

Covid-19, sovereign risk and monetary policy: Evidence from the European Monetary Union

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ABSTRACT

This paper investigates the impact of Covid-19 pandemic and monetary policy measures adopted by the European Central Bank (ECB) on the sovereign risk for the European Monetary Union (EMU) countries for the period between March-2020 and November-2020 using daily data. The impact of Covid-19 and monetary policy shocks on the credit default swap rates and bond yields are investigated relying on a fixed effects panel regression model for five core (Germany, France, Austria, Netherlands, Belgium) and three periphery (Italy, Portugal and Spain) countries. To investigate the cross-country differences in responses, the interactions of the independent variables with periphery dummy and other country-specific variables are included in the regressions. The results of the empirical analysis suggest that Covid-19 shock increased the sovereign risk in the periphery EMU countries significantly and monetary policy measures have been effective in easing financial conditions in these countries. The results are insignificant for the core countries. The results also show that financial stability alleviates the negative impact of Covid-19 on the sovereign risk.

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1. Introduction

At the beginning of 2020, the world was hit by Covid-19 shock, with major adverse effects on the economic activity. Both the demand and supply sides are affected negatively. On the supply side, production decreased due to the lockdowns and shelter-in-place measures imposed by the governments. Even with the relaxation of the lockdown measures, supply shocks still remained as the infected people could not work. On the demand side, both losing their jobs and the fear of getting infected might have led to permanent changes in the preferences and consumption behavior of the agents. In addition to the decline in the economic activity, risk and distress in the financial markets increased significantly and liquidity conditions deteriorated which arguably accelerated the negative impact of the shock. These complexities in the economy raised questions about the impact of the shock and correct policy mix to mitigate the adverse consequences of the pandemic.

This paper investigates the impact of Covid-19 pandemic on financial distress for the European Monetary Union (EMU) countries and the effectiveness of the monetary policy measures taken by the European Central Bank (ECB) for the period between March 2020 and November 2020 using daily data. More specifically, the paper analyzes whether the impact of Covid-19 shock on the bond yields and CDS rates varies across countries and whether the monetary policy measures taken in response to the shock were effective in containing the negative consequences of the shock. The analysis relies on a fixed effects panel regression model with high frequency data for eight EMU countries spanning Germany, France, Austria, Netherlands, Belgium, Italy, Portugal and Spain.

Covid-19 and monetary policy shocks are respectively measured by the daily percentage change in the number of new cases and the policy surprises on the policy announcement days. The policy surprises are calculated by taking the change in the first principal component of the 10-year bond yield spreads of the sample countries with respect to the German bonds. The regressions also control for the global fear by the VIX index, fiscal policy announcements by the European Commission by fiscal dummy,

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countries' own fiscal measures by the stringency index and the US monetary policy by the FED policy dummy.

To investigate the cross-country differences in responses, the interactions of the independent variables with periphery dummy¹ and other country-specific variables are included in the regressions. If the interactions of Covid-19 and monetary policy shocks with the periphery dummy are significant and positive for the former and negative for the latter, we conclude that the increase in the financial distress is higher for the periphery economies, which have weaker financial positions, and monetary policy was more effective in easing financial conditions in these countries. If the interactions of Covid-19 and monetary policy shocks with the country specific variables are significant we conclude that those variables affect the magnitude of the impact.

The results of the empirical analysis show that coefficients of Covid-19 and monetary policy shocks are statistically insignificant while the interactions of periphery dummy with these shocks are significant and positive for the former and negative for the latter. This finding suggests that Covid-19 pandemic increased the financial distress in the periphery EMU countries and monetary policy measures have been effective in easing financial conditions in these countries. The results are insignificant for the core countries. As for the magnitudes, for the periphery countries, a 1 percent increase in the new Covid-19 cases increases the CDS rates and bond yields respectively by 9 basis points and 3 basis points on average and a 100 basis points expansionary policy surprise decreases the CDS rates and bond yields respectively by 30 and 15 basis points on average. As for the impact on the different maturities, the impact of Covid-19 shock doesn't change with respect to maturity while the impact of the monetary policy shock increases with the maturity. This pattern suggests that the policy announcements flattened the yield curve for the periphery economies. The results also suggest that financial stability affects the magnitude of the impact for both Covid-19 and monetary policy shocks. More specifically, in the countries with less sound financial stability the impacts of both shocks are stronger.

The findings of the paper closely relate to debates on the economic impacts of pandemics and more generally extreme economic events. The Covid pandemic has raised questions about the preparedness of the economic institutions against such shocks and the available toolbox of policy responses. In this respect, monetary policy has received particular attention, as political stalemates over the use of fiscal policies have limited their availability. This study provides insights into both the impacts of and policy responses to pandemics. As for the impact of pandemics, it provides evidence that the impact works by exacerbating existing financial risks, with greater impact for already troubled economies. As for the effectiveness of monetary policy response, it presents a positive result, as the measures taken by ECB appear to have worked in alleviating the perceived financial risks associated with the pandemic. These insights, however, are based on the European evidence, and the extent to which they generalize to other settings requires further studies.

The paper contributes to the rapidly growing literature on the financial market reactions to Covid-19 pandemic and the effectiveness of the policy measures in response. One strand in the literature investigates the impact of Covid-19 shock on the financial markets. In this strand, Akhtaruzzaman et al. (2020); Albuлесcu (2020); Bai et al. (2020); Okorie and Lin (2020); Zhang et al.

