 b.p. and 86 b.p. respectively. In comparison Portugal and Spain show much better resiliency to the shock with 3.4 b.p. and 1.2 b.p. increase due to pre-conditions; 3) the Italian spread is the one that has benefited the most from the interventions of the European institutions with a total of contribution of -99 b.p., i.e. an almost complete compensation for their unfavourable preconditions.

If we look at factors that contributed to increase the spreads, we observe that the first ECB

15. The introduction of fixed-effects implies the elimination of our time-invariant variables; the estimate yields similar coefficients on time-varying variables as in the pooled OLS which reassures us on the robustness of our results (see Table 3 in the Robustness Section). We compute the standardized coefficients as previously and we plot them as well as the fixed-effects that we interpret as pre-conditions contribution to the spreads

announcement on March 12 is the main widening factor for Italy, Portugal and Spain (+ 45.8 b.p., +26.9 b.p. and + 16.2 b.p. respectively); the second factor is the financial package based on loans (+16.5 b.p.for Italy, +6.8 b.p. for Portugal, + 18.7 b.p. for Greece and + 7 b.p. for Spain) and the one based on bugdet for Italy and Portugal (+7.6 b.p. and +6.8 b.p.); the German Court ruling affected all spreads homogeneously by +8.5 b.p.. Now turning to factors that contributed to reduce the spreads, our results suggest that the main driver was March 18 ECB announcement, D0318, (-67.5 b.p. for Italy, -33.7 b.p. for Portugal, -22.8 b.p. for Spain) and April 9 Eurogroup meeting announcement, D0409 (-25 b.p. for Italy, -12 b.p. for Portugal, -32.9 b.p. for Greece and -12.5 b.p. for Spain); the Franco-German recovery plan proposal reduced the spreads of Greece, Italy and Portugal by -15.8 b.p., -4 b.p. and -5.8 b.p. respectively; last we find that the ECB announcement on April 7 (D0407) about relaxing collateral rules contributed to reduce the spreads of Greece, Italy and Portugal (-32.9 b.p, -6.5 b.p. and -5.1 b.p. resp.). The large contribution for Greece most likely reflects the specific announcement that Greek government bonds were now eligible as collateral in Eurosystem credit operations.

Our results suggest that Greece differs significantly from the three other countries as March 18 ECB announcement and the relaxing of budget rule by the European Commission both contributed to significantly widen the Greek spread (60.5 b.p. and 60.9 b.p. resp). It may be due to the fact that the PEPP was more restrictive for Greece than for the rest of the EA;[16] and the relaxing of budget rule signaled to investors that the fiscal situation of all members was strongly deteriorating, a fact that could potentially reduce common resources for Greece.[17]

In total, important takeaways are that E.A. members entered the crisis with heterogeneous

16. Greek securities were not eligible to the Asset Purchasing Program until the adoption of the PEPP because of the rule that bans the ECB to hold more than 33% of the outstanding secrurities stock of one country. The eligibility rule has been waived for Greek government securities under the PEPP, but not for Greek private securities that remain not eligible.

17. Another difference is the significant contribution of the fiscal stimulus in Greece for which we find that an increase in one s.d. reduces the spread by 25 b.p. We take this result with caution as we previously mentioned that the quality of the data may be improved.

situations that largely influenced their sovereign risk. Once the crisis started, we find that spreads reacted mostly to policy announcements and that they contributed to reduce the Italian spread to a larger extent than the other largely indebted countries. In the next Section we draw lessons from our empirical results.

# 4 Three lessons for Monetary Unions

The Covid pandemic was an exogenous shock with heterogeneous effects on the EA members and we uncover which initial conditions made countries resilient. Three lessons can be drawn from our findings on further developments during the crisis episode:

1. Monetary policy speech is stronger than deeds during a sovereign debt crisis episode. Indeed, our findings suggest that the main spreads movers have been Central Bank speeches while securities purchase programs had a limited contribution. A likely mechanism suggested by P. Lane, a member of the executive board of the ECB is that heightened risk aversion triggered a global flight-to-safety episode implying large sell-off of largely indebted government bonds.[18] Multiple equilibria emerged in these countries after the pandemic shock with the bad equilibrium implying higher spreads and higher probability of default. By committing to purchase debt securities, the ECB "crowded in" other investors by securing liquidity to all E.A. governments, thereby protecting members of the euro area from beliefs-driven self-fulfilling switch in equilibria. In this framework, the interpretation of our results is that the first ECB announcement on March 12 failed to convince investors unlike the second announcement on March 18 which did shift investors' beliefs.

   It is interesting to observe that March 18 speech associated with a limited contribution of actual securities purchase recalls the OMT effect in 2012 which allowed the European

18. see "The market stabilisation role of the pandemic emergency purchase programme" by Philip R. Lane on June 22 2020.

