WORKING PAPER

ECB MONETARY POLICY AND BANK DEFAULT RISK

Nicolas Soenen
Rudi Vander Vennet

May 2020
2020/997

GHENT UNIVERSITY

Department of Economics

Faculty of Economics and Business Administration
Campus Tweekerken, St.-Pietersplein 5, 9000 Ghent - BELGIUM

ECB Monetary Policy and Bank Default Risk *

Nicolas Soenen[†] Rudi Vander Vennet[†]
nicolas.soenen@ugent.be[‡] rudi.vandervennet@ugent.be

November 23, 2021

Abstract

We empirically analyze the effect of ECB monetary policy on bank default risk, captured by bank CDS spreads, of Euro Area banks during the period 2008-2018. We disentangle the impact of monetary policy in a direct channel and an indirect effect operating through a sovereign risk channel. We document that accommodative ECB policies in general lower bank default risk. ECB policy actions exert their beneficial effect on the banks' perceived risk profile through a combination of a direct effect and an indirect-through-the-sovereign effect. We demonstrate that these effects are stronger for banks in peripheral countries of the Euro Area and that the downward effect on bank default risk was especially pronounced in the 2012-2014 sovereign stress period. Yet, our time-varying impact analysis shows that the beneficial effect of ECB policy persists in the post-2014 era during which the ECB implemented its asset purchase program and other unconventional tools. Our results support the argument that, on balance, the beneficial effects of accommodative ECB monetary policy on Euro Area banks' risk profile outweigh any negative side-effects.

Keywords: bank default risk, CDS spreads, monetary policy, sovereign risk

JEL classification: G21, G32, E52

*We gratefully acknowledge helpful comments from an anonymous referee, Martien Lamers, Koen Inghelbrecht, Elien Meuleman, Thomas Present, Mathieu Simoens, Klaas Mulier, Mattia Bevilacqua and participants at Ghent University Banking and Finance seminar and the 2020 World Finance Conference. The authors acknowledge financial support from the Research Foundation - Flanders (FWO). The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

[†]Department of economics, Ghent University, Sint-Pietersplein 5, 9000 Ghent, Belgium

[‡]Corresponding Author

1 Introduction

The risk profile of banks in the Euro Area is a primary policy concern because the risk behavior of banks not only affects the economy but also determines the systemic risk of the banking industry. A bank's risk profile is mainly determined by the macroeconomic environment in which the bank operates and its own strategic choices. In this paper we focus on the impact of ECB monetary policy on perceived bank default risk, but we duly account for sovereign risk, capturing the feedback loop between sovereigns and banks, and bank fundamentals, as an expression of bank's business model choices. In the period following the Great Financial Crisis, the defining feature of the macroeconomic environment in the Euro Area has been the consecutive waves of monetary easing by the ECB. While stimulating monetary conditions have beneficial effects on banks, it is also argued that a prolonged period of low interest rates may provoke risk-taking behavior by banks. In addition, a bank-sovereign nexus has emerged during the sovereign debt crisis which remains unresolved in several countries. As a result, we not only consider the direct effect of monetary policy on the banks' risk profile, but also analyze the indirect channel operating via sovereign risk.

Our primary focus is on the impact of ECB monetary policy on bank risk. Since 2008 the ECB has used various instruments of conventional and unconventional monetary policy to stimulate the economy and bring inflation back to its target (Hartmann and Smets, 2018; Rostagno et al., 2019). Some actions were designed to influence bank funding conditions, e.g. interest rate decreases and (Targeted) Longer-Term Refinancing Operations ((T)LTRO). Other types of measures have been introduced to affect the transmission of monetary policy to sovereign credit spreads, e.g. the Securities Markets Program (SMP) and Outright Monetary Transactions (OMT) (Falagiarda and Reitz, 2015; Krishnamurthy et al., 2018). Hence, they are designed to affect sovereign yields directly, but through this channel they also indirectly translate into more benign bank funding conditions (Acharya et al., 2014). Finally, a number of ECB unconventional policy measures, such as asset purchases and forward guidance are intended to affect the entire yield curve (Rostagno et al., 2019). Since various types of ECB monetary policy action were announced simultaneously and were often anticipated by market participants, we use a VAR methodology to identify monetary policy shocks, as in Lamers et al. (2019). There is large agreement that the accommodative monetary policy of the ECB stimulated the economy (Altavilla et al., 2018, 2019) and that bank funding and lending conditions were eased considerably (Rostagno et al., 2019). Moreover, the monetary policy actions taken by the ECB during the crisis contributed positively to bank stability because they restored the capacity of the banking system to provide financial intermediation services and they acted as a circuit breaker of adverse macro-financial feedback loops (Albertazzi et al., 2020). The hypothesis is that these beneficial effects should be reflected in lower bank default risk.

However, there is an ongoing debate on the effect of accommodative monetary policy on bank risk taking and financial stability in general. One concern relates to the potential increase in risk taking and the possible under-pricing of risk. Indeed the objective of some monetary policy measures is to promote rebalancing away from safe assets, hence a higher bank risk appetite may be warranted as it is an important part of the transmission mechanism. The relevant question is whether or not monetary policy causes excessive risk taking by banks, since this could hamper financial stability and this may be reflected in higher bank CDS spreads. Rajan (2006) argues that accommodative monetary policy implies lower market rates which may induce a search-for-yield by financial institutions. Banks confronted with diminishing revenues as a consequence of lower rates may increase their risk appetite and invest in higher-risk loans and securities (Altunbas et al., 2012; Jiménez et al., 2014; Paligorova and Santos, 2017). Finally, prolonged periods of low policy rates, accompanied by depressed long-term interest rates due to quantitative easing, may induce banks to extrapolate low risk assessments into their lending decisions and this may increase their risk tolerance (Adrian and Shin, 2009; Borio and Zhu, 2012).

For the case of the ECB's negative deposit facility rate, Heider et al. (2019) find that banks more reliant on retail deposit funding cut lending relative to their peers but also that these intermediaries tilted their loan supply towards more risky borrowers. However, Albertazzi et al. (2020) conclude that the additional risk taken by banks in the post-2014 period was not inadequately priced. Similar evidence is reported for the rebalancing of bank securities portfolios. Bubeck et al. (2020) report that since the introduction of negative policy rates, banks reliant on deposit funding exhibited some search for yield in the composition of their securities portfolios. Albertazzi et al. (2020) confirm that, since the start of the Asset Purchase Program (APP), banks' bond portfolios have shifted through an active rebalancing out of the safest categories of securities into other investment grade bonds. However, they argue that over the same period, this effect was more than offset by positive rating migration caused by improved macroeconomic conditions. Moreover, they show that banks' portfolio rebalancing has not translated into a loading up of domestic sovereign debt securities, not even in those economies where such securities offer higher yields.

Another concern is the possible negative effect on bank profitability and intermediation capacity stemming from the compression of interest margins (Borio and Gambacorta, 2017; Claessens et al., 2018). Yet, Altavilla et al. (2019) conclude that the APP and negative deposit facility rates have a close to zero net effect on banks' ROA since positive effects (capital gains on securities and better credit quality) compensate any decline in the banks' net interest margins. Moreover, Brei et al. (2019) find that low interest rates induce banks to shift their revenues towards fee-generating activities and the longer low interest rates persist, the more this rebalancing is reinforced.

Hence, the ultimate impact of stimulating monetary policy on bank health and bank default risk is an empirical matter, which we try to address. If the beneficial effects to banking stability from the monetary policy measures introduced by the ECB outweigh the adverse spillovers, we expect a downward effect on bank CDS spreads. If, on the other hand, accommodative monetary policy would ultimately provoke risk taking by banks, we expect bank CDS spreads to increase.

In the empirical analysis we duly account for the bank-sovereign loop. European banks have been accused of disproportionately investing in bonds issued by their home sovereign, especially in periods of sovereign stress. It has been argued that some banks exhibit excessive exposures, thereby creating a potential doom loop between European banks and their sovereigns and exacerbating the risk of contagion (De Bruyckere et al., 2013; Stângă, 2014). The existing literature has identified several channels that may explain why banks invest in certain sovereign bonds: banks may search for yield or engage in carry trade and collateral trade behavior (Acharya and Steffen, 2015; Acharya et al., 2018; Altavilla et al., 2018; Crosignani et al., 2020), banks may be subject to moral suasion by their home sovereign

(Horváth et al., 2015; De Marco and Macchiavelli, 2016; Ongena et al., 2019), or they can engage in a flight-to-safety strategy (Buch et al., 2016). Alternatively, even in the absence of banks' sovereign bond holdings, a negative bank-sovereign loop may occur through the presence of government guarantees, linking the financial stability of banks and sovereigns to each other (Leonello, 2018). To capture the effect of sovereign risk on the banks' default risk profile, we include sovereign CDS spreads. Moreover, since several ECB monetary policy actions are explicitly targeted to affect sovereign funding conditions (SMP, OMT and APP), we disentangle the overall effect of monetary policy by identifying a direct channel to bank risk and an indirect channel which affects bank default risk through the impact on sovereign risk.

Finally, we control for bank fundamentals by including indicators of the banks' asset structure, funding mix, income diversification and capital adequacy as well as performance variables such as asset quality and profitability. Profitable banks with high capital buffers and access to stable funding sources are considered as relatively safe (Mergaerts and Vander Vennet, 2016), and less prone to risk taking (Altunbas et al., 2011). Conversely, banks with large exposures to loans and especially those with high levels of non-performing loans are expected to display a worse risk profile (Bogdanova et al., 2018).

We apply our examination of the drivers of bank default risk on a sample of 49 European banks over the period 2008-2018. Our preferred proxy for bank default risk are bank CDS spreads and we alternatively use spreads on 1-year and 5-year CDS contracts to assess difference in short-term and long-term impacts. Similarly, we present evidence for senior and junior CDS contracts in order to investigate the role of seniority in the CDS market's assessment of the banks' risk profile.

The main findings of our empirical investigation can be summarized as follows. The results indicate that during the period 2008-2018, expansionary monetary policy on average diminishes bank CDS spreads. Moreover, our time-varying impact analysis shows that accommodative monetary policy by the ECB is always associated with lower bank CDS spreads, not only in the period 2012-2014 when the impact was most pronounced (see also Altavilla et al. (2018)), but also in the post-2014 era during which the ECB implemented its asset purchase program and started charging banks a negative deposit rate. Other studies have concluded that negative policy rates and the prospect of low for long interest rates may be detrimental for bank profitability and may induce bank risk-taking behavior (Borio and Gambacorta, 2017; Heider et al., 2019). Our findings do not imply that banks do not take more risk. They may e.g. rebalance their asset portfolios towards riskier loans or securities. But our results are not consistent with the hypothesis that expansionary monetary policy causes excessive risk taking by banks, because such behavior would be reflected in higher CDS spreads. Our findings are consistent with Albertazzi et al. (2020) who conclude that, on balance, the beneficial spillovers to banking stability from the ECB monetary policy measures introduced since the crisis outweigh the adverse spillovers. When we distinguish between a direct channel of monetary policy to bank credit risk and an indirect channel via sovereign risk, we document that both impacts are significant. Accommodative ECB monetary policy shocks are directly associated with lower bank CDS spreads. At the same time, stimulating monetary policy lowers sovereign risk, and since sovereign CDS spread changes in turn impact bank CDS spreads, the decline in sovereign CDS spreads is amplified. Our conclusion is that, so far, ECB monetary policies have contributed to improving the risk profile of Euro Area banks.