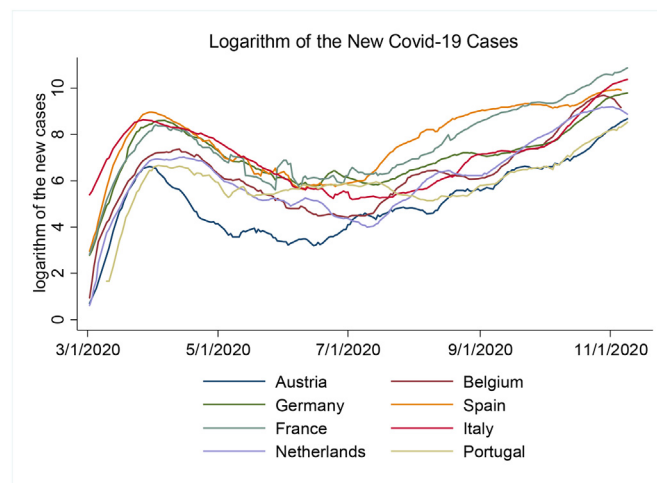


Fig. 1. New Covid-19 Cases in the European Monetary Union.

(2020); D'Orazio and Dirks (2020); Heyden and Heyden (2021); Gherghina et al. (2020); Gormsen and Kojen (2020) show that Covid-19 shock negatively affects the stock market whereas Sène et al. (2021) provides evidence that the policy shocks increase the Eurobond yields in the emerging and developing countries. The second strand investigates the effectiveness of the policy measures during the pandemic. In this strand, Klose and Tillmann (2020); Fendel et al. (2020); Corradin et al. (2021); Ortmans and Tripier (2021) provide evidence that the fiscal and monetary policy measures were effective in reducing the bond yields for the European economies. The current study differs from the literature in three aspects. First, we investigate the responses of the CDS rates and bond yields to both Covid-19 and monetary policy shocks for maturities from two to ten years and for a longer time horizon. Second, we analyze the heterogeneity in responses. Third, we calculate the policy surprises using the first principal component of the 10-year bond yield spreads for all monetary policy announcements in the pandemic period.

The rest of the paper proceeds as follows. Section 2 presents the data. Section 3 introduces the empirical model and the identification strategy. Section 4 presents and discusses the empirical results and the last section concludes.

2. Data

Covid-19 data is taken from Our world in Data. The number of new cases data is available daily for all EMU countries. Covid-19 shocks are measured by the daily percentage change in the number of new cases.² Fig. 1 shows the logarithm of the number of new cases for eight EMU countries. We observe that Covid-19 shocks follow similar patterns in all countries.³

Daily bond yield and CDS rate data are taken from the Thomson Reuters Eikon Database. Fig. 2 shows 5-year bond yields between

² The data is smoothed on a 7-day basis to reduce the reporting anomalies.

³ The logarithm of new covid cases follow similar patterns for all EMU countries and there is a common time trend in the number of total cases. Therefore, in the paper, I use the daily percentage change in the number of new cases instead of percentage change in the number of total cases as the daily shock to eliminate the time trend. This measuring approach also prevents some scaling issues because percentage changes in the number of total cases become relatively small as the number of cases increases. Moreover, to account for the fact that the pandemic hit certain countries harder than others overall, country fixed effects are introduced in the regression equation, which help control for the differences in levels.

¹ Bayoumi and Eichengreen (1993) first established the difference between the core and periphery economies in the EMU through analyzing the degree of synchronization of the supply shocks. Based on their categorization, periphery countries in this paper include Italy, Portugal and Spain.

Feb-2020 and Nov-2020 for eight EMU countries. In the figure, we observe that bond yields increased in the EMU countries after the onset of the pandemic. The figure also shows that the increase in the bond yields is greater for Italy, Portugal and Spain. 5-Year bond yields increased by 200 basis points in Italy and 100 basis points in Portugal and Spain in the beginning of March-2020.

Fig. 3 shows 5-year CDS rates between Feb-2020 and Nov-2020 for eight EMU countries. The figure shows that CDS rates increased significantly in the periphery EMU countries after the onset of the pandemic. 5-Year CDS rate increased by more than 150 basis points for Italy and 100 basis points for Portugal and Spain in the beginning of March.

Figs. 2 and 3 suggest that the increase in the financial distress after the onset of the pandemic is heterogeneous across the EMU countries. The increase in the financial distress is greater for the periphery countries, which have weaker financial positions. Among the periphery countries, Italy experienced the highest increase in the financial distress in the early phase of the pandemic. The descriptive review of the relationships in the figures motivates further research to investigate the causal effect of the pandemic.

Bank non-performing loans to gross loans, bank regulatory capital to risk weighted assets and bank z-score are the measures of financial stability and taken from the Global Financial Development Database. Their interactions with Covid-19 and monetary policy shocks show how financial stability changes the magnitude of the impact of these shocks. Other country specific variables used in the analysis are current account deficit to GDP and government debt to GDP ratios and taken from Trading Economics.

To control for the fiscal policy announcements, fiscal policy dummy is included in the regressions. Fiscal policy dummy takes the value of one on the announcement days and zero on the other days. Fiscal policy announcements are based on the press releases by the European Commission and presented in Table 1. They include the announcements made by the Commission for the member countries. To control for the impact of countries' own fiscal measures stringency index, which is taken from Our World in Data, is included in the regressions.