Central Bank to purchase sovereign bonds in secondary markets without explicit quantity limits. Indeed, Altavilla, Giannone, and Lenzaa (2016) and Delatte, Fouquau, and Portes (2017) both documented that President Draghi's "whatever it takes" speech was enough to bring the spreads down without activating the purchase program. A corollary lesson is that the lender of last resort effect of speeches works with different initial conditions and different modus operandi : in 2012, the risk faced by peripheral countries was less a risk of flight-to-safety than a self-fulfilling *rollover* risk (Bocola and Dovis, 2019) and OMTs were unlimited but conditional on the country being in a European Financial Stability Facility/European Stability Mechanism macroeconomic adjustment or precautionary program.

2. The constraint of a one-size-fits-all monetary policy in a monetary union can marginally be alleviated with specific instruments. Indeed, our results suggest that the collateral easing (D0407) has had a significant contribution on the Greek, Italian and Portuguese spreads but none on the rest of the sample. A likely mechanism is that the easing of collateral rules endogenously relaxed supply constraints on stressed credit market. Indeed, providing banks access to cheaper credit through a loosening of collateral requirement by the ECB aimed at offsetting credit shortage in the banking sectors where the quality of banks balance sheet has deteriorated the most.

3. Financial assistance in the form of a loan does not work as an adjustment mechanism as do fiscal transfers. Indeed, we find that loan-based financial assistance programs have contributed to widening the spreads of heavily indebted countries. The theory of Optimal Currency Area can help us shed light on how the adjustment was carried out after the virus appeared with the caveat that the shock was only heterogeneous and not asymmetric. Kenen (1969) showed that fiscal transfers play an important role in most monetary unions in offsetting region-specific demand shocks. However, transfers based on loans may well carry the opposite effect by adding debt on already largely indebted countries. Loans contribute to increase future government budget constraint and therefore decrease present

household consumption by virtue of Ricardo's equivalence. As a result, loan-based financial assistance increases the risk premium of the countries most in need of these transfers. Therefore the recovery plan based mainly on transfers instead of loans proposed by the European Commission after a Franco-German initiative would most likely be a positive outcome if adopted.

# 5 Robustness

We re-estimate the determinants of sovereign spreads along alternative vectors of variables, alternative estimation method and alternative samples of countries.

1. Alternative variables:

   - Instead of Stringency Index, we include the number of COVID deaths per 100,000 people (in log) and and its squared value (Table 3, column 1): contrary to Stringency Index, the estimated coefficients are significant with a negative and positive sign respectively, a result that suggests a threshold effect, i.e. passing up a certain death ratio may have stressed up markets. Therefore, it suggests that the severity of sanitary factors may well have mattered.
   - Instead of the realized volatility of the Euronext Index, we include Euronext daily return (Table 3 columns 8 and 9): the estimated coefficient is significant and negative as expected: the lower the aggregated European stock return, the higher the domestic spreads.
   - We test one alternative measure of domestic policy measure, PolicyTracker, the COVID-19 Response Tracker (CFRT) computed by Yale University which tracks 13 economic policy responses by country and by date (Table 3, column 2): the estimated coefficient is negative as expected but not significant.

- Instead of Health Expenditure, we include the number of hospital beds and median age of the population (Table 3, columns 4-7): median age is positive and significant, a result that suggests that investors expected detrimental effects of health system on growth prospect. Indeed COVID affected elderly more than the rest of the population and therefore the older the population, the more the health system was potentially under pressure.
- Instead of Debt-to-GDP in 2019, we include the projected debt-to-GDP in 2020, $Debt20$ (Table 3, columns 3, 5 and 7): the estimated coefficients have the same sign and p-value as $Debt19$.

In general, our main results presented in Section 3 hold constant within most alternative specifications. Consistent with previous results, NPL, Debt and Health Expenditures seem to be good predictors of spreads. Our findings on the contribution of policy announcements holds: March 18 and April 9 have contributed to reducing the spreads, with an amplified contribution in largely indebted countries. We also confirm a differentiated contribution on these countries of the weekly purchase of securities under the PEPP on the one hand (reducing the spreads) and of financial assistance programs based on loans on the other hand (increasing the spreads). For the latter, the results seem highly robust: assistance programs based on loans tend to increase sharply the spreads.

2. Alternative specification: instead of using a pooled OLS, we estimate Eq. 2 with country fixed effects and we cluster standard errors at the country level. The inclusion of country FE accounts for all observable and unobservable invariant factors; therefore, we include only time-varying factors at the aggregate and country-levels (Table 3 column 10): adding country fixed effects rather than a country's vector of invariant variables does not affect our main findings about differentiated contribution of policy measures and announcements on spreads of largely indebted countries (note that the contribution of March 18 ECB announcement on largely indebted country is significant with a p-value of 0,147).