Our findings confirm the strong association between banks and some home sovereigns that has been documented in previous literature and suggests that a higher perceived sovereign default risk is transmitted to bank default risk with an amplification factor. This finding indicates that restoring bank health after a crisis requires decisive action in terms of severing the link between sovereigns and banks. In the Euro Area the negative feedback loop from sovereign risk to bank risk has been left unattended for too long. Yet, our results also show that there is a strong monetary-policy induced beneficial impact on the banks' default risk via the sovereign risk channel. Hence, ECB monetary policy has contributed to financial stability by easing sovereign-bank risk contagion, especially for the periphery Euro Area countries.

This paper contributes to various strands of the literature on bank risk. First, our analysis is situated in the literature on the determinants of bank CDS spreads (Annaert et al., 2013; Chiaramonte and Casu, 2013; Samaniego-Medina et al., 2016; Drago et al., 2017). Most of these papers analyze the association between bank CDS spreads, bank-specific variables and market-based indicators. We extend the analysis by introducing the effect of ECB monetary policy, which is a defining feature of the macro-financial environment in the post-crisis era. Moreover, we consider not only the typical 5-year senior bond CDS spread, but also the 1-year CDS and we distinguish between CDS contracts on senior and subordinated bonds. This allows us to investigate differences in the dynamics of bank default risk based on the maturity and seniority of the CDS claims. By extension, our analysis is related to the literature investigating the determinants of bank funding costs based on CDS spreads (Babihuga and Spaltro, 2014). Second, our analysis contributes to the vast literature on the bank-sovereign nexus in Europe. Previous papers have documented the existence of a bank-sovereign negative feedback loop (De Bruyckere et al., 2013; Acharya et al., 2014; Caporin et al., 2019; Fratzscher and Rieth, 2019) and have investigated its causes (Acharya and Steffen, 2015; Buch et al., 2016; Leonello, 2018), its negative real effects (Bocola, 2016; Acharya et al., 2018) and how to regulate it (Alogoskoufis and Langfield, 2019; Laeven, 2019; Pancotto et al., 2019). Here, we analyze not only the transmission of monetary policy to bank credit risk directly, but also through its impact on sovereign credit spreads. It is important for central banks to identify the effectiveness of several transmission channels of their policy to the real economy. As banks and sovereigns have found themselves in a doom loop, it is natural to assume that monetary policy affects banks through this sovereign channel. Third, there is an extensive literature examining the effects of conventional and unconventional monetary policy on bank risk taking. Various channels have been documented, usually focusing on the incentives for banks to search for yield by engaging in riskier loans and investments (Jiménez et al., 2014; Paligorova and Santos, 2017; Heider et al., 2019), although Albertazzi et al. (2020) conclude that the unintended consequences of unconventional monetary policy do not outweigh the beneficial effect on bank stability. Here, we provide direct empirical evidence to test this hypothesis by examining the impact of ECB policy on bank CDS spreads. Moreover, we integrate the bank-sovereign risk nexus in our analysis and we decompose the impact of monetary policy on bank default risk through a direct channel and indirect channel via sovereign risk. Finally, and although not the main focus of the paper, we contribute to a long-standing literature on market discipline of bank behavior by showing that bank characteristics are significantly related to a market-based measure of bank default risk. These findings corroborate the established conclusion that market participants, in this case the CDS market, are able to distinguish bank risk profiles based on observable bank characteristics (see Bliss and Flannery (2002)).

The paper unfolds in the following way. In section 2 and 3, we provide details on the data and methodology. In section 4 we discuss the results of our estimations as well as some extensions focusing on cross-country differences and time variation. Section 5 concludes the paper and formulates some policy considerations.

2 Data and variable construction

We construct a dataset containing daily CDS spreads of banks and sovereigns, daily market variables and quarterly bank-specific control variables. CDS spreads are retrieved from Markit. The bank-specific and market variables are obtained from SNL and Thomson Reuters Datastream, respectively. We limit the sample to banks that meet selection criteria with regard to their CDS spreads[1] and bank-specific variables[2].

The application of the selection criteria results in a sample of 49 banks from 9 Euro Area countries during the period of 2008-2018. These banks represent a large share of the Euro Area banking sector. The sample period covers the post-crisis era and includes both the great financial crisis and the sovereign debt crisis in Europe.

2.1 Bank and Sovereign default risk indicator

We capture bank default risk by their CDS spreads because they are a market-based, unbiased measure of bank default risk (Altavilla et al., 2018). In our dataset we exploit the CDS spreads on senior and subordinated bonds and on 1-year and 5-year maturities. Figure 1 displays the evolution of the CDS spreads. On average, CDS spreads on subordinated bonds are higher than their senior counterparts since subordinated bonds bear a higher risk. CDS contracts with a shorter maturity yield on average a lower spread, as bank default risk on

[1] If the frequency of the CDS spread quotes is less than 25% for the sample period 2008-2018, the bank is omitted from the sample.

[2] First, we limit the sample to banks for which relevant bank-specific data is available during the sample period. Second, we include only those banks with Loans/Assets or Deposits/Liabilities ratios above 20% to ensure that we focus on banks engaged in financial intermediation.

1-year contracts is also captured by longer maturities. The global financial crisis and the sovereign debt crisis led to pronounced increases in perceived bank default risk. Also the 2016-2017 period is characterized by an increase of bank CDS spreads caused by uncertainty with regard to the viability of certain bank business models in the Euro Area.

To capture sovereign credit risk, we use the sovereign CDS spread on 5-year senior bonds. Figure 2 shows the evolution of sovereign credit risk over the sample period. The graph illustrates differences in perceived credit risk across European sovereigns. More specifically, the peripheral countries diverged from the core Euro Area countries in the sovereign debt crisis. As the ECB took measures to restore confidence in peripheral sovereign bonds with e.g. the announcement of the OMT program, sovereign CDS spreads converged from mid-2012 onwards. The CDS spreads of Portugal and Italy display a resurgence in 2016-2017, owing to concerns about debt sustainability. As of 2018, the Italian CDS spread is the highest of the sample, due to political uncertainty.

2.2 Identifying monetary policy

Since our focus is on the impact of monetary policy on bank risk, we need to identify the monetary policy stance in the Eurozone in the post-2008 period. We cannot use the policy rate because of the zero lower bound constraint and, similarly, we cannot use the ECB balance sheet because some important monetary policy measures did not affect the balance sheet (e.g., OMT was pre-announced by the Draghi 'whatever it takes ' speech in July 2012, operationally implemented in September 2012 but subsequently never activated). And finally, different conventional and unconventional policy measures were announced simultaneously (e.g. in January 2015, APP was announced jointly with a decrease in the Deposit Facility Rate and strengthened forward guidance) and were often largely anticipated. When reviewing the potential approaches to identify monetary policy (Rossi, 2018), we opt for a structural VAR because incorporating a broad set of financial market indicators allows us not only to identify actual ECB monetary policy decisions, but also to capture anticipation effects and instances in which financial markets judge that monetary policy actions were insufficient, given the prevailing market conditions. For the CDS market, current and future financial conditions are relevant to assess the default risk of banks.

Therefore we estimate a time series of exogenous monetary policy shocks by modeling a set of relevant financial market variables in a structural VAR model at daily frequency as in Wright (2012), Rossi (2018) and Lamers et al. (2019):

$$Y_t = A_1 Y_{t-1} + \ldots + A_p Y_{t-p} + R v_t \tag{1}$$

where Y_t is an N-dimensional vector of endogenous variables, v_t an N-dimensional vector of orthogonal structural innovations with mean zero and $A_1, \ldots, A_p$ and R are $N \times N$ time-invariant parameter matrices. The reduced-form residuals corresponding to this structural model are given by the relationship $\varepsilon_t = R v_t$.

To estimate the structural VAR we use a set of variables that capture the pass-through of monetary policy to the financial sector. Following Rogers et al. (2014), we select those variables that are expected to respond most to a monetary policy shock. More specifically, as we conduct the analysis for the Euro Area, we include the German 10-year bond yield, the VSTOXX, the CDS spread of Spain, a market index and the 5-year 5-year forward inflation expectation. The identification of the policy shock is based on the identification-through-heteroscedasticity strategy, proposed by Rigobon and Sack (2004), which assumes that a structural monetary policy shock is more volatile on announcement days of a central bank. The main idea is that a structural monetary policy shock for the Euro Area has a higher volatility on days where the ECB made announcements with regard to monetary policy. Based on the differences in the volatility of the shock during both regimes, the structural VAR is uniquely identified. The only assumption is that there is some kind of heteroskedastic pattern in the monetary policy shock while all other shocks are homoskedastic:

$$Var\left(v_t\right) = \Omega_t = \begin{cases} \Omega^{(0)} = \operatorname{diag}\left(\omega_1, \omega_2, \ldots, \omega_N\right) & \text{if } \textit{no announcement} \\ \Omega^{(1)} = \operatorname{diag}\left(\omega_1^*, \omega_2, \ldots, \omega_N\right) & \text{if } \textit{announcement} \end{cases} \tag{2}$$

It can be shown that, as long as the covariance matrix of the reduced form errors v_t changes on announcement days, these assumptions suffice to uniquely identify the first column of the structural impact multiplier R and the structural monetary policy shocks except for their scale and sign. The model can be estimated following the iterative estimation procedure outlined in Lanne and Lütkepohl (2008)[3]. We normalize the monetary policy shock by fixing the response on impact of one of the included variables to a unit monetary policy shock. We define a unit expansionary monetary policy shock as a shock that decreases the 5-year CDS spread of Spain with 5% points[4]. This identification-through-heteroskedasticity approach is widely used in the literature to identify monetary policy shocks, for example Rogers et al. (2014), Arai (2017) and Rossi (2018). We estimate a VAR of order 2 over a sample period from 1 October 2008 to 31 December 2018. This methodology allows us to identify monetary policy shocks that capture the effect of the main ECB announcements and potential anticipation effects, e.g. the OMT program has been implemented in September 2012, yet it was already announced two months earlier. The financial variables in the VAR capture these potential anticipation effects. It is the combination of actual ECB announcements and anticipation effects that determines the macro-financial environment in which the CDS market assesses bank default risk.

Figure 3 shows the absolute and cumulative monetary policy shocks. A sequence of positive monetary policy shocks indicates that monetary policy becomes more expansionary and therefore the cumulative series reflects the monetary policy stance with respect to the prevailing economic environment and expectations of financial markets. Similarly, a drop in the series may reflect a tightening of monetary policy but may also capture the lack of monetary policy action, or even that there were expansionary announcements that failed to live up to financial market expectations. Figure 3 shows that the shocks are able to capture important monetary policy announcements, as well as the anticipation of some measures. In October 2008, the financial crisis hit the economy and monetary policy was initially perceived to be not sufficiently expansionary. Once the ECB stepped up its policy actions with substantial repo rate decreases and the launch of longer-term refinancing operations, the monetary policy stance reverted to expansionary. The LTRO and Covered Bond Purchase Program (CBPP1) announcement in May 2009 and the SMP announcement in May 2010 are among the largest expansionary daily shocks and can therefore be considered as surprises to financial markets. In the following years, the monetary policy stance is somewhat volatile,

[3]For details on the estimation procedure we refer to Lamers et al. (2019).