2.1. Measuring monetary policy surprises

Monetary policy event days used in the analysis, presented in Table 2, include unconventional policy announcement days and monetary policy meeting days between March 2020 and November 2020. As the unconventional measures to contain the negative

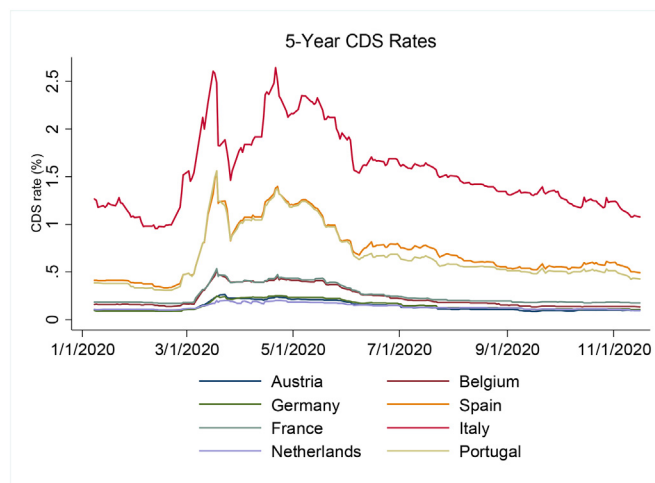


Fig. 3. CDS Rates in the European Monetary Union.

consequences of the Covid-19 shock, European Central Bank started to implement the Pandemic Emergency Purchase Program (PEPP) in March 2020 and Pandemic Emergency Longer Term Refinancing Operations (PELTRO) in April 2020.

The ECB monetary policy shocks are measured by the policy surprises on the policy announcement days. The conventional wisdom in the literature to calculate the unexpected component of the policy announcements is to take the change in the future contracts⁴ or overnight indexed swap rates⁵ in the policy announcement window. However, it is difficult to measure the market expectation before the policy announcement and calculate the unexpected component for unconventional policies. Rogers et al. (2014) and Haitisma et al. (2016) use the changes in the spread between the German and Italian 10-year government bond yields on the policy announcement days to measure unconventional policy surprises.

Because the policies implemented by the ECB aim to reduce the sovereign risk in all EMU countries and target the longer-term maturities, in this study, the policy surprises are calculated by taking the change in the first principal component of the 10-year bond yield spreads of the sample countries with respect to German bonds on the policy announcement days. In particular, to calculate the policy surprises, I first estimate the following factor model using principal components method for the 10-year bond yield spreads of France, Austria, Netherlands, Belgium, Spain, Italy and Portugal:

$$Y_{i,t} - Y_{Ger,t} = \Lambda_i F_t$$

where $Y_{i,t} - Y_{Ger,t}$ is the vector of 10-year bond yield spreads with respect to German bonds and Λ_i is the value of factor loading for country i . F_t is the vector of latent factors. First principal component explains 83% of the total variation in the yield spreads and the loading values are substantial and positive for all countries, as depicted in Table 3. Hence, a change in the first principal component affects all yield spreads in the same direction.

Next, I construct a new variable, which takes the value of the change in the first principal component on the policy announcement days, and zero on the other days. This variable is the monetary

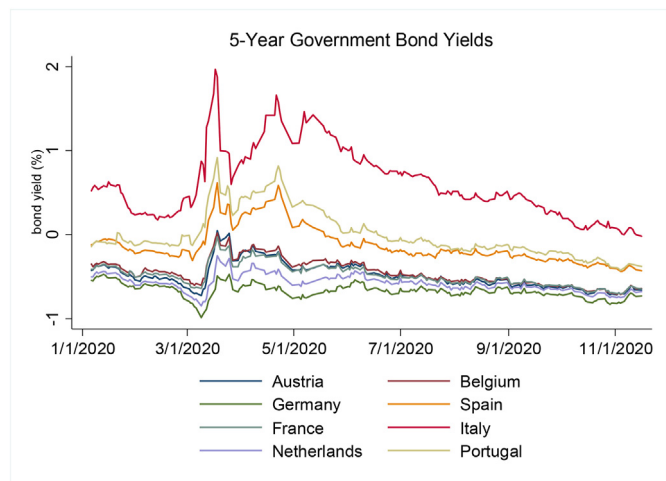


Fig. 2. Government Bond Yields in the European Monetary Union.

⁴ Kuttner (2001), Rigobon and Sack (2004), Bernanke and Kuttner (2005), Gürkaynak et al. (2005).

⁵ Gürkaynak and Wright (2011).

Table 1
Fiscal Policy Announcements by the European Commission.

March 19, 2020	The European Commission has adopted a Temporary Framework to enable Member States to use the full flexibility foreseen under State aid rules to support the economy in the context of the COVID-19 outbreak.
April 03, 2020	The European Commission has adopted an amendment extending the Temporary Framework adopted on March 19, 2020 to enable Member States to accelerate the research, testing and production of coronavirus relevant products, to protect jobs and to further support the economy in the context of the coronavirus outbreak.
April 06, 2020	The European Commission and European Investment Fund (part of EIB Group) unlock €8 billion in finance for 100,000 small and medium-sized businesses
April 22, 2020	The European Commission announces exceptional measures to support the agri-food sector
May 04, 2020	The European Commission adopts package of measures to further support the agri-food sector
May 08, 2020	The European Commission expands Temporary Framework to recapitalisation and subordinated debt measures to further support the economy in the context of the coronavirus outbreak *
June 29, 2020	The European Commission expands Temporary Framework to further support micro, small and start-up companies and incentivise private investments
July 01, 2020	The European Commission launches Youth Employment Support: a bridge to jobs for the next generation
July 02, 2020	The European Commission prolongs EU State aid rules and adopts targeted adjustments to mitigate impact of coronavirus outbreak
September 13, 2020	The European Commission has decided to prolong and extend the scope of the State aid Temporary Framework adopted on March 19, 2020 to support the economy in the context of the coronavirus outbreak.