3. Shorter samples:

   (a) We restrict the sample of countries to 9 main EA economies as in Afonso, Jalles, and Kazemi (2019) ( Australia, Belgium, France, Greece, Ireland, Italy, Netherlands, Portugal, Spain) and we obtain similar signs and p-value confirming differentiated contribution of policy announcements across the EA and the contribution of financial packages based on loans (Table 3 column 12):

   (b) We exclude Italy and Greece from the sample and our main results hold with a few exceptions and lower values of coefficient: we confirm the differentiated contribution on highly indebted countries of market volatility, of the PEEP, of the financial package assistance based on loans, of the European Executive and ECB March 18 announcements for both sub-samples (the coefficient on March 18 is significant at a p-value 0.11 in the sample without Italy); it suggests that our findings are not driven by one country only (Table 3 column 12 and column 13).

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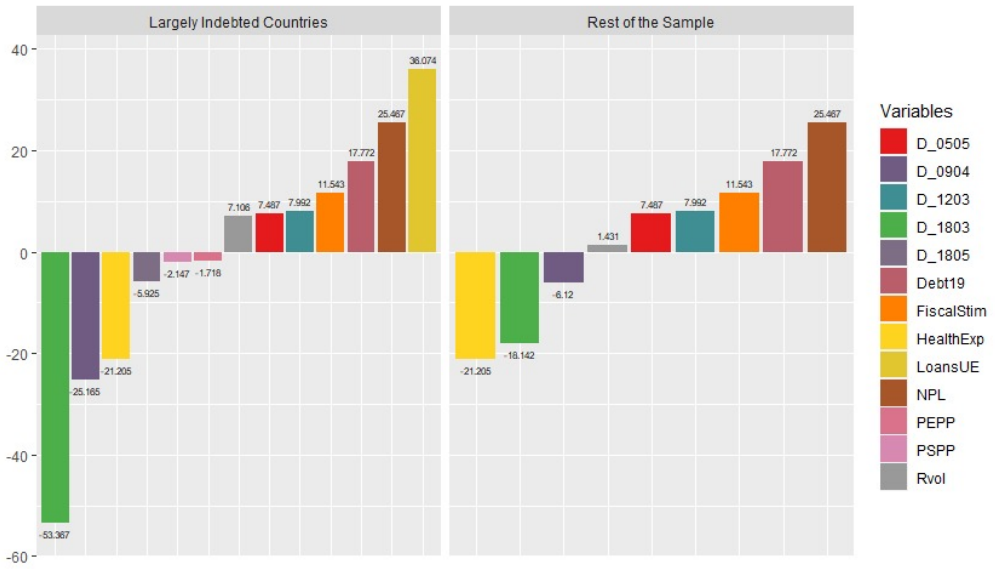
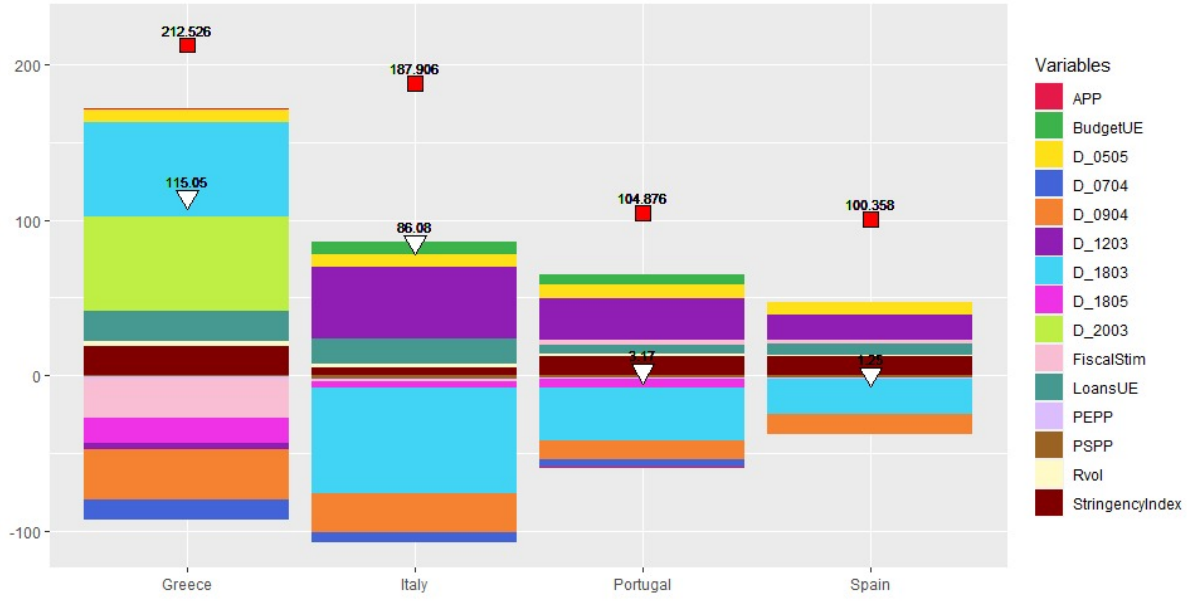
# A Figures