[4]Using other variables to identify a unit shock and using the CDS spread of e.g. Italy to calibrate an accommodative shock yields an almost identical shock series.

with periods of restrictive monetary regimes followed by expansionary shocks in the monetary policy stance, caused by events such as the ECB president Mario Draghi London speech in July 2012. The OMT announcement in September 2012 appears to have been largely anticipated following this July Draghi speech in which he alluded to the implementation of additional unconventional monetary policy measures. The QE period which started in 2015 is sometimes perceived as a period of restrictive monetary policy, probably because of economic uncertainty stemming from the economic and political environment (e.g. Brexit). From 2017 onwards, the sustained monetary easing is considered by financial markets as effectively stimulating the economy. An interesting example of the potential divide between policy intentions and market perception is described by Rostagno et al. (2019) in their account of the first 20 years of ECB monetary policy. In December 2015 the Governing Council decided to lower the deposit facility rate by 10 basis points. However, the authors conclude that the markets expected a larger reduction in the deposit facility rate, hence despite the intention of the ECB to be accommodating, the policy actions did not meet the expectations of financial markets (Rostagno et al., 2019). This resulted in a tightening of the monetary policy stance, as is reflected in our Figure 3, illustrating that our indicator of the monetary policy stance succeeds in identifying divergences between intended policy outcomes and actual market perceptions. This is an important value added of the identification approach since our objective is to assess the impact of the monetary policy stance on a market-based indicator of the banks' risk profile.

2.3 Control variables: bank-specific and market variables

Next to the prevailing macroeconomic conditions, the risk profile of a bank is determined by the strategic choices which define the bank's business model and the associated performance outcomes in terms of profitability and risk. To control for bank fundamentals, we include variables capturing the asset structure, funding mix, revenue composition and the bank's capital strength. The balance sheet control variables are the loans to assets ratio (LTA) as a proxy for the importance of the bank's lending activity and the proportion of deposits in total liabilities (DEP) as a measure of the funding mix. The revenue structure is approximated by the proportion of non-interest income in total revenues (DIV) which captures the degree of diversification of the bank's income streams (Köhler, 2015; Mergaerts and Vander Vennet, 2016). Capital strength is captured by the unweighted capital ratio (CAP). Capital buffers have been shown to decrease banks' market beta (Baele et al., 2007), as well as their systemic risk (Laeven et al., 2016) and several papers have demonstrated that higher capital before the crisis increased the likelihood of survival and enhanced bank performance in distress periods (Berger and Bouwman, 2013; Vazquez and Federico, 2015). Finally, we include the natural logarithm of total assets (SIZE) as a proxy for any potential size-related benefits in terms of banks' perceived risk profile. In terms of outcome variables we focus on profitability, i.e. return on assets (ROA) and we include a measure of the quality of the bank's lending portfolio, i.e. non-performing loans to total loans (NPL)[5].

The risk profile of the bank may be affected by prevailing financial market conditions. We include the VSTOXX as a measure of market volatility, since it has been shown to be an indicator of uncertainty and risk (Nave and Ruiz, 2015; Baele et al., 2020).

The descriptive statistics for the CDS spreads of banks and sovereigns, bank-specific variables and market volatility are reported in Table 1. A detailed overview of the banks in the sample is provided in Table 2.

3 Methodology

We estimate whether or not monetary policy shocks affect bank CDS spreads using the following model:

$$\Delta CDS_{i,s,m,t} = \alpha_i + \lambda_y + \delta\, \Delta MPS_t + \theta\, \Delta CDS_{c,t}^{\text{Home Sov}} + \sum_{k=1}^{K} \beta_k\, BNK_{k,i,t} + \gamma\, \Delta V_t + \varepsilon_{i,t} \quad (3)$$

where $CDS_{i,s,m,t}$ represents the CDS spread with underlying bond s and maturity m of bank i at time t. The k^{th} fundamental of bank i is contained in the vector $BNK_{k,i}$. We control for market movements by including the VSTOXX (V_t) and the CDS spread of the home country of the bank ($CDS_c^{\text{Home Sov}}$). The model controls for unobserved heterogeneity at the bank level by including bank fixed effects (α_i). We also include year fixed effects to filter

[5] In Appendix A, we graphically document the evolution of the bank-specific variables

out the effects of common shocks (λ_y). Since we estimate the impact of a change in the monetary policy stance, i.e. the impact of a monetary policy shock (ΔMPS_t), we argue that its impact should be analyzed on the change of bank credit risk. Hence, we use the first differences of the bank CDS spreads. Since a positive monetary policy shock is interpreted as accommodative, the coefficient δ is interpreted as a change in bank default risk due to an accommodative change in the monetary policy shock, all else equal. It measures the direct transmission of monetary policy to bank credit risk.

Next to the direct effect of monetary policy on bank risk we assess the impact of an indirect transmission channel of monetary policy. We acknowledge that some types of monetary policy actions by the ECB have been explicitly directed at decreasing bank credit risk, e.g. the various waves of (T)LTRO (see Hartmann and Smets (2018)). As a consequence, these measures are expected to directly impact market-perceived bank default risk. Other measures were introduced to affect the transmission of monetary policy to sovereign credit spreads, e.g. SMP and OMT (Falagiarda and Reitz, 2015). They are designed to affect sovereign yields directly, but through this channel they also indirectly translate into more benign bank funding conditions (Acharya et al., 2014). Finally, a number of ECB unconventional policy measures, such as asset purchases and forward guidance are intended to affect the entire yield curve. These measures simultaneously affect sovereign yields, bank funding conditions and bank profitability. Hence, in order to quantify the full impact of monetary policy on bank risk, we need to capture the transmission of ECB actions through sovereign risk, next to the monetary policy channel.

To analyze these channels, we disentangle the change in sovereign CDS spreads into a part that is driven by monetary policy, which we label monetary-policy-induced sovereign credit risk, and an autonomous sovereign credit risk part, which we interpret as a change in sovereign CDS spreads not caused by changes in the monetary policy shock and hence caused by country-specific political events or public finance conditions. Since monetary policy actions produce heterogeneous impacts across counties (Rostagno et al., 2019), we disentangle the impact on the sovereign CDS spreads based on the following estimation:

$$\Delta CDS_{c,t}^{Sov} = \alpha_c + \phi_c D_c \times \Delta MPS_t + \mu_{c,t} \tag{4}$$

where a country dummy D_c is included in order to estimate the impact of monetary policy on each sovereign separately. The fitted values of model 4 capture changes in $\Delta CDS^{Sov}_{c,t}$ caused by changes in the monetary policy shock, i.e. monetary-policy-induced changes in sovereign credit risk. The estimated residuals capture the autonomous change in $\Delta CDS^{Sov}_{c,t}$ spreads that are unrelated to changes in monetary policy.

The fitted values and the residuals obtained in the first-stage model are simultaneously introduced in a second stage:

$$\Delta CDS_{i,t} = \alpha_i + \theta \; \widehat{\Delta CDS^{Sov}_{i,t}} + \zeta \; \widehat{\mu_{c,t}} + \sum_{k=1}^{K} \beta_k \; BNK_{k,i,t} + \gamma \; \Delta V_t + \varepsilon_{i,t} \tag{5}$$

where θ measures the impact of monetary-policy-induced sovereign CDS changes on bank CDS spreads, while ζ captures the transmission of autonomous sovereign CDS changes to bank CDS spreads. We do not include changes in the monetary policy stance in this model. This would cause multicollinearity since the fitted values from the first stage model are a linear combination of the monetary policy shock.

Finally, we estimate a model which includes both the direct and indirect effect of the monetary policy shock on bank CDS spreads. This estimation is realised by the following specification:

$$\Delta CDS_{i,t} = \alpha_i + \delta \; \Delta MPS_t + \zeta \; \widehat{\mu_{i,t}} + \sum_{k=1}^{K} \beta_k \; BNK_{k,i,t} + \gamma \; \Delta V_t + \varepsilon_{i,t} \tag{6}$$

In this model, we only include autonomous changes in the sovereign CDS spread, which are orthogonal to monetary policy shocks, combined with the monetary policy shock, which in this case captures the cumulative effect of monetary policy, both directly and indirectly through changes in sovereign credit risk.

4 Results

We conduct a comprehensive investigation of the impact of ECB monetary policy on bank CDS spreads. In order to fully capture the transmission to bank credit risk, it is important to distinguish two channels: a direct effect of monetary policy on perceived bank credit risk and an indirect channel operating via the sovereign risk channel. The findings are presented in Tables 3-4. The first step in the sequence is to estimate the direct impact of a monetary policy shock, estimated with a SVAR and based on the identification-through-heteroscedasticity approach[6], on sovereign risk. The results in Table 3 indicate that an accommodative monetary policy shock is associated with declining sovereign CDS spreads in the Euro Area, as expected. Since previous studies report that Euro Area monetary policy had a differential impact on sovereign credit risk across countries (Rostagno et al., 2019), we interact the monetary policy shock with a country dummy. We confirm that the impact is heterogeneous across countries, ECB monetary policy shocks have a more pronounced downward impact on sovereign credit risk for the peripheral countries of the Euro Area (Portugal, Italy, Spain and Ireland), compared to the core countries. This first-stage regression partitions variation in sovereign credit risk into a component caused by monetary policy shocks (monetary-policy-induced sovereign credit risk) and a residual country-specific component (autonomous sovereign credit risk).

The results of the second-stage regressions, where we estimate both the direct and indirect transmission of monetary policy shocks on bank credit risk are reported in Table 4 (using the heterogeneous impact of monetary policy across countries in Table 3). We show the results of three specifications for each CDS type. The first column for each type displays the results of equation 3, i.e. the impact of monetary policy combined with the impact of sovereign credit risk on bank credit risk. The second column contains the coefficients for the

[6]While we are convinced that our approach is well suited for the research question we address, we considered alternative ways to identify monetary policy shocks. One recently developed alternative is the identification with external instruments, as in Gertler and Karadi (2015). When we conduct this estimation, using the monetary policy surprises constructed by Altavilla et al. (2019) as external instrument, the monetary policy shock series we obtain exhibits a correlation of 82.6% with the monetary policy shocks produced by the identification-through-heteroscedasticity approach, indicating that our results are robust to this alternative method of shock identification. Another alternative would be to consider a shadow rate as in Wu and Xia (2016). However, shadow rates are typically used to estimate the impact of unconventional monetary policy on low frequency macroeconomic variables, such as inflation and GDP (Rossi, 2018). Furthermore, the shadow rate is determined in a yield curve model and the impact of the shadow rate on macroeconomic variables depends on the underlying assumptions of these models. In contrast, in our identification-through-heteroscedasticity approach, we only assume that the monetary policy shock has a higher variance on ECB announcement days. Moreover, the variables included in our SVAR allow us to capture the financial conditions that we argue are most relevant for the assessment of bank default risk via their CDS spreads.

impact of monetary policy combined with the autonomous sovereign credit risk (as described in equation 6). The third column displays the effects of a monetary-policy-induced change in sovereign risk combined with the impact of the autonomous part of sovereign credit risk (as described in equation 5). The difference between the first and second column is the sovereign credit risk variable. In the first column, the unpartitioned sovereign CDS spread is used as our measure of sovereign credit risk, which means that this regressor will be correlated with the monetary policy shock (in Table 3 we report that the monetary policy shock significantly lowers sovereign credit risk). The indirect transmission of the monetary policy shock, i.e. the effect of monetary policy on bank credit risk through its impact on sovereign credit risk, is therefore captured by the sovereign credit risk measure. Consequently, the coefficient of the change in monetary policy only contains its direct impact on bank credit risk. In the second column, we only include the autonomous sovereign part of changes in sovereign credit risk. Therefore, as the sovereign credit risk measure no longer correlates with the monetary policy shock, the estimated impact of a monetary policy shock now contains both the direct and indirect (through the sovereign transmission channel) effects. Hence, the coefficient of the monetary policy shock in the second column contains both the direct and indirect effects. In the third column, we analyze whether or not the two sources of sovereign credit risk are translated differently into bank credit risk, i.e. does a monetary-policy-induced change in sovereign credit risk impact bank credit risk differently than when the change in sovereign credit risk stems from events affecting sovereign risk other than monetary policy (e.g. political events).