Table 2
Monetary Policy Announcements by the European Central Bank.

Date	ECB Announcements
March 12, 2020	(Scheduled policy meeting) The ECB announced that additional longer-term refinancing operations (1s) would be conducted and a temporary envelope of additional net asset purchases of €120 billion would be added until the end of the year.
March 18, 2020	The ECB announced the new Pandemic Emergency Purchase Programme (PEPP) with an overall envelope of €750 billion. Purchases would be conducted until the end of 2020 and would include all the asset categories eligible under the existing asset purchase programme (APP).
April 30, 2020	(Scheduled policy meeting). The ECB announced that the conditions on the targeted longer-term refinancing operations had been further eased, a new series of non-targeted pandemic emergency longer-term refinancing operations (PE1s) would be conducted, PEPP would continue to be conducted in a flexible manner over time, across asset classes and among jurisdictions and net purchases under the asset purchase programme (APP) would continue at a monthly pace of €20 billion, together with the purchases under the additional €120 billion temporary envelope until the end of the year.
June 04, 2020	(Scheduled policy meeting) The ECB announced that the envelope for the pandemic emergency purchase programme (PEPP) would be increased by €600 billion to a total of €1350 billion and the horizon for net purchases under the PEPP would be extended to at least the end of June 2021.
July 16, 2020	(Scheduled policy meeting) The ECB announced that it would continue its purchases under the pandemic emergency purchase programme (PEPP) with a total envelope of €1350 billion and net purchases under the asset purchase programme (APP) would continue at a monthly pace of €20 billion, together with the purchases under the additional €120 billion temporary envelope until the end of the year. The Governing Council would also continue to provide ample liquidity through its refinancing operations.
September 10, 2020	(Scheduled policy meeting) The ECB announced that it would continue its purchases under the pandemic emergency purchase programme (PEPP) with a total envelope of €1350 billion and net purchases under the asset purchase programme (APP) would continue at a monthly pace of €20 billion, together with the purchases under the additional €120 billion temporary envelope until the end of the year. The Governing Council would also continue to provide ample liquidity through its refinancing operations.
October 29, 2020	(Scheduled policy meeting) The ECB announced that it would continue its purchases under the pandemic emergency purchase programme (PEPP) with a total envelope of €1350 billion and net purchases under the asset purchase programme (APP) would continue at a monthly pace of €20 billion, together with the purchases under the additional €120 billion temporary envelope until the end of the year. The Governing Council would also continue to provide ample liquidity through its refinancing operations.

Table 3
Loadings of the Yield Spreads on the First Principal Component.

Yield spreads	Factor Loadings ^a
France-spr	0.95
Austria-spr	0.92
Netherlands-spr	0.87
Belgium-spr	0.95
Italy-spr	0.87
Spain-spr	0.90
Portugal-spr	0.94

^a Factor loadings measure the relationship of each variable with the given factor.

policy surprise variable in the panel regression analysis.

To justify using the change in the first principal component on the policy announcement days, I calculated the mean and the standard deviation of the first difference of the first principal component of the 10-year bond yield spreads for the policy announcement days and other days. As Table 4 shows both the mean and the standard deviation of the differentials are higher for the policy announcement days which suggests that using the difference of the first principal component of the spreads on the policy

Table 4
Mean and the Standard Deviation of the Change in the First Principal Component for the Policy Announcement Days and Other Days.

	Mean of the absolute value	Standard Deviation
Policy announcement days	0.108	0.122
Other days	0.032	0.042

announcement days is a good way of measuring monetary policy surprises.

3. Econometric model

The impacts of Covid-19 and monetary policy shocks on the bond yields and credit default swap rates are investigated relying on a fixed effects panel regression model and daily data. The estimated equation is:

$$\Delta Y_{it}^j = \alpha^j + \beta^j Cov_{it} + \theta^j MPS_t + \gamma^j Cov_{it} * Z_{it} + \varphi^j MPS_t * Z_{it} + \delta^j Z_{it} + \mu^j X_{it} + v_t^j + w_t^j + \varepsilon_t^j$$

ΔY_{it}^j , the dependent variable is the change in the bond yield in some specifications and change in the CDS rate in other specifications, where i , t and j respectively represent country, time and maturity. Because the yield series have unit root, the first differences are used in the estimations. The regressions are estimated for the maturities from two to ten years.

Cov_{it} is the proxy of Covid-19 shock for country i , at time t . Covid-19 shocks are measured by the daily percentage change in the number of new cases. Log-change of the smoothed variable is used in the regressions to measure the percentage change in the new Covid-19 cases.

MPS_t is the monetary policy shock at time t . EMU has a unique structure in which there is a single monetary authority and multiple economies. Therefore, monetary policy shock is common for all EMU countries and controlled by the ECB. Monetary policy shock is a variable which takes the value of the surprise on the announcement days and zero on the other days. As explained above, monetary policy surprise is measured by the change in the first principal component of the 10-year bond yield spreads of the sample countries with respect to the German bonds on the announcement days.

X_{it} is the vector of control variables. It includes implied volatility index (VIX) to control for the global fear, FED policy dummy to control for the US monetary policy, fiscal policy dummy⁶ to control for the impact of fiscal policy announcements by the European Commission and stringency index to control for local measures employed by the local governments. In other words, X is the vector of the exogenous shocks for the countries.