**Figure 1 – Relative Contributions To Spreads**




This Figure plots the average contribution by factor based on standardized coefficients $\beta'_k$ with: $\beta'_k = \beta_k \times s_{x_k}$ for continuous explanatory variables with $\beta_k$ the estimated coefficient from Eq.2 and $s_{x_k}$ the standard deviation of the explanatory variable k; $\beta'_k = \beta_k$ for dummies. For the largely indebted countries, the average contribution of each explanatory variable is the sum of $\beta'_k$ of largely indebted countries and of the rest of the sample. The largely indebted countries include Greece, Italy, Spain, Portugal. Here we plot only significant coefficients.

**Figure 2 – Individual Factors Contributions by Country**




This Figure plots the average contribution by factor based on the standardized coefficients $\beta'_k$ with: $\beta'_k = \beta_k \times s_{x_k}$ for continuous explanatory variables with $\beta_k$ the estimated coefficient from amended Eq.2 and $s_{x_k}$ the standard deviation of the explanatory variable k; $\beta'_k = \beta_k$ for dummies. The average contribution of each explanatory variable for each country i is the sum of $\beta'_k$ of country i and of the rest of the sample. Here we plot only significant coefficients. Red squares represent the mean of the spreads over January 2-May 25 period and white diamonds represent the value of the fixed effect.

# B Tables

**Table 1 – Summary Statistics**

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| SovSpread | 1475 | 86.4 | 65 | 8.3 | 413.6 |
| CovidDeath | 1976 | 19.9 | 23.5 | .5 | 81.1 |
| CovidCases | 1976 | 236 | 186.4 | 26.8 | 656.7 |
| HealthExp | 1933 | 8.7 | 1.6 | 6.2 | 11.5 |
| Stringency | 1768 | 43.1 | 5 | 34.6 | 55.2 |
| Debt19 | 1976 | 72.6 | 40.7 | 8.4 | 179.2 |
| Debt20 | 1976 | 84.3 | 44.8 | 20 | 200.8 |
| FiscalStim | 1976 | 2.8 | 2 | .7 | 7.2 |
| NPL | 1976 | 5 | 7.5 | .6 | 33.4 |
| RVol | 1938 | 0.02 | 0.02 | 0 | .14 |
| PEPP | 1976 | 42728.4 | 65959.9 | 0 | 221632.4 |
| PSPP | 1976 | 2150617 | 35598.6 | 2102927 | 2217437 |
| RemAPP | 1976 | 547509.9 | 11490.2 | 528961 | 566915.6 |
| EUBudget | 1976 | 19670.2 | 19689.6 | 0 | 40140 |
| EULoans | 1976 | 190961.5 | 265685.2 | 0 | 580000 |

This table reports summary statistics over January 1- May 25 2020 of the vector of variables used to estimate Eq.1 and Eq.2. The Stringency Index is a number between 0 to 100 that reflects the overall stringency of the governments response. Definitions and sources are detailed in the online Appendix.