The results in the first column of Table 4 indicate that the direct effect of a unit accommodative monetary policy shock is associated with a decrease of bank default risk. This effect is slightly higher for subordinated bond CDS spreads and for shorter maturities. Thus, the subordinated 1-year CDS spread experiences the most pronounced beneficial impact associated with monetary policy stimulus. To guide the reader through the interpretation of the three columns we focus on the coefficients for the 5-year bank CDS spreads. Bank CDS spreads on 5-year senior bonds decrease by 1.744 basis points after an accommodative unit monetary policy shock, controlling for sovereign risk. In the second column the sovereign risk variable is the autonomous sovereign credit risk measure and in this case the estimated impact of a unit monetary policy shock on bank credit risk is -3.191, which now captures both the direct (-1.744) and the indirect effect of a monetary policy shock. Hence, the aggregate direct and indirect (via the sovereign channel) impact of a monetary policy shock is associated with lower bank default risk. Moreover, the cumulative effect of both transmission channels is stronger than the standalone direct effect. This indicates that both channels work in the same direction and amplify each other. This argument is confirmed by the results of the third column, where the monetary policy shock is omitted and sovereign risk is now partitioned into the monetary-policy-induced effect and the autonomous sovereign effect. We observe that both terms are significant and positively affect bank CDS spreads, which is a straightforward finding since higher sovereign risk pushes up bank risk. Yet, changes in sovereign risk are translated more strongly into the CDS spread of banks when that change is caused by monetary policy shocks (0.583 for the 5-year senior CDS spreads). Next to the monetary policy impact, changes in sovereign risk unrelated to ECB actions (e.g. political events) affect bank CDS spreads with an estimated coefficient of 0.273, a finding that is very similar to the one reported in Fratzscher and Rieth (2019). Consequently, the picture that emerges can be summarized as follows. Accommodative ECB monetary policy shocks are directly associated with lower bank CDS spreads. At the same time, stimulating monetary policy lowers sovereign risk, and since sovereign CDS spread changes impact bank CDS spreads, the decline in sovereign CDS spreads is amplified into more pronounced decreases in bank CDS spreads. Hence, ECB monetary policy actions exert their beneficial effect on the banks' perceived risk profile through a combination of a direct effect and an indirect-through-the-sovereign effect[7].

The conclusion is that over the period under investigation, accommodative monetary policy by the ECB is associated with a beneficial impact on the perceived default risk of

[7]The results are robust to 2 alternative specifications of sovereign risk. First, banks may have sovereign exposures to several countries, next to their home sovereign. To account for this feature, we calculate a weighted sovereign CDS spread, using the bank-level sovereign exposures as weights. These exposures are retrieved from the EBA transparency exercises and we include the sovereign exposures to Euro Area countries, since these are the relevant countries which are impacted by ECB monetary policy actions. Second, since most banks are primarily exposed to their home sovereign, we adjust the home sovereign CDS spread by multiplying it with the ratio of the home sovereign exposure to each bank's total sovereign exposures. This introduces bank level heterogeneity with respect to the degree to which the bank exhibits a home bias. Appendix B displays the results of the robustness checks, they confirm all the findings from Table 4.

European banks. Apparently, the assessment of the CDS market is that the positive effects of stimulating monetary policy outweigh any negative side effects. These findings are consistent with the conclusion of Albertazzi et al. (2020) that ECB policy actions have contributed to restoring and maintaining financial stability. They also complement the event study evidence in Altavilla et al. (2019) who report that announcements of unconventional monetary policy actions by the ECB were associated with declining bank CDS spreads and higher stock market returns. Obviously, this assessment may be dynamic in nature since potential adverse spillovers to banking stability may only become visible the longer the period of exceptional monetary policy accommodation is extended.

4.1 Extensions: geography and time variation

When analyzing the impact of ECB monetary policy, two natural extensions of the impact analysis may provide deeper insight: core versus periphery and variation over time. First, differences in transmission of monetary policy to bank risk profiles in the core versus the peripheral countries of the Euro Area may be driven by the fact that monetary policy transmission differs across countries, e.g. OMT had a more pronounced downward effect on interest rates in the Euro Area periphery (Krishnamurthy et al., 2018). Second, in terms of time variation in the transmission of monetary policy, it is important to take into account that the ECB has implemented policies aimed at credit easing (e.g. LTRO) and quantitative easing (e.g. asset purchases) and that these policies have been introduced at various stages in the post-crisis period. Interest rate decreases initially supported bank net interest margins and LTRO lowered the funding costs of the banks, but once the ECB started applying negative interest rates on its deposit facility and once forward guidance pointed at low for long interest rates, bank profitability may be affected negatively (Borio and Gambacorta, 2017) and risk-taking incentives may have become larger (Heider et al., 2019). Yet, the ultimate effect of monetary policy on bank profitability and the banks' risk profile is the net result of beneficial effects (e.g. better economic conditions) and potential negative side effects (e.g. risk taking) (see Altavilla et al. (2019) and Albertazzi et al. (2020)). Hence, we examine whether or not the impact of changes in the monetary stance on the banks' risk profile differs in consecutive periods of ECB monetary accommodation.

4.1.1 Monetary policy and bank risk profile: Core versus Periphery

In Table 5, we analyze the heterogeneous impact of monetary policy on bank default risk depending on whether the banks are located in a core Euro Area country or in the periphery (i.e. Italy, Ireland, Portugal or Spain). We estimate the effect on bank risk of the monetary policy shock and the sovereign CDS spread, both interacted with a dummy variable equal to one when a bank is headquartered in a periphery country, zero otherwise. To facilitate the interpretation, Table 5 only reports the coefficients of monetary policy, sovereign risk and their interaction with country dummies, but bank controls and fixed effects are also included in the estimations. The first column of the 4 types of bank CDS spreads in Table 5 displays the results for the combination of the direct impact of monetary policy and the sovereign CDS spread. As in Table 4, ECB monetary stimulus has a downward effect on bank CDS spreads and changes in the home sovereign CDS are positively associated with bank CDS spreads. However, since the interaction term of MPS and periphery is insignificant, the direct impact of monetary policy is found to be homogeneous in core and periphery Euro Area countries. Similarly, we find no evidence that changes in sovereign credit risk display a stronger transmission to bank CDS spreads for periphery banks (with the exception of the 1-year senior bond CDS spread where we find a marginally significant impact of the transmission of sovereign risk). The second column of Table 5 displays the results for monetary policy in combination with the autonomous sovereign credit risk measure. Hence, we now capture the total, direct and indirect-through-the-sovereign effect of monetary policy. We find that that the accommodative monetary policy impacts the CDS spreads of peripheral banks more than those located in the core Euro Area. When we again focus on the results for the 5-year senior bank CDS spreads, we find that the total effect of monetary policy easing on bank CDS spreads is -2.223 basis points per unit monetary accommodation and this effect is amplified in the periphery by an extra -2.055 basis points. The third column presents the coefficients for the impact of sovereign CDS spreads on banks, now partitioned into a sovereign part induced by monetary policy and an autonomous sovereign part. The impact of the autonomous part of sovereign risk on bank CDS spreads is almost identical as in the second column (0.297 and 0.284) and does not differ between core and periphery.

Yet, changes in the sovereign CDS spread induced by monetary policy exhibit a higher impact for banks in core countries, since the interaction coefficient with periphery is -0.674, suggesting a stronger pass-through for core country banks. We also notice that this effect is more pronounced for subordinated bonds. This finding may seem counterintuitive at first sight, but it makes perfect economic sense, when interpreted in conjunction with Table 3. In Table 3 we document that the effect of monetary policy on sovereign risk is heterogeneous across countries and most notably between the core and the periphery. When considering the core countries (Austria, Belgium, France, Germany and Netherlands, the impact of monetary easing on sovereign CDS spreads ranges from -0.9 to -2.9, whereas for the periphery (Ireland, Italy, Portugal and Spain) the effect is between -5.4 and -9.1, i.e. about 4 times as large. In the third column of Table 5 we find that the effect of monetary-policy-induced changes in bank CDS spreads transmitted via sovereign spread reduction is half as large in the periphery versus the core (for the 5-year senior CDS spread: core +1.230, periphery +1.230 - 0.674). This yields exactly the magnitude for the total effect of monetary policy easing we document in column 2, i.e. -2.233 for the core and an additional -2.055 for the periphery banks. The conclusion is that the effect of accommodative monetary policy on bank CDS spreads is twice as large for periphery banks compared to core banks and that this effect is not caused by a direct effect of monetary policy, which is similar for core and periphery, but is associated with the monetary-policy-induced-through-the-sovereign effect. Hence, ECB monetary policy actions have not only lowered sovereign CDS spreads, they have also been transmitted to significantly lower bank default risk thereby contributing to a more stable banking system in the Euro Area. Our results complement the findings of Altavilla et al. (2019) who conduct an event study around ECB monetary policy actions and report a downward effect on bank CDS spreads.

4.1.2 Monetary policy and bank risk profile: time-varying impact

Does the beneficial effect of ECB monetary policy accommodation on bank risk persist over the entire post-2008 period or do CDS markets judge that risk-taking incentives associated with low-for-longer interest rates deteriorate the banks' risk profile at some point? In order to investigate the time-varying pattern of the impacts across periods characterized by different types of ECB actions, we estimate 1-year rolling window regressions. Figure 4 is constructed such that it mimicks the structure of Table 4, i.e. the two graphs in each of the three rows of Figure 4 correspond to the combination of pairs of variables in the three columns in Table 4. The two graphs in the first row show the evolution of the coefficients of the monetary policy shock combined with those for the sovereign CDS spread. The second row displays the coefficients of the monetary policy shock and the autonomous sovereign credit risk. The third row reports the evolution of the effect of the monetary-policy-induced change in sovereign risk combined with that of the autonomous sovereign credit risk.