Z_{it} represents periphery dummy in some specifications and country specific variables in other specifications. $Cov_{it} * Peripherydummy$ and $MPS_t * Peripherydummy$ are respectively the interactions of the periphery dummy with Covid-19 and monetary policy shocks. These interactions are included in the analysis to observe whether the responses are different for the core and periphery economies. If the interaction of Covid-19 shock with periphery dummy is positive and significant, we conclude that the increase in the financial distress in response to Covid-19 shock is higher for the periphery economies. If the interaction of monetary policy shock and periphery dummy is negative and significant, it implies that monetary policy was more effective in easing the financial conditions in these countries. Coefficients of the interactions of Covid-19 and monetary policy shocks with the other country specific variables show how these variables affect the magnitude of the impact.

All regressions include country and month fixed effects. Country fixed effects control for the impact of the country specific factors and month fixed effects control for the periodic shocks common to all countries in the sample.

The strength of conducting the analysis with high frequency data is that it provides a clear identification strategy and addresses the endogeneity concerns in the estimation. Because fundamentals change at a low frequency, they are also influenced by the other shocks in the economy. However, estimating the responses of the financial variables at high frequency prevents this problem because they respond contemporaneously to the announcements and are

not contaminated by the other shocks. Nevertheless, a set of control variables, country and time fixed effects are included in the regressions to eliminate the omitted variable bias in the estimation.

The empirical results are also unlikely to be driven by reverse causation. Covid-19 is a natural disaster shock and monetary policy shock is a variable which takes the value of the surprise on the policy announcement days and zero on the other days. Hence, they can plausibly be treated as exogenous.⁷ In words, there is no causation from the yield series to the percentage change in the number of cases and monetary policy surprises.

4. Results

Table 5 displays the panel regression results for the responses of the bond yields to Covid-19 and monetary policy shocks for different maturities. As the first four columns show, when there is no interaction term in the estimation, the impacts of Covid-19 and monetary policy shocks are insignificant.

For the empirical specifications that include the interactions of Covid-19 and monetary policy shocks with the periphery dummy, the results are shown in the last four columns of Table 5. In these specifications, the coefficient of Covid-19 shock is insignificant but its interaction with the periphery dummy is positive and significant at high significance levels. This pattern suggests that Covid-19 shock increased the bond yields significantly for the periphery economies but the impact was insignificant for the core economies in the sample period.

As for the impact of monetary policy shock, its coefficient is insignificant, but the coefficient of its interaction with the periphery dummy is substantially negative and significant. Hence, expansionary monetary policy surprises decreased the bond yields substantially for the periphery while the impact was insignificant for the core.⁸ This pattern suggests that the monetary policy actions were effective in easing the financial conditions in the periphery economies after the onset of the pandemic.

Table 6 displays the panel regression results for the responses of CDS rates to Covid-19 and monetary policy shocks for different maturities. As evident in the first four columns, when there is no interaction term, the impacts of Covid-19 and monetary policy shocks are insignificant.

When the interactions of Covid-19 and monetary policy shocks with periphery dummy are added to the regression, as shown in the last four columns of Table 6, the coefficient of the interaction of Covid-19 shock and periphery dummy is positive and significant in all specifications. This pattern suggests that Covid-19 shock increased the CDS rates significantly in the periphery economies while the impact was insignificant for the core economies.

As for the impact of the monetary policy shock on the CDS rates, the coefficient of the interaction of monetary policy shock with periphery dummy is substantially negative and significant while that of the monetary policy shock is insignificant. Hence, expansionary monetary policy surprises decreased the CDS rates substantially for only the periphery economies and the impact was insignificant for the core countries.

Another variable that increases financial distress for the periphery economies is the percentage change in the implied

⁷ It is true that reverse causality might be at work in the long run. The reason is that economic conditions affect government policies against the pandemic. For example, the state of the economy play into the decision over when to impose and lift lock downs. At the same time, because this channel of reverse causality works over the long run, and our analysis is based on day-to-day variation, it is unlikely to bias our findings.

⁸ Monetary policy surprises are multiplied by (-1) so that we find negative coefficient for the negative (expansionary) surprises.

⁶ One potential issue with the estimated effects of the controls for the fiscal shocks is that fiscal measures are harder to interpret, and so they might not be priced by the markets immediately. For this reason, the estimated impact for fiscal shocks should be interpreted with caution.

Table 5
Responses of the Bond Yields to Monetary Policy and Covid-19 Shocks.