## Table 2 – Determinants of sovereign bond spreads

| | Time-varying variables | | Interacted Variables | |
|---|---|---|---|---|
| | Linear specification | Nonlinear specification | Nonlinear specification (cont') | |
| StringencyIndex | 4.960 | 3.442 | South*Stringency | -0.990 |
| | (2.980) | (3.571) | | (4.962) |
| Rvol | 108.657** | 52.025* | South*Rvol | 193.331** |
| | (41.058) | (28.685) | | (67.409) |
| FiscalStim | 2.040 | 4.358*** | South*FiscStim | -8.263 |
| | (2.016) | (1.023) | | (5.476) |
| D_1203 | 11.672** | 7.992** | South*D_1203 | 7.603 |
| | (4.493) | (3.211) | | (9.919) |
| D_1803 | -27.988*** | -18.142*** | South*D_1803 | -35.225 |
| | (7.296) | (4.400) | | (20.192) |
| D_2003 | 0.458 | -3.618 | South*D_2003 | 12.049 |
| | (4.363) | (4.573) | | (10.807) |
| D_0704 | -5.676** | -3.518 | South*D_0704 | -7.531 |
| | (2.201) | (3.227) | | (4.613) |
| D_0904 | -11.932*** | -6.120* | South*D_0904 | -19.045*** |
| | (3.512) | (3.010) | | (5.764) |
| D_0505 | 6.575** | 7.487* | South*D_0505 | -3.477 |
| | (2.890) | (4.028) | | (4.790) |
| D_1805 | -1.858 | -0.808 | South*D_1805 | -5.925* |
| | (1.991) | (2.024) | | (3.322) |
| RemAPP | 636.358 | 50.207 | South*RemAPP | 2,838.084 |
| | (590.124) | (752.083) | | (3,288.505) |
| PEPP | -1.374** | -0.700 | South*PEPP | -1.804** |
| | (0.501) | (0.535) | | (0.706) |
| PSPP | -2,307.306** | -984.673 | South*PSPP | -3,579.075* |
| | (861.115) | (739.948) | | (1,910.400) |
| BudgetUE | 1.385* | 1.187 | South*BudgetUE | 0.195 |
| | (0.766) | (0.961) | | (1.672) |
| LoansUE | 2.811** | 0.874 | South*LoansUE | 5.820** |
| | (1.063) | (0.875) | | (2.135) |
| | Time-Invariant variables | | | |
| HealthExp | -157.930** | -131.624*** | | |
| | (62.613) | (41.564) | | |
| NPL | 25.010 | 28.795*** | | |
| | (14.885) | (9.400) | | |
| Debt19 | 74.277* | 41.885 | | |
| | (38.458) | (23.729) | | |
| Constant | 41.965 | 120.220* | | |
| | (90.737) | (66.178) | | |
| Observations | 1,366 | 1,366 | | |
| R-squared | 0.809 | 0.852 | | |
| AIC | 13135.86 | 12785.78 | | |
| BIC | 13203.71 | 12853.63 | | |
| Number of id | 14 | 14 | | |

This table reports the estimates of the the spread determinants specified in Eq.1. The period of estimation is January 1- May 25 2020 on daily data (5 days per week). ***, ** indicates a correlation significant at the 0.01 and 0.05 level resp.