The findings for the direct effect of ECB monetary policy on bank CDS spreads and the indirect effect via the sovereign channel can be summarized as follows. The left panels of rows (1) and (2) demonstrate that accommodative monetary policy has a pronounced downward effect on bank credit risk. The confidence intervals show that this is the case for the entire post-2008 period, but the effect is especially visible in the period 2012-2014 during which the ECB undertook unprecedented actions to avoid a break-up of the eurozone and diminish the bond spreads of the vulnerable countries (e.g. the Draghi speech and OMT, see Rostagno et al. (2019)). These actions are associated with a pronounced decrease in bank CDS spreads an this can be interpreted as the direct effect since we control for the sovereign spread, which is itself positively related to bank CDS spreads (right panel in row (1)). The direct effect of monetary policy to bank credit risk remains significantly negative (i.e. associated with a downward pressure on bank CDS spreads) in the post-2014 period, but the magnitude is lower. The indirect effect of monetary policy through the sovereign risk channel is depicted in row (3). We observe that both the monetary-policy-induced changes in sovereign CDS spread (left panel) as well as the autonomous part of sovereign risk (righ panel) are positively related to bank credit risk, i.e. higher (lower) sovereign CDS spreads are associated with higher (lower) bank CDS spreads and the effect is larger for the monetary-policy-induced part (as in Table 4). Yet, the impact of the monetary-policy-induced part is clearly much more pronounced in the 2012-2014 period, again confirming that the decisive actions of the ECB in that period contributed to alleviating stress in the banking system, in this case through its moderating effect on sovereign risk. These results confirm that ECB monetary policy in those days operated through the strong feedback loop between sovereigns and banks (see Acharya et al. (2014)). In the post-2014 period the positive relationship between sovereign risk and bank risk remains significant in row (3), suggesting that unconventional monetary policy actions by the ECB such as the asset purchase program, continue contributing to lowering bank credit risk. Overall, our time-varying results confirm that, from the perspective of the CDS market, accommodative monetary policy by the ECB is associated with lower bank credit risk, very pronounced during the sovereign crisis, but also significant in the more recent part of the post-2008 period. We find no evidence in the bank CDS market of a perception of excessive risk-taking behavior in the period where the prolonged monetary accommodation may have provided incentives for bank risk taking.

5 Conclusion

Since 2008 Euro Area banks have witnessed a stressful decade, with a banking crisis, a sovereign debt crisis and several unprecedented policy actions by the ECB. These rough waters may have consequences for the risk profile of the banks and even for the viability of part of the banking industry. This is our motivation to empirically investigate the evolution of bank default risk, proxied by bank CDS spreads. In this paper we focus on the impact of ECB monetary policy on perceived bank default risk, accounting for sovereign risk, capturing the feedback loop between sovereigns and banks, and bank fundamentals, as an expression of bank's business model choices. In order to fully capture the channels through which monetary policy actions affect bank risk, we disentangle the effect on bank default risk via a direct transmission channel and via an indirect channel operating through sovereign credit risk.

Our main findings can be summarized as follows. The results demonstrate that during the period 2008-2018, ECB expansionary monetary policy on average diminishes bank CDS spreads. Moreover, our time-varying impact analysis shows that accommodative monetary policy by the ECB is always associated with lower bank CDS spreads, not only in the period 2012-2014 when the impact was most pronounced, but also in the post-2014 era during which the ECB implemented its asset purchase program as well as started charging banks a negative deposit rate on their excess liquidity holdings at the central bank. Other studies have concluded that negative policy rates and the prospect of low for long interest rates may be detrimental for bank profitability and may induce bank risk-taking behavior. Our findings do not imply that banks do not take more risk. They may e.g. rebalance their asset portfolios towards riskier loans. But our results are not consistent with the hypothesis that expansionary monetary policy causes excessive risk taking by banks, because such behavior would be reflected in higher CDS spreads. When we distinguish between a direct channel of monetary policy to bank credit risk and an indirect effect via the sovereign risk channel, our main finding is that both impacts are significant. Accommodative ECB monetary policy shocks are directly associated with lower bank CDS spreads. At the same time, stimulating monetary policy lowers sovereign risk, and since sovereign CDS spread changes in turn impact bank CDS spreads, the decline in sovereign CDS spreads is amplified into more pronounced decreases in bank CDS spreads. Hence, ECB monetary policy actions exert their beneficial effect on the banks' perceived risk profile through a combination of a direct effect and an indirect-through-the-sovereign effect. Moreover, we demonstrate that these effects are stronger for banks in peripheral countries of the Euro Area and that the downward effect of monetary policy on bank default risk was especially pronounced in the 2012-2014 period when the Euro Area was under severe stress. Our results indicate that ECB monetary policy is a powerful tool to contain bank credit risk, especially in stress periods. Based on the assessment of CDS markets, the risk profile of European banks has benefited from the post-2008 actions of the ECB.

With respect to sovereign default risk, our results confirm the feedback loop between the health of banks and that of their home country that has been documented in many previous studies. However, in view of the fact that sovereign risk is not only determined by the state of the domestic economy and public finances in particular, but also by monetary policy actions aimed at influencing the funding conditions of governments, we design a methodology that allows us to partition total sovereign risk into a part that is driven by monetary policy and a part that is due to country-specific circumstances and policies. Our results show that both components of sovereign risk affect bank CDS spreads, but that the effect of monetary-policy-induced changes in sovereign CDS spreads played a predominant role in decreasing bank CDS spreads in the 2012-2014, especially in the periphery countries of the Euro Area period. These findings illustrate that the central bank can effectively use unconventional monetary policy actions to influence not only sovereign spreads, but also bank credit risk. Nevertheless, the results do not imply that the correlation between bank health and the condition of the sovereign diminishes. A loosening of the bank-sovereign loop requires action beyond monetary policy, e.g. imposing diversification requirements on bank sovereign portfolios as well as improving the public finance conditions of stressed countries.

References

Acharya, V. V., Dreschler, I., and Schnabl, P. (2014). A Pyrrhic Victory? Bank Bailouts and Sovereign Credit Risk. *The Journal of Finance*, 69(6), 2689–2739.

Acharya, V. V., Eisert, T., Eufinger, C., and Hirsch, C. (2018). Real effects of the sovereign debt crisis in Europe: Evidence from syndicated loans. *Review of Financial Studies*, 31(8), 2855–2896.

Acharya, V. V. and Steffen, S. (2015). The "greatest" carry trade ever? Understanding eurozone bank risks. *Journal of Financial Economics*, 115(2), 215–236.

Adrian, T. and Shin, H. S. (2009). Money, Liquidity, and Monetary Policy. *American Economic Review: Papers & Proceedings*, 99(2), 600–605.

Albertazzi, U., Barbiero, F., Marques-Ibanez, D., Popov, A., Rodriguez D'Acri, C., and Vlassopoulos, T. (2020). Monetary policy and bank stability: the analytical toolbox reviewed. *ECB Working Paper Series, No. 2377*.

Alogoskoufis, S. and Langfield, S. (2019). Regulating the doom loop. *ECB Working Paper Series, No. 2313*.

Altavilla, C., Boucinha, M., and Peydró, J.-L. (2018). Monetary policy and bank Profitability in a low interest rate environment. *Economic Policy*, 33(96), 531–586.

Altavilla, C., Brugnolini, L., Gürkaynak, R. S., Motto, R., and Ragusa, G. (2019). Measuring Euro Area monetary policy. *Journal of Monetary Economics*, 108, 162–179.

Altunbas, Y., Gambacorta, L., and Marques-Ibanez, D. (2012). Do bank characteristics influence the effect of monetary policy on bank risk? *Economics Letters*, 117(1), 220–222.

Altunbas, Y., Manganelli, S., and Marques-Ibanez, D. (2011). Bank Risk During the Financial Crisis: Do Business Models Matter? *ECB Working Paper Series, No. 1394*.

Annaert, J., De Ceuster, M., Roy, P. V., and Vespro, C. (2013). What determines Euro Area bank CDS spreads? *Journal of International Money and Finance*, 32, 444–461.

Arai, N. (2017). The Effects of Monetary Policy Announcements at the Zero Lower Bound. *International Journal of Central Banking*, 13(2), 159–196.

Babihuga, R. and Spaltro, M. (2014). Bank Funding Costs for International Banks. *IMF Working Paper, No. 14/71*.

Baele, L., Bekaert, G., Inghelbrecht, K., and Wei, M. (2020). Flights to Safety. *The Review of Financial Studies*, 33(2), 689–746.

Baele, L., De Jonghe, O., and Vander Vennet, R. (2007). Does the stock market value bank diversification? *Journal of Banking and Finance*, 31(7), 1999–2023.

Berger, A. N. and Bouwman, C. H. (2013). How does capital affect bank performance during financial crises. *Journal of Financial Economics*, 109(1), 146–176.

Bliss, R. R. and Flannery, M. J. (2002). Market Discipline in the Governance of U.S. Bank Holding Companies: Monitoring vs. Influencing. *European Review of Finance*, 6(3), 361–396.

Bocola, L. (2016). The pass-through of sovereign risk. *Journal of Political Economy*, 124(4), 879–881.

Bogdanova, B., Fender, I., and Takáts, E. (2018). The ABCs of bank PBRs. *BIS Quarterly Review, March 2018*, 81–95.

Borio, C. and Gambacorta, L. (2017). Monetary policy and bank lending in a low interest rate environment: Diminishing effectiveness? *Journal of Macroeconomics*, 54, 217–231.

Borio, C. and Zhu, H. (2012). Capital regulation, risk-taking and monetary policy: A missing link in the transmission mechanism? *Journal of Financial Stability*, 8, 236–251.

Brei, M., Borio, C., and Gambacorta, L. (2019). Bank intermediation activity in a low interest rate environment. *BIS Working Papers, No 807.*

Bubeck, J., Maddaloni, A., and Peydró, J.-L. (2020). Negative Monetary Policy Rates and Systemic Banks' Risk-Taking: Evidence from the Euro Area Securities Register. *Journal of Money, Credit and Banking*, 52(S1), 197–231.

Buch, C. M., Koetter, M., and Ohls, J. (2016). Banks and sovereign risk: A granular view. *Journal of Financial Stability*, 25, 1–15.

Caporin, M., Natvik, G. J., Ravazzolo, F., and Santucci de Magistris, P. (2019). The bank-sovereign nexus: Evidence from a non-bailout episode. *Journal of Empirical Finance*, 53(8019), 181–196.

Chiaramonte, L. and Casu, B. (2013). The determinants of bank CDS spreads: Evidence from the financial crisis. *European Journal of Finance*, 19(9), 861–887.

Claessens, S., Coleman, N., and Donnelly, M. (2018). "Low-For-Long" interest rates and banks' interest margins and profitability: Cross-country evidence. *Journal of Financial Intermediation*, 35, 1–16.

Crosignani, M., Faria-e Castro, M., and Fonseca, L. (2020). The (Unintended?) consequences of the largest liquidity injection ever. *Journal of Monetary Economics*, 112, 97–112.

De Bruyckere, V., Gerhardt, M., Schepens, G., and Vander Vennet, R. (2013). Bank/sovereign risk spillovers in the European debt crisis. *Journal of Banking & Finance*, 37(12), 4793–4809.

De Marco, F. and Macchiavelli, M. (2016). The Political Origin of Home Bias: The Case of Europe. *FEDS Working Paper No. 2016-060.*

Drago, D., Tommaso, C. D., and Thornton, J. (2017). What determines bank CDS spreads? Evidence from European and US banks. *Finance Research Letters*, 22, 140–145.

Falagiarda, M. and Reitz, S. (2015). Announcements of ECB unconventional programs: Implications for the sovereign spreads of stressed Euro Area countries. *Journal of International Money and Finance*, 53, 276–295.

Fratzscher, M. and Rieth, M. (2019). Monetary Policy, Bank Bailouts and the Sovereign-Bank Risk Nexus in the Euro Area. *Review of Finance*, 23(4), 745–775.