	Responses of the Bond Yields							
	Without periphery interaction				With periphery interaction			
	2-year	5-year	7-year	10-year	2-year	5-year	7-year	10-year
constant	-0.012 (-0.93)	-0.011 (-0.73)	-0.009 (-0.61)	-0.007 (-0.47)	-0.014 (-1.13)	-0.013 (-0.88)	-0.011 (-0.73)	-0.008 (-0.55)
covid shock	0.010 (1.38)	0.011 (1.24)	0.008 (0.93)	0.006 (0.62)	0.007 (0.96)	0.007 (0.76)	0.004 (0.41)	0.012 (0.13)
monetary policy shock	0.006 (0.36)	-0.028 (-1.41)	-0.035* (-1.73)	-0.033 (-1.59)	0.031 (1.46)	0.022 (0.89)	0.027 (1.07)	0.036 (1.41)
per. change in VIX	0.017** (2.06)	0.017* (1.76)	0.015 (1.52)	0.011 (1.12)	-0.004 (-0.43)	-0.008 (-0.71)	-0.011 (-0.9)	-0.015 (-1.21)
Fiscal dummy	0.002 (0.46)	0.003 (0.57)	0.006 (1.21)	0.006 (1.38)	-0.0004 (-0.09)	0.0002 (0.03)	0.004 (0.65)	0.005 (0.85)
covid shock * periphery dummy					0.024** (2.04)	0.029** (2.07)	0.030** (2.11)	0.027* (1.86)
monetary policy shock * periphery dummy					-0.060* (-1.76)	-0.127*** (-3.16)	-0.156*** (-3.89)	-0.174*** (-4.26)
per. change in VIX * periphery dummy					0.056*** (3.49)	0.068*** (3.57)	0.068*** (3.56)	0.068*** (3.54)
Fiscal dummy*periphery					0.006 (0.8)	0.007 (0.74)	0.005 (0.58)	0.004 (0.49)
Stringency index	-0.0001 (-1.33)	-0.0002** (-2.43)	-0.0002** (-2.19)	-0.0002*** (-2.71)	-0.0001 (-1.56)	-0.0002*** (-2.81)	-0.0002*** (-2.64)	-0.0002*** (-3.21)
FED policy dummy	-0.0011 (-0.29)	-0.003 (-0.81)	-0.004 (-1.04)	-0.006 (-1.36)	-0.001 (-0.33)	-0.004 (-0.87)	-0.005 (-1.11)	-0.006 (-1.44)

t-values in parentheses.

All regressions include country and month fixed effects.

Levels of statistical significance: * 0.1 ** 0.05 *** 0.01.

Table 6
Responses of the CDS Rates to Monetary Policy and Covid-19 Shocks.

	Responses of the CDS Rates							
	Without periphery interaction				With periphery interaction			
	2-year	5-year	7-year	10-year	2-year	5-year	7-year	10-year
constant	0.01 (1.24)	0.029*** (3)	0.031*** (3.26)	0.034*** (3.51)	0.011 (1.44)	0.031*** (3.23)	0.033*** (3.5)	0.035*** (3.78)
covid shock	0.014 (1.08)	0.016 (0.98)	0.014 (0.87)	0.011 (0.66)	0.004 (0.3)	-0.001 (-0.05)	-0.002 (-0.14)	-0.005 (-0.3)
monetary policy shock	-0.032 (-0.72)	0.011 (0.19)	0.012 (0.21)	0.009 (0.16)	0.062 (1.15)	0.130* (1.91)	0.136** (2.01)	0.14** (2.07)
per. change in VIX	0.025* (1.67)	0.042** (2.22)	0.042** (2.23)	0.043** (2.27)	0.000 (0.03)	0.004 (0.17)	0.007 (0.31)	0.012 (0.54)
Fiscal dummy	-0.026*** (-4.45)	-0.036*** (-4.85)	-0.035*** (-4.73)	-0.034*** (-4.68)	-0.003 (-0.48)	-0.006 (-0.63)	-0.005 (-0.54)	-0.003 (-0.35)
covid shock * periphery dummy					0.058*** (2.57)	0.096*** (3.4)	0.093*** (3.33)	0.089*** (3.19)
monetary policy shock * periphery dummy					-0.252*** (-2.89)	-0.321*** (-2.93)	-0.334*** (-3.07)	-0.352*** (-3.24)
per. change in VIX * periphery dummy					0.064** (2.18)	0.10*** (2.7)	0.091** (2.48)	0.079** (2.15)
Fiscal dummy*periphery					-0.060*** (-5.27)	-0.080*** (-5.62)	-0.080*** (-5.61)	-0.083*** (-5.85)
Stringency index	-0.0002* (-1.71)	-0.001*** (-3.7)	-0.001*** (-4.03)	-0.001*** (-4.36)	-0.0002** (-2.22)	-0.001*** (-4.33)	-0.001*** (-4.66)	-0.001*** (-5.01)
FED policy dummy	-0.006 (-1.01)	-0.008 (-1.2)	-0.008 (-1.18)	-0.008 (-1.18)	-0.006 (-1.04)	-0.008 (-1.24)	-0.008 (-1.22)	-0.008 (-1.22)

t-values in parenthesis.

All regressions include country and month fixed effects.

Levels of statistical significance: * 0.1 ** 0.05 *** 0.01.

volatility index. The interaction of periphery dummy with the percentage change in VIX is positive and significant for both the bond yield and CDS rate regressions. VIX measures the global uncertainty and market fear. The impact of VIX on the yields in the periphery captures the impact of the increase in the fear in the global markets caused by the new Covid-19 cases in the world.