## Table 3 – Determinants of the sovereign bond spreads: Robustness

| Variables | Rvol | | | | | | | Euronext Daily Value | | Rvol | 9 countries sample | Without Italy | Without Greece |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Covid19 Death Debt 19 | Policy Tracker Debt 19 | Health Exp Debt 20 | Hospital Beds Debt 19 | Hospital Beds Debt 20 | Median Age Debt 19 | Median Age Debt 20 | Health Exp Debt 19 | Health Exp Debt 20 | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| StringencyIndex | | 3.343 | 3.324 | 4.502 | 4.200 | 7.428** | 7.356** | 2.781 | 2.718 | 6.811* | -2.026 | 5.304 | 2.589 |
| | | (3.215) | (3.571) | (3.777) | (3.810) | (2.725) | (2.677) | (3.641) | (3.630) | (3.648) | (3.096) | (3.885) | (4.032) |
| Death Per100k | -21.406** | -10.304 | | | | | | | | | | | |
| | (9.905) | (10.161) | | | | | | | | | | | |
| Death Per100k$^2$ | 3.734* | 1.489 | | | | | | | | | | | |
| | (2.063) | (1.877) | | | | | | | | | | | |
| Rvol | -36.178 | -28.300 | 66.631* | 4.818 | 6.194 | 11.312 | 11.744 | | | 22.432 | 76.745** | 52.089 | 50.066 |
| | (35.056) | (29.548) | (32.103) | (27.127) | (28.257) | (33.788) | (35.837) | | | (22.453) | (26.101) | (32.691) | (32.018) |
| FiscalStim | 4.269*** | | 4.716*** | 1.725 | 1.596 | 0.616 | 0.446 | 4.236*** | 4.577*** | 1.980** | 0.758 | 3.916*** | 4.390*** |
| | (1.175) | | (1.106) | (1.235) | (1.269) | (1.316) | (1.316) | (0.977) | (1.056) | (0.913) | (1.401) | (1.071) | (1.107) |
| Euronext | | | | | | | | -86.523*** | -87.853*** | | | | |
| | | | | | | | | (26.279) | (26.089) | | | | |
| Policy Tracker | | -0.535 | | | | | | | | | | | |
| | | (1.262) | | | | | | | | | | | |
| D_1203 | 18.823*** | 18.059** | 8.011** | 10.056** | 10.142** | 9.322* | 9.292* | 0.479 | 1.163 | 9.661*** | 11.288** | 10.732*** | 12.586*** |
| | (5.639) | (6.023) | (3.215) | (4.051) | (4.041) | (4.398) | (4.395) | (3.658) | (3.454) | (2.605) | (3.377) | (2.460) | (2.181) |
| D_1803 | -17.453*** | -9.347** | -18.087*** | -16.107*** | -15.829*** | -14.035*** | -13.730*** | -17.921*** | -18.124*** | -15.358*** | -12.745*** | -18.719*** | -19.185*** |
| | (4.319) | (3.319) | (4.565) | (4.108) | (4.167) | (4.441) | (4.521) | (4.696) | (4.837) | (3.783) | (3.259) | (4.916) | (5.175) |
| D_2003 | -17.814** | -17.764* | -3.242 | -7.433* | -7.491* | -9.488** | -9.632** | -1.313 | -1.349 | -6.521 | 0.137 | -5.782 | -5.229 |
| | (8.224) | (9.349) | (4.685) | (3.914) | (3.974) | (4.342) | (4.440) | (4.882) | (4.916) | (3.944) | (1.044) | (5.073) | (5.226) |
| D_0704 | -4.475 | -1.751 | -3.387 | -3.102 | -2.952 | -2.363 | -2.221 | -3.363 | -3.543 | -3.429 | 2.936** | -3.141 | -3.368 |
| | (3.940) | (2.873) | (3.374) | (2.610) | (2.578) | (2.455) | (2.407) | (2.875) | (3.044) | (2.583) | (1.081) | (3.922) | (4.065) |
| D_0904 | -8.735** | -7.121** | -5.224* | -6.871** | -7.112** | -5.732** | -5.981** | -5.429* | -4.670 | -4.221 | -1.990 | -5.731 | -5.714 |
| | (3.769) | (3.239) | (2.893) | (2.708) | (2.778) | (2.577) | (2.603) | (2.809) | (2.744) | (2.950) | (1.348) | (3.340) | (3.285) |
| D_0505 | 13.140*** | 12.689** | 6.858 | 9.690** | 9.699** | 9.387** | 9.420** | 11.854*** | 11.820*** | 8.533** | -0.538 | 8.425 | 8.665* |
| | (3.965) | (4.663) | (3.969) | (3.974) | (4.024) | (4.105) | (4.166) | (3.562) | (3.526) | (3.847) | (1.176) | (4.774) | (4.687) |
| D_1805 | 7.902** | 6.876* | -1.415 | 2.050 | 2.092 | 2.100 | 2.164 | 3.752* | 3.272 | 0.873 | -2.263* | -0.546 | -0.492 |
| | (3.337) | (3.817) | (2.253) | (2.004) | (2.080) | (2.114) | (2.190) | (2.034) | (2.148) | (1.477) | (1.213) | (2.467) | (2.440) |
| RemAPP | -1,639.033* | -8.063 | 308.677 | -102.574 | -130.570 | 1,094.088 | 1,110.713 | -1,044.400 | -800.759 | 775.727 | -159.568 | 431.692 | -339.864 |
| | (884.930) | (637.277) | (718.167) | (959.680) | (929.820) | (636.495) | (652.473) | (957.737) | (893.466) | (549.065) | (1,052.090) | (858.974) | (853.176) |