Gertler, M. and Karadi, P. (2015). Monetary Policy Surprises, Credit Costs and Economic Activity. *American Economic Journal: Macroeconomics*, 7(1), 44–76.

Hartmann, P. and Smets, F. (2018). The first twenty years of the European Central Bank: monetary policy. *ECB Working Paper Series, No. 2219.*

Heider, F., Saidi, F., and Schepens, G. (2019). Life below Zero: Bank Lending under Negative Policy Rates. *Review of Financial Studies*, 32(10), 3728–3761.

Horváth, B. L., Huizinga, H., and Ioannidou, V. (2015). Determinants and Valuation Effects of the Home Bias in European Banks Sovereign Debt Portfolios. *CEPR Discussion Paper Series, No. 10661.*

Jiménez, G., Ongena, S., Peydró, J.-L., and Saurina, J. (2014). Hazardous Times for Monetary Policy: What Do Twenty-Three Million Bank Loans Say About the Effects of Monetary Policy on Credit Risk-Taking? *Econometrica*, 82(2), 463–505.

Köhler, M. (2015). Which banks are more risky? The impact of business models on bank stability. *Journal of Financial Stability*, 16, 195–212.

Krishnamurthy, A., Nagel, S., and Vissing-Jorgensen, A. (2018). ECB Policies Involving Government Bond Purchases: Impact and Channels. *Review of Finance*, 22(1), 1–44.

Laeven, L. (2019). The regulatory response to the sovereign-bank nexus. *Global Finance Journal*, 39, 17–20.

Laeven, L., Ratnovski, L., and Tong, H. (2016). Bank size, capital, and systemic risk: Some international evidence. *Journal of Banking and Finance*, 69, S25–S34.

Lamers, M., Mergaerts, F., Meuleman, E., and Vander Vennet, R. (2019). The Tradeoff between Monetary Policy and Bank Stability. *International Journal of Central Banking*, 15(2), 1–42.

Lanne, M. and Lütkepohl, H. (2008). Identifying Monetary Policy Shocks via Changes in Volatility. *Journal of Money, Credit and Banking*, 40(6), 1131–1149.

Leonello, A. (2018). Government guarantees and the two-way feedback between banking and sovereign debt crises. *Journal of Financial Economics*, 130(3), 592–619.

Mergaerts, F. and Vander Vennet, R. (2016). Business models and bank performance: A long-term perspective. *Journal of Financial Stability*, 22, 57–75.

Nave, J. M. and Ruiz, J. (2015). Risk aversion and monetary policy in a global context. *Journal of Financial Stability*, 20, 14–35.

Ongena, S., Popov, A., and Horen, N. V. (2019). The Invisible Hand of the Government: Moral Suasion during the European Sovereign Debt Crisis. *American Economic Journal: Macroeconomics*, 11(4), 2016.

Paligorova, T. and Santos, J. A. (2017). Monetary policy and bank risk-taking: Evidence from the corporate loan market. *Journal of Financial Intermediation*, 30, 35–49.

Pancotto, L., ap Gwilym, O., and Williams, J. (2019). The European Bank Recovery and Resolution Directive: A market assessment. *Journal of Financial Stability*, 44, 100689.

Rajan, R. G. (2006). Has Finance Made the World Riskier? *European Financial Management*, 12(4), 499–533.

Rigobon, R. and Sack, B. (2004). The impact of monetary policy on asset prices. *Journal of Monetary Economics*, 51, 1553–1575.

Rogers, J. H., Scotti, C., and Wright, J. H. (2014). Evaluating asset-market effects of unconventional monetary policy: a multi-country review. *Economic Policy*, 29(80), 749–799.

Rossi, B. (2018). Identifying and Estimating the Effects of Unconventional Monetary Policy in the Data : How to Do It And What Have We Learned ? *CEPR Discussion Paper Series, No. 14064*.

Rostagno, M., Altavilla, C., Carboni, G., Lemke, W., Motto, R., Guilhem, A. S., and Yiangou, J. (2019). A tale of two decades: the ECB's monetary policy at 20. *ECB Working Paper Series, No. 2346*.

Samaniego-Medina, R., Trujillo-Ponce, A., Parrado-Martínez, P., and di Pietro, F. (2016). Determinants of bank CDS spreads in Europe. *Journal of Economics and Business*, 86, 1–15.

Stângă, I. M. (2014). Bank bailouts and bank-sovereign risk contagion channels. *Journal of International Money and Finance*, 48, 17–40.

Vazquez, F. and Federico, P. (2015). Bank funding structures and risk: Evidence from the global financial crisis. *Journal of Banking and Finance*, 61, 1–14.

Wright, J. H. (2012). What does Monetary Policy do to Long-term Interest Rates at the Zero Lower Bound? *The Economic Journal*, 122(564), F447–F466.

Wu, J. C. and Xia, F. D. (2016). Measuring the Macroeconomic Impact of Monetary Policy at the Zero Lower Bound. *Journal of Money, Credit and Banking*, 48(2-3), 253–291.

Tables

Table 1: Descriptive statistics. CDS spreads, bank-specific variables and market data are obtained from Markit, SNL and Datastream.

Variable	Abbrevation	Mean	SD	P1	P50	P99
CDS Senior 1 Year	CDS SEN 1	148.60	222.06	7.07	70.78	1,399.33
CDS Subordinated 1 Year	CDS SUB 1	257.24	346.94	15.37	128.35	1,962.64
CDS Senior 5 Years	CDS SEN 5	192.88	182.85	25.44	134.51	1,064.57
CDS Subordinated 5 Years	CDS SUB 5	312.96	266.71	50.09	220.16	1,404.32
CDS Sovereign	$CDS^{HOME\ SOV}$	89.01	118.52	5.37	44.78	729.09
Equity/Assets	CAP	5.94	2.40	0.96	5.92	14.13
Size	SIZE	19.12	1.20	16.46	19.09	21.48
Loans to Assets	LTA	58.80	16.39	19.89	62.08	88.70
Deposits to Liabilities	DEP	46.21	16.28	9.13	47.49	79.12
ROA	ROA	0.04	0.56	−2.25	0.11	1.14
Diversification	DIV	37.91	15.35	0.00	37.88	75.35
NPL	NPL	6.88	6.17	0.64	4.54	29.38
Vstoxx	VSTOXX	23.37	8.76	12.44	21.93	60.60
Monetary Policy	MPS	0.00	0.12	−0.31	0.00	0.30

Table 2: Overview of the bank sample.

Name	Country
Erste Group Bank	Austria
Raiffeisen Bank International	Austria
Raiffeisen Zentralbank Österreich	Austria
UniCredit Bank Austria	Austria
BNP Paribas Fortis	Belgium
KBC Bank	Belgium
BNP Paribas	France
Banque Fédérative du Crédit Mutuel	France
Crédit Agricole	France
Crédit Lyonnais	France
Natixis	France
Société Générale	France
Bayerische Landesbank	Germany
Commerzbank	Germany
Deutsche Bank	Germany
Hamburg Commercial Bank	Germany
IKB Deutsche Industriebank	Germany
Landesbank Baden-Württemberg	Germany
NORD/LB Norddeutsche Landesbank Girozentrale	Germany
Portigon	Germany
UniCredit Bank	Germany
Governor and Company of the Bank of Ireland	Ireland
Permanent TSB Group Holdings	Ireland
Banca Monte dei Paschi di Siena	Italy
Banca Nazionale del Lavoro	Italy
Banca Popolare di Milano	Italy
Banco BPM	Italy
Banco Popolare	Italy
Intesa Sanpaolo	Italy
Mediobanca - Banca di Credito Finanziario	Italy
UniCredit	Italy
Unione di Banche Italiane	Italy
ABN AMRO Group	Netherlands
Coöperatieve Rabobank	Netherlands
ING Bank	Netherlands
NIBC Bank	Netherlands
Banco BPI	Portugal
Banco Comercial Português	Portugal
Banco Espírito Santo	Portugal
Caixa Geral de Depósitos	Portugal
Novo Banco	Portugal
Banco Bilbao Vizcaya Argentaria	Spain
Banco Pastor	Spain
Banco Popular Español	Spain
Banco Santander	Spain
Banco de Sabadell	Spain
Bankia	Spain
Bankinter	Spain
CaixaBank	Spain

Table 3: Effect of monetary policy on sovereign CDS spreads across Euro Area countries. This table shows the coefficient estimates from OLS regressions relating the interaction of the monetary policy shock and a country dummy variable to sovereign credit risk, as based on equation 4. All estimations use country and year fixed effects to control for unobserved heterogeneity and common macroeconomic shocks. Standard errors in parentheses are clustered at the country level. *, ** and *** represent significance at the 10%, 5% and 1% percent level, respectively.

Dependent Variable:	ΔCDS^{SOV}
ΔMPS $\times$ Interaction Term:	
AUSTRIA	−1.969***
	(0.214)
BELGIUM	−2.889***
	(0.214)
FRANCE	−1.631***
	(0.214)
GERMANY	−0.925***
	(0.215)
IRELAND	−5.450***
	(0.214)
ITALY	−6.402***
	(0.215)
NETHERLANDS	−1.130***
	(0.215)
PORTUGAL	−9.115***
	(0.214)
SPAIN	−6.242***
	(0.214)
Country fixed effects	Yes
Year fixed effects	Yes
R^2	0.160
No. of Sovereigns	9
No. of obs	24,339

Table 4: Direct and indirect effect of the monetary policy shock on bank CDS spreads. For each bank CDS contract type, this table shows the results of the effect of the monetary policy shock and sovereign credit risk on bank credit risk. In the first column (1) the table shows the results of the monetary policy shock and changes in sovereign credit risk, column (2) displays the monetary policy shock and autonomous changes in sovereign credit risk and column (3) presents monetary policy induced changes in sovereign credit risk and autonomous changes in sovereign credit risk. All estimations use bank- and year fixed effects to control for unobserved heterogeneity and common macroeconomic shocks. Bank control variables capturing the business model and the profitability of the bank are included as well. Standard errors in parentheses are clustered at the country level. *, ** and *** represent significance at the 10%, 5% and 1% percent level, respectively.

	Δ CDS on senior bond						Δ CDS on subordinated bond					
	1 year			5 years			1 year			5 years		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
ΔMPS	−1.734***	−3.327***		−1.744***	−3.191***		−2.808***	−5.333***		−2.745***	−4.887***	
	(0.134)	(0.281)		(0.126)	(0.243)		(0.250)	(0.443)		(0.230)	(0.366)	
$\Delta\text{CDS}^{\text{HOME SOV}}$	0.468***			0.427***			0.714***			0.624***		
	(0.040)			(0.037)			(0.068)			(0.057)		
$\mu_{c,t}^{\widehat{\text{HOME SOV}}}$		0.305***	0.302***		0.275***	0.273***		0.502***	0.501***		0.411***	0.410***
		(0.034)	(0.035)		(0.030)	(0.031)		(0.051)	(0.053)		(0.052)	(0.054)
$\Delta\text{CDS}^{\widehat{\text{HOME}}\text{ SOV}}$			0.647***			0.583***			0.976***			0.873***
			(0.063)			(0.056)			(0.090)			(0.076)
Bank control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.133	0.122	0.128	0.232	0.212	0.216	0.091	0.086	0.088	0.171	0.156	0.157
No. of banks	49	49	49	49	49	49	47	47	47	49	49	49
No. of obs	111,541	111,541	111,541	113,769	113,769	113,769	100,954	100,954	100,954	108,103	108,103	108,103

Table 5: Direct and indirect effect of the monetary policy shock on bank CDS spreads. For each bank CDS contract type, this table shows the results of the effect of the monetary policy shock and sovereign credit risk on bank credit risk, both standalone and interacted with a periphery dummy variable. In the first column (1) the table shows the results of the monetary policy shock and changes in sovereign credit risk, column (2) displays the monetary policy shock and autonomous changes in sovereign credit risk and column (3) presents monetary policy induced changes in sovereign credit risk and autonomous changes in sovereign credit risk. All estimations use bank- and year fixed effects to control for unobserved heterogeneity and common macroeconomic shocks. Bank control variables are included. Standard errors in parentheses are clustered at the country level. *, ** and *** represent significance at the 10%, 5% and 1% percent level, respectively.