Figs. 4–6 show how the magnitudes of the impact change with

respect to maturity for the periphery countries. For both the CDS rates and bond yields, the impact of Covid-19 shock is similar across different maturities and the impact of monetary policy shock increases with the maturity. An expansionary monetary policy shock decreases the 2-year bond yields and CDS rates respectively by 6 and 25 basis points while it decreases the 10-year bond yields and CDS rates respectively by 17 and 35 basis points. This pattern

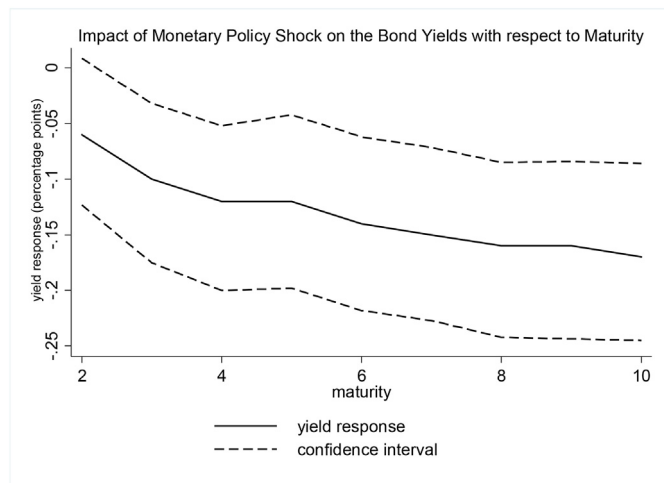


Fig. 4. Impact of Monetary Policy Shock on the Bond Yields for Different Maturities.

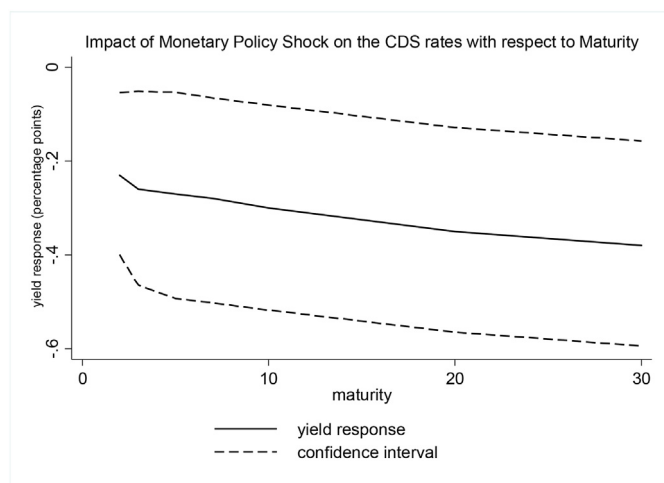


Fig. 5. Impact of Monetary Policy Shock on the CDS Rates for Different Maturities.

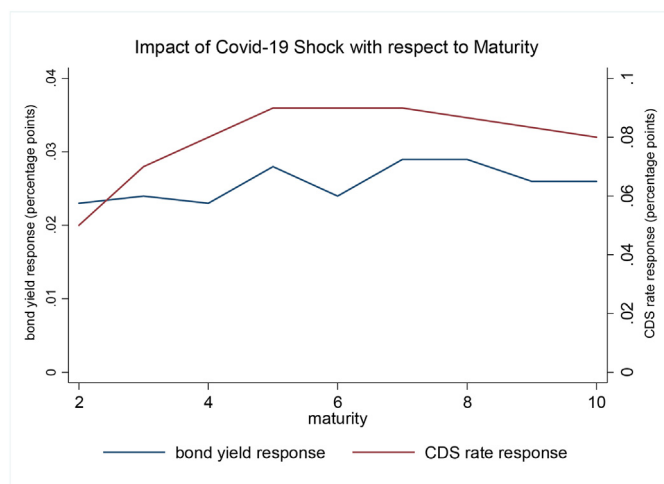


Fig. 6. Impact of Covid-19 Shock on the Bond Yields and CDS Rates for Different Maturities.

suggests that monetary policy announcements in the sample period flattened the yield curve for the periphery EMU countries.

Overall, these results suggest that Covid-19 pandemic increased financial distress significantly only for the periphery economies which are financially fragile and policy measures by the ECB were effective in mitigating the negative impact of the pandemic for these economies. This finding is consistent with the findings of Falagiarda and Reitz (2015), Eser and Schwaab (2016), Chadha and Hantzsche (2018), Demir et al. (2021) and Corradin et al. (2021) which show that the policy measures taken by the ECB were effective in reducing the sovereign risk of the periphery economies during the Great Recession and pandemic period.

Table 7 presents the panel regression results for the interactions of country specific variables with Covid-19 and monetary policy shocks. In the first six columns, we observe the results for the interactions of monetary policy and Covid-19 shocks with different financial stability measures, which are z-score, bank non-performing loans to gross loans⁹ and bank capital to risk weighted assets ratios. The coefficients of the Covid-19 and monetary policy shocks are significant and positive for the former and negative for the latter. The coefficients of the interactions of financial stability with Covid-19 and monetary policy shocks are significant and negative for the former and positive for the latter in all specifications. This finding suggests that as financial stability increases, negative impact of Covid-19 shock on the sovereign risk decreases and monetary policy measures are more effective in the financially fragile countries. The other country specific variables do not affect the impact of Covid-19 shock. As for the monetary policy shock, the impact is stronger in the countries with higher government debt to GDP ratio.

One concern in the estimation is the possibility of contemporaneous correlations of the error terms across countries. To handle this issue, I re-estimated the model with panel corrected standard errors (PCSE) which takes the possibility of contemporaneous correlations into account and accounts for the deviations from spherical errors. PCSE estimation assumes that the disturbances are heteroskedastic and contemporaneously correlated across panels. PCSE estimation results are consistent with the original results. The main findings of the article remain robust to this additional precaution.