| PEPP | -0.774 | -1.284* | -0.733 | -0.821 | -0.820 | -1.117** | -1.126** | -0.408 | -0.420 | -1.032* | -0.246 | -1.190** | -1.030* |
| | (0.587) | (0.689) | (0.522) | (0.521) | (0.524) | (0.473) | (0.475) | (0.581) | (0.570) | (0.542) | (0.262) | (0.485) | (0.472) |
| PSPP | -3,212.950** | -3,822.543** | -863.579 | -2,073.440*** | -2,087.433*** | -2,413.374*** | -2,439.681*** | -264.170 | -7.590 | -1,908.219*** | -617.288** | -1,213.472 | -1,082.004 |
| | (1,090.424) | (1,392.978) | (761.671) | (561.781) | (592.967) | (661.014) | (695.462) | (1,005.072) | (1,042.227) | (531.669) | (233.359) | (741.006) | (742.310) |
| BudgetUE | 2.333*** | 1.548 | 1.143 | 1.247 | 1.318 | 0.395 | 0.406 | 2.156* | 2.269* | 0.568 | 3.159*** | 0.845 | 1.691 |
| | (0.591) | (0.887) | (0.961) | (1.121) | (1.101) | (0.969) | (0.961) | (1.204) | (1.201) | (0.919) | (0.887) | (1.081) | (1.089) |
| LoansUE | 2.267* | 3.031** | 0.825 | 1.432* | 1.485* | 1.791** | 1.852** | 0.358 | 0.215 | 1.341 | 0.424 | 1.293 | 1.101 |
| | (1.168) | (1.269) | (0.864) | (0.699) | (0.698) | (0.665) | (0.667) | (1.013) | (1.003) | (0.804) | (0.521) | (1.034) | (1.022) |
| South*Stringency | | 6.241 | 5.090 | 10.395 | 10.566 | 3.027 | 2.830 | 7.063 | 5.464 | -1.792 | 10.650* | 1.457 | 6.225 |
| | | (4.709) | (4.905) | (5.975) | (6.036) | (5.174) | (5.232) | (5.116) | (5.030) | (5.214) | (5.210) | (5.132) | (4.422) |
| South*Rvol | 456.513*** | 246.579*** | 172.010** | 270.200*** | 268.286*** | 205.399*** | 203.432*** | | | 212.941*** | 163.949** | 227.595*** | 155.094*** |
| | (132.472) | (78.258) | (68.015) | (48.000) | (56.886) | (54.779) | (58.293) | | | (66.438) | (67.505) | (54.509) | (41.468) |
| South*FiscStim | -0.264 | | -6.150 | -1.740 | -1.587 | -1.012 | -0.810 | -5.942 | -6.572 | -8.583 | -1.650 | -5.814 | 0.503 |
| | (8.843) | | (7.399) | (8.029) | (8.020) | (8.010) | (7.980) | (6.815) | (6.708) | (5.787) | (7.479) | (6.607) | (2.644) |
| South*Euronext | | | | | | | | -81.069 | -96.858* | | | | |
| | | | | | | | | (55.797) | (52.278) | | | | |
| South*D_1203 | 4.392 | 2.872 | 9.128 | 1.399 | 1.414 | 6.536 | 6.784 | 8.507 | 6.222 | 11.059 | 5.549 | -1.416 | 11.964 |
| | (9.251) | (10.810) | (9.959) | (10.520) | (10.954) | (10.909) | (10.929) | (9.405) | (8.633) | (11.816) | (9.717) | (9.432) | (7.534) |
| South*D_1803 | -35.314 | -42.332** | -35.176* | -39.023* | -39.408* | -43.091** | -43.585** | -36.798* | -36.119* | -23.344 | -41.977* | -25.159 | -37.666* |
| | (22.742) | (15.087) | (19.853) | (19.994) | (19.935) | (19.397) | (19.313) | (18.140) | (17.786) | (15.130) | (19.604) | (14.406) | (18.901) |
| South*D_2003 | 25.106** | 18.572 | 11.206 | 16.415 | 16.494 | 17.674* | 17.842* | 9.065 | 10.060 | 10.948 | 8.239 | 18.251 | 6.145 |
| | (10.680) | (13.034) | (10.840) | (9.614) | (9.768) | (8.754) | (8.866) | (9.840) | (9.583) | (11.532) | (9.893) | (11.136) | (10.032) |
| South*D_0704 | -2.759 | -8.748* | -8.092 | -7.638 | -7.821* | -9.992** | -10.205** | -10.937** | -10.530** | -6.103* | -14.585*** | -7.702 | -6.895 |
| | (6.153) | (4.097) | (4.649) | (4.353) | (4.319) | (4.075) | (4.067) | (4.319) | (4.424) | (3.334) | (3.342) | (5.837) | (5.607) |
| South*D_0904 | -12.916* | -19.385*** | -20.215*** | -18.278*** | -18.043** | -20.276*** | -20.045*** | -20.448*** | -20.944*** | -20.809*** | -23.454*** | -17.480** | -15.059** |
| | (6.436) | (5.885) | (5.746) | (5.967) | (6.039) | (5.945) | (5.966) | (6.468) | (6.497) | (5.635) | (5.208) | (7.479) | (4.959) |
| South*D_0505 | -14.276** | -6.032 | -1.997 | -6.590 | -6.572 | -3.782 | -3.741 | 6.455 | 7.040 | -3.308 | 5.302** | -6.213 | -4.047 |
| | (5.275) | (4.440) | (4.674) | (4.714) | (4.974) | (4.773) | (4.842) | (4.223) | (4.134) | (4.005) | (2.251) | (5.849) | (5.676) |
