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Sovereign debt holdings and banks' credit risk: Evidence from the Eurozone

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ABSTRACT

This paper investigates the direct effect of sovereign debt holding on banks' credit risk. Using individual Eurozone listed banks' information, we find that holding sovereign debt improves the level of banks' credit risk, but this effect is reversed when the credit risk associated with such debt is taken into account. For this purpose, we consider three alternative sovereign debt holding proxies and two types of banks' credit-risk measures, both forward- and backward-looking. We find that the transmission of credit risk from sovereign debt holdings to banks' credit risk is only captured when forward-looking credit-risk measures, based on market data, are used.

1. Introduction

Sovereign debt has traditionally been considered a good proxy for risk-free assets in the implementation of classical valuation models. However, the past sovereign debt crisis in the Eurozone has opened a lively debate on the suitability of sovereign debt as a risk-free asset, since the solvency and risk of some countries and, therefore, the certainty of the issued debt has been punctually questioned (Farhi and Tirole, 2017).

Banks have played a key role after exposing themselves to large amounts of sovereign debt, partly pressured by their governments. Its maintenance on the bank's balance sheet can influence the risk of its assets, thus worsening its credit risk, transferring this effect to the financial stability of the environment, and feeding the well-known "doom loop". Affinito et al. (2019) argue that direct exposure of banks to sovereign debt might have negative effects on their viability, leading to collateral risks and capital losses. However, it can also have positive effects if it acts as a disciplining device for governments, thereby reducing their probability of bankruptcy and preventing sovereign debt yields from reaching relatively high levels. Furthermore, Acharya et al. (2018) indicate that during a crisis the maintenance of sovereign debt can produce a change in the portfolio of banks that switch from corporate debt to sovereign debt, thus producing a change in loan supply. Since banks' credit risk directly affects financial stability, understanding its determinants should be a priority.

In this paper we study the direct effect of sovereign debt banks' holding on banks' credit risk, as the first part of the transmission mechanism. Specifically, we use individual Eurozone listed banks' information to determine whether sovereign debt in the bank's portfolio translates into lower banks' credit risk or whether this translation is conditioned by the level of sovereign debt's risk.

Our research is related to different strands of the literature. First, this study is linked to previous papers that investigate the determinants of banks' risk-taking behavior (Laeven and Levine, 2009; Fiordelisi et al., 2011; Louzis et al., 2012; Gulamhussen

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et al., 2014; Berger et al., 2017; Acosta-Smith et al., 2020, among others). Although these studies focus on the determinants of banks' risk from different perspectives, to the best of our knowledge, our paper is one of the first endeavors to investigate whether sovereign debt – as a specific bank asset – might be a determinant of banks' credit risk.

Second, this study is related to the research that measures banks' credit risk. Although Ferrari et al. (2021) point out that the most popular alternatives for measuring bank credit risk come from two sources, bank accounting and borrower default databases, there is no consensus on the best measure of banks' credit risk. Our paper focuses on measures of bank credit risk based on structural models using market information, in line with works by Chan-Lau and Sy (2006); Lepetit et al. (2008); Fiordelisi et al. (2011); Duan and Wang (2012); Gulamhussen et al. (2014); Berger et al. (2017); or Khan and Ahmad (2021). The advantage of structural-over accounting-based models is that, besides considering past data, they use the market price of shares, thereby incorporating investors' expectations about future share performance. Moreover, the structural Black–Scholes–Merton (BSM hereafter) measure has been proven as an accurate measure of non-financial firms' credit risk, outperforming the accounting-ratio models and the credit rating in terms of outcome prediction and data availability (Hillegeist et al., 2004; Gharghori et al., 2006; Abinzano et al., 2020). These reasons lead us to compute this structural model. We also implement the adaptation to banks proposed by Chan-Lau and Sy (2006), which makes it possible to consider the special nature of their balance sheets and the anticipated adjustment by banking supervisors.[1] We also calculate the accounting-based measure Z-index in its standardized form to provide a complete overview (forward- and backward-looking).

Third, this article is also connected to studies addressing the causes that encourage banks to purchase sovereign debt. The moral suasion hypothesis, renationalizations, carry trade, gamble for resurrection, or caution are some of the explanations offered in the literature (see Affinito