Another concern in the estimation is the sample period which excludes the period after December 2020. The choice of the early phase of the pandemic as the sample period is motivated by the availability of vaccination after December 2020 which arguably decreased the financial stress caused by Covid-19. Nevertheless, to formally test how the impact changes after the availability of vaccination I extended the data until the end of 2021 and constructed a vaccination dummy which takes the value of “1” in the vaccination period and “0” in the pre-vaccination period. Next, I reestimated the econometric model, also testing whether the impact of Covid changed after the introduction of the vaccine by including the interaction of Covid shock and vaccination dummy in the regression equation. The results of this exercise show that, for the periphery countries, the coefficient of Covid-19 shock is positive and significant and the coefficient of the interaction of vaccination dummy with the Covid-19 shock is negative and significant. Furthermore, the sum of the coefficients is statistically insignificant. In words, Covid-19 increased the financial stress in the pre-vaccination period for the periphery economies, but the impact became insignificant once the vaccine was introduced.

⁹ Bank non-performing loans to gross loans ratio is multiplied by (-1) so that an increase in this ratio is associated with an increase in financial stability.

Table 7
Interactions of the shocks with the Country Specific Variables.

	Responses of the Bond Yields									
	5-year	10-year	5-year	10-year	5-year	10-year	5-year	10-year	5-year	10-year
constant	–0.019 (–1.35)	–0.017 (–1.19)	–0.026* (–1.92)	–0.024* (–1.74)	–0.027* (–1.92)	–0.025* (–1.76)	–0.023* (–1.65)	–0.021 (–1.47)	–0.022 (–1.58)	–0.020 (–1.39)
covid shock	0.056** (2.24)	0.051** (2)	0.009 (0.91)	0.003 (0.3)	0.109** (2.27)	0.112** (2.29)	0.005 (0.24)	–0.003 (–0.13)	0.017** (1.97)	0.013 (1.47)
monetary policy shock	–0.202*** (–3.12)	–0.231*** (–3.5)	0.090*** (3.21)	0.090*** (3.13)	–0.424*** (–3.72)	–0.536*** (–4.61)	0.292*** (4.39)	0.327*** (4.82)	–0.045* (–1.93)	–0.059** (–2.5)
per. change in VIX	0.077** (2.58)	0.078** (2.54)	–0.023* (–1.78)	–0.024* (–1.76)	0.201*** (3.77)	0.188*** (3.46)	–0.098*** (–3.17)	–0.091*** (–2.87)	0.024** (2.2)	0.019* (1.68)
fiscal dummy	0.007 (0.47)	0.006 (0.4)	0.002 (0.28)	0.007 (1.07)	0.02 (0.70)	0.02 (0.79)	0.001 (0.07)	0.007 (0.44)	0.003 (0.63)	0.008 (1.49)
covid shock * z-score	–0.002* (–1.66)	–0.002 (–1.6)								
monetary policy shock * z-score	0.009** (2.74)	0.01*** (3.07)								
per. change in VIX * z-score	–0.003** (–2.09)	–0.003** (–2.26)								
fiscal dummy*z-score	0.000 (–0.30)	0.000 (0.05)								
covid shock * bnpl			–0.003** (–1.96)	–0.003** (–2.15)						
monetary policy shock * bnpl			0.021*** (5.93)	0.022*** (6)						
per. change in VIX * bnpl			–0.007*** (–4.37)	–0.006*** (–3.71)						
fiscal dummy*bnpl			0.000 (0.25)	0.000 (–0.04)						
covid shock * ctrwa					–0.005* (–1.91)	–0.005** (–2.04)				
monetary policy shock * ctrwa					0.022*** (3.49)	0.029*** (4.36)				
per. change in VIX * ctrwa					–0.010 (–3.48)	–0.010 (–3.28)				
fiscal dummy*ctrwa					–0.001 (–0.59)	–0.001 (–0.54)				
covid shock * govdebtogdp							0.000 (0.62)	0.000 (0.77)		
monetary policy shock * govdebtogdp							–0.003 (–5.12)	–0.003*** (–5.62)		
per. change in VIX * govdebtogdp							0.001*** (3.93)	0.001*** (3.41)		
fiscal dummy* govdebtogdp							0.000 (0.12)	0.000 (0.000)		
covid shock * cadeficittogdp									0.000 (0.24)	0.000 (0.02)
monetary policy shock * cadeficittogdp									0.004 (0.86)	0.008 (1.63)
per. change in VIX * cadeficittogdp									–0.002 (–1.09)	–0.003 (–1.12)
fiscal dummy* cadeficittogdp									–0.000 (–0.22)	–0.001 (–0.53)
FED policy dummy	0.003 (0.6)	0.0065772 (1.43)	–0.003 (–0.66)	–0.005 (–1.26)	–0.002 (–0.62)	–0.005 (–1.22)	0.002 (–0.64)	–0.005 (–1.24)	–0.002 (–0.62)	–0.005 (–1.2)

t-values in parenthesis.

All regressions include country and month fixed effects.

Levels of statistical significance: * 0.1 ** 0.05 *** 0.01.

5. Conclusion

Covid-19 pandemic increased the distress in the global financial markets and the central banks in advanced economies resorted to unconventional policies to contain the adverse consequences. Understanding the effects of the pandemic shock, and the effectiveness of the policies adopted to counter them are crucial both from academic and policy perspectives.

This study investigates the impacts of Covid-19 and monetary policy shocks on the credit default swap rates and bond yields

relying on a fixed effects panel regression model with high frequency data for the EMU countries. The results suggest that both the impacts of Covid-19 and monetary policy shocks are heterogeneous across periphery and core EMU countries. In particular, Covid-19 shock increased the sovereign risk in the periphery EMU countries substantially and monetary policy was effective in countering them. The results, however, are insignificant for the core countries. The results also suggest that strengthening financial stability is important for the robustness of the economy to the negative shocks.

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