| South*D_1805 | -18.034*** | -9.926** | -4.398 | -10.092*** | -10.102*** | -7.518** | -7.500** | -0.961 | 1.097 | -5.535 | -3.712 | -6.894* | -4.574 |
| | (5.282) | (3.893) | (3.608) | (2.805) | (3.206) | (2.802) | (2.931) | (3.494) | (3.733) | (3.183) | (3.083) | (3.149) | (3.212) |
| South*RemAPP | 4,301.041 | 2,434.185 | 1,547.853 | 5,344.871 | 5,304.542 | 1,037.689 | 872.592 | 1,957.940 | 512.765 | 1.789 | 2,106.956 | -92.602 | 3,706.852 |
| | (3,725.624) | (2,934.239) | (3,066.772) | (3,789.804) | (3,676.443) | (3,026.570) | (3,119.910) | (3,724.437) | (3,460.506) | (964.021) | (3,360.874) | (2,706.197) | (4,185.502) |
| South*PEPP | -2.070** | -1.318 | -1.571** | -2.128** | -2.119** | -1.270** | -1.236** | -1.316* | -1.097 | -0.850 | -2.100*** | -1.093** | -1.246* |
| | (0.787) | (0.865) | (0.653) | (0.708) | (0.721) | (0.549) | (0.555) | (0.740) | (0.676) | (0.748) | (0.545) | (0.441) | (0.639) |
| South*PSPP | -67.539 | -1,861.726 | -3,735.622* | -2,669.060 | -2,645.561 | -2,350.661 | -2,308.967 | -1,652.576 | -1,995.683 | -2,991.996** | -3,930.046* | -1,648.113 | -3,452.615 |
| | (1,492.530) | (2,037.051) | (1,863.116) | (1,881.275) | (1,915.358) | (1,672.855) | (1,702.071) | (2,257.779) | (2,200.511) | (1,110.071) | (1,796.765) | (1,050.080) | (2,237.747) |
| South*BudgetUE | 1.094 | 0.305 | 0.812 | -1.413 | -1.444 | 1.117 | 1.194 | 2.598 | 2.909 | 2.462* | -1.288 | 1.311 | -0.407 |
| | (0.732) | (1.481) | (1.596) | (2.056) | (2.046) | (1.788) | (1.834) | (1.960) | (1.861) | (1.312) | (1.645) | (2.309) | (1.875) |
| South*LoansUE | 5.176** | 4.404** | 5.764** | 5.389** | 5.325** | 4.607** | 4.523* | 4.314** | 4.421** | 5.835*** | 6.107** | 4.750** | 3.941** |
| | (2.394) | (1.589) | (2.096) | (2.123) | (2.118) | (2.102) | (2.113) | (1.953) | (1.909) | (1.798) | (2.080) | (2.074) | (1.604) |
| HealthExp | -76.205 | -116.019** | -148.433*** | | | | | -132.505*** | -149.482*** | | -53.109 | -70.761** | -104.019* |
| | (52.100) | (45.360) | (42.326) | | | | | (42.305) | (43.029) | | (42.004) | (29.543) | (48.728) |
| Debt19 | 18.162 | 43.751* | | -18.154 | | -21.651 | | 43.652* | | | 51.330* | 20.319 | 48.865* |
| | (30.074) | (22.829) | | (19.834) | | (16.781) | | (24.380) | | | (26.787) | (11.260) | (23.547) |
| Debt20 | | | 56.625* | | -15.562 | | -20.708 | | 58.548* | | | | |
| | | | (27.546) | | (21.688) | | (17.672) | | (28.151) | | | | |
| NPL | 37.305*** | 27.920*** | 25.935** | 56.529*** | 55.335*** | 59.679*** | 58.769*** | 28.251** | 25.377** | | 30.113** | 43.045*** | 33.803** |
| | (11.036) | (8.200) | (9.468) | (6.714) | (6.564) | (7.436) | (7.159) | (9.606) | (9.651) | | (9.964) | (6.457) | (10.806) |
| HospitalBeds | | | | 13.218 | 14.697 | | | | | | | | |
| | | | | (18.010) | (19.886) | | | | | | | | |
| Medage | | | | | | 149.367* | 158.283* | | | | | | |
| | | | | | | (77.074) | (80.852) | | | | | | |
| Constant | 103.310 | 81.273 | 88.017 | 39.566 | 30.116 | -490.515 | -523.704 | 116.594 | 83.838 | 54.514*** | -95.145* | 55.923 | 21.019 |
| | (69.019) | (88.665) | (60.687) | (73.791) | (79.816) | (291.681) | (295.916) | (66.815) | (60.961) | (6.242) | (48.396) | (64.495) | (94.403) |
| Observations | 1,462 | 1,366 | 1,366 | 1,366 | 1,366 | 1,366 | 1,366 | 1,379 | 1,379 | 1,366 | 890 | 1,075 | 1,075 |
| R-squared | 0.822 | 0.852 | 0.859 | 0.826 | 0.824 | 0.835 | 0.834 | 0.851 | 0.858 | 0.650 | 0.902 | 0.884 | 0.810 |
| Number of id | 15 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 9 | 12 | 12 |
| FE | NO | NO | NO | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO |

This table reports the estimates of the the spread determinants specified in Eq.2 along alternative variables, alternative estimation methods and alternative samples of countries. The period of estimation is January 1- May 25 2020 on daily data (5 days per week). ***, ** indicates a correlation significant at the 0.01 and 0.05 level resp.