	Δ CDS on senior bond						Δ CDS on subordinated bond					
	1 year			5 years			1 year			5 years		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
ΔMPS	−1.537***	−2.058***		−1.735***	−2.233***		−3.042***	−3.962***		−2.892***	−3.708***	
	(0.204)	(0.233)		(0.204)	(0.236)		(0.370)	(0.405)		(0.369)	(0.412)	
ΔMPS× Periphery	−0.518	−2.708***		−0.060	−2.055***		0.486	−2.836***		0.325	−2.518***	
	(0.337)	(0.536)		(0.319)	(0.509)		(0.602)	(0.911)		(0.529)	(0.778)	
$\Delta CDS^{\text{HOME SOV}}$	0.378***			0.364***			0.627***			0.582***		
	(0.033)			(0.030)			(0.048)			(0.044)		
$\Delta CDS^{\text{HOME SOV}}$× Periphery	0.097*			0.073			0.112			0.055		
	(0.056)			(0.051)			(0.090)			(0.080)		
$\mu_{c,t}^{\widehat{\text{HOME SOV}}}$		0.298***	0.310***		0.284***	0.297***		0.461***	0.483***		0.436***	0.456***
		(0.028)	(0.029)		(0.025)	(0.026)		(0.044)	(0.046)		(0.037)	(0.039)
$\mu_{c,t}^{\widehat{\text{HOME SOV}}}$× Periphery		0.004	−0.005		−0.013	−0.023		0.045	0.028		−0.030	−0.046
		(0.048)	(0.049)		(0.043)	(0.044)		(0.073)	(0.076)		(0.070)	(0.073)
$\Delta CDS^{\widehat{\text{HOME}}\text{ SOV}}$			1.121***			1.230***			2.204***			2.051***
			(0.172)			(0.162)			(0.278)			(0.273)
$\Delta CDS^{\widehat{\text{HOME}}\text{ SOV}}$× Periphery			−0.495**			−0.674***			−1.283***			−1.230***
			(0.187)			(0.176)			(0.301)			(0.291)
Bank control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.134	0.128	0.129	0.233	0.220	0.221	0.091	0.088	0.091	0.171	0.160	0.162
No. of banks	49	49	49	49	49	49	47	47	47	49	49	49
No. of obs	111,541	111,541	111,541	113,769	113,769	113,769	100,954	100,954	100,954	108,103	108,103	108,103

Figures

Figure 1: Time series of 1-year and 5-year senior and subordinated bank CDS spreads. The solid black line represents the median CDS spread value in a given month, while the darker and lighter blue areas represent the 25%-75% and the 10%-90% percentiles.

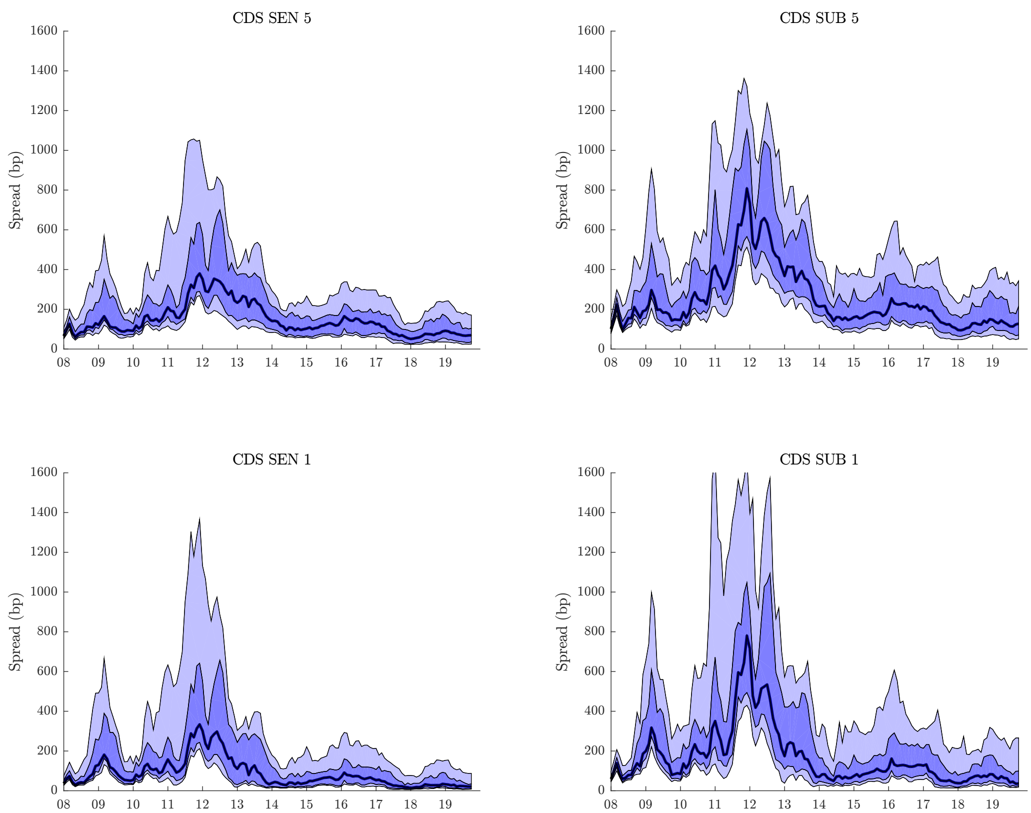


Figure 2: Time series of sovereign CDS spreads. This graph contains the home countries of the banks in the sample. The sovereigns in the periphery have the highest and most volatile CDS spreads. The CDS spreads of the non-periphery countries tend to be low as the perceived probability of default for core Euro Area countries remained low over the sample period.

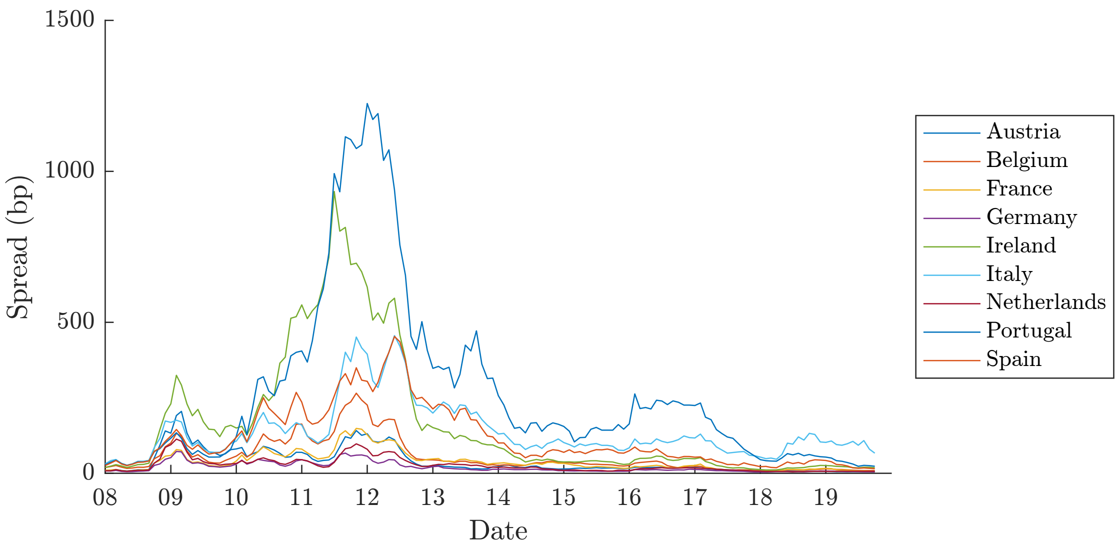


Figure 3: Time series of the absolute (red) and cumulative (blue) monetary policy shocks for the Euro Area, estimated using an identification-through-heteroskedasticity approach proposed by Rigobon and Sack (2004). A positive monetary policy shock reflects an accommodative monetary policy change, negative shocks capture restrictive monetary policy changes.

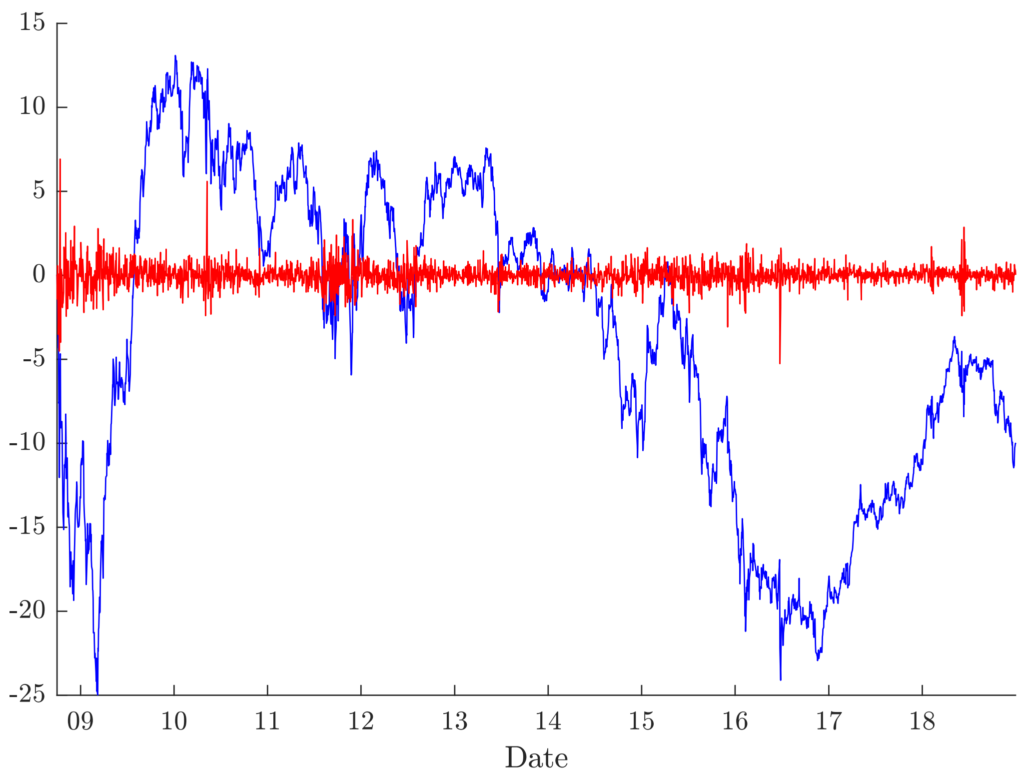
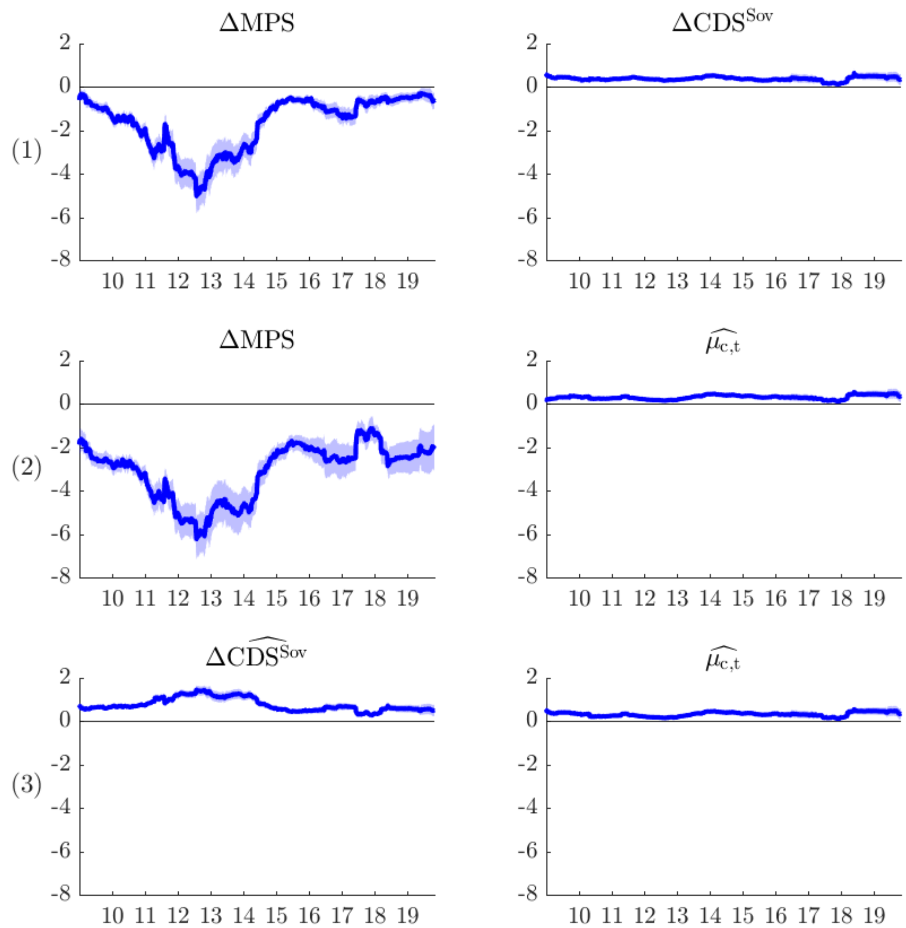


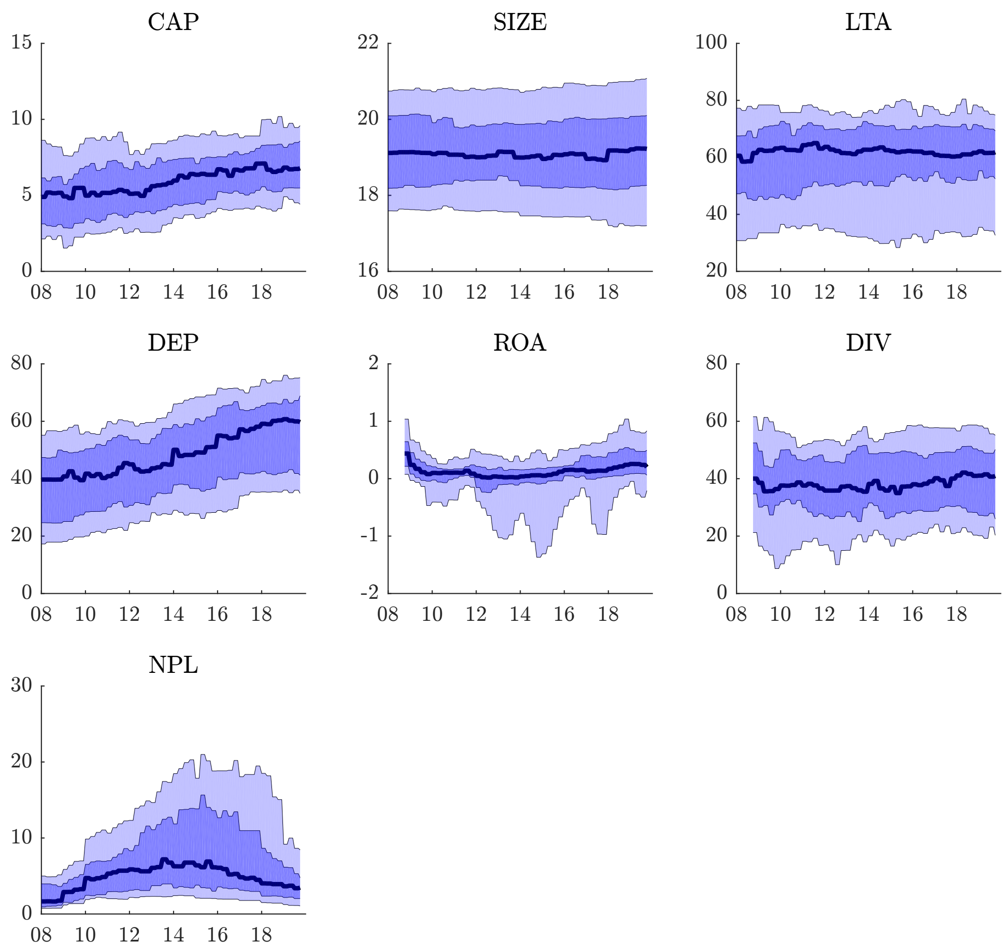
Figure 4: Effect of monetary policy and sovereign credit risk on bank CDS spreads over time. The figure shows the coefficient estimates of the OLS regressions relating the impact of monetary policy and sovereign credit risk on bank credit risk over a rolling window of 1 year in three different models. In model (1) we include a monetary policy shock and sovereign credit risk. In the second model (2) we include the monetary policy shock and the autonomous changes in sovereign credit risk. In the third row (3) we estimate the model including both the monetary-policy-induced changes of sovereign credit risk and the autonomous changes in sovereign credit risk. The x-axis denotes the last observation of each estimation period. The coefficients are surrounded by the 95% confidence interval of each estimation.



Appendix

A Bank fundamentals

Figure 5: Time series of bank fundamentals. The solid black line represents the median value of the variables in a given month, while the darker and lighter blue areas show the 25%-75% and the 10%-90% percentiles.



B Alternative sovereign risk specifications, monetary policy and bank default risk

Table 6: Robustness check of the direct and indirect effect of the monetary policy shock on bank CDS spreads, using a sovereign CDS spread, weighted by bank level sovereign exposures. For each bank CDS contract type, this table shows the results of the effect of the monetary policy shock and sovereign credit risk on bank credit risk. In the first column (1) the table shows the results of the monetary policy shock and changes in sovereign credit risk, column (2) shows the monetary policy shock and autonomous changes in sovereign credit risk and column (3) shows monetary policy induced changes in sovereign credit risk and autonomous changes in sovereign credit risk. All estimations use bank- and year fixed effects to control for unobserved heterogeneity and common macroeconomic shocks. Bank control variables capturing the business model and the profitability of the bank are included as well. Standard errors in parentheses are clustered at the country level. *, ** and *** represent significance at the 10%, 5% and 1% percent level, respectively.

	Δ CDS on senior bond						Δ CDS on subordinated bond					
	1 year			5 years			1 year			5 years		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
ΔMPS	-1.446^{***}	-3.211^{***}		-1.467^{***}	-3.134^{***}		-2.585^{***}	-5.265^{***}		-2.377^{***}	-4.840^{***}	
	(0.145)	(0.207)		(0.127)	(0.193)		(0.244)	(0.356)		(0.227)	(0.321)	
$\text{CDS}^{\text{WEIGHTED SOV}}$	0.455^{***}			0.429^{***}			0.691^{***}			0.635^{***}		
	(0.032)			(0.030)			(0.056)			(0.054)		
$\mu_{c,t}^{\widehat{\text{WEIGHTED}}\text{ SOV}}$		0.453^{***}	0.453^{***}		0.428^{***}	0.428^{***}		0.688^{***}	0.688^{***}		0.632^{***}	0.632^{***}
		(0.032)	(0.032)		(0.030)	(0.030)		(0.056)	(0.056)		(0.054)	(0.054)
$\Delta\text{CDS}^{\widehat{\text{WEIGHTED}}\text{ SOV}}$			0.830^{***}			0.809^{***}			1.357^{***}			1.249^{***}
			(0.053)			(0.049)			(0.091)			(0.082)
Bank control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.129	0.128	0.129	0.231	0.230	0.231	0.091	0.090	0.091	0.172	0.171	0.172
No. of banks	37	37	37	37	37	37	36	36	36	37	37	37
No. of obs	72,462	72,462	72,462	73,968	73,968	73,968	66,045	66,045	66,045	71,001	71,001	71,001

Table 7: Robustness check of the direct and indirect effect of the monetary policy shock on bank CDS spreads, where the home sovereign CDS spread is multiplied with the home bias of the bank. For each bank CDS contract type, this table shows the results of the effect of the monetary policy shock and sovereign credit risk on bank credit risk. In the first column (1) the table shows the results of the monetary policy shock and changes in sovereign credit risk, column (2) shows the monetary policy shock and autonomous changes in sovereign credit risk and column (3) shows monetary policy induced changes in sovereign credit risk and autonomous changes in sovereign credit risk. All estimations use bank- and year fixed effects to control for unobserved heterogeneity and common macroeconomic shocks. Bank control variables capturing the business model and the profitability of the bank are included as well. Standard errors in parentheses are clustered at the country level. *, ** and *** represent significance at the 10%, 5% and 1% percent level, respectively.

	Δ CDS on senior bond						Δ CDS on subordinated bond					
	1 year			5 years			1 year			5 years		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
ΔMPS	−1.879***	−3.539***		−1.887***	−3.390***		−3.102***	−5.596***		−2.964***	−5.207***	
	(0.157)	(0.264)		(0.154)	(0.253)		(0.299)	(0.460)		(0.284)	(0.395)	
$\Delta CDS^{\text{HOME SOV}}$	0.547***			0.495***			0.821***			0.739***		
	(0.061)			(0.057)			(0.097)			(0.091)		
$\widehat{\mu_{c,t}^{\text{HOME SOV}}}$		0.544***	0.544***		0.492***	0.493***		0.816***	0.817***		0.734***	0.735***
		(0.061)	(0.061)		(0.056)	(0.057)		(0.097)	(0.097)		(0.090)	(0.091)
$\Delta CDS^{\widehat{\text{HOME}}\text{ SOV}}$			1.178***			1.125***			1.863***			1.732***
			(0.087)			(0.083)			(0.152)			(0.130)
Bank control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.135	0.134	0.135	0.230	0.229	0.231	0.090	0.090	0.091	0.172	0.171	0.172
No. of banks	37	37	37	37	37	37	36	36	36	37	37	37
No. of obs	87,251	87,251	87,251	88,882	88,882	88,882	79,349	79,349	79,349	85,244	85,244	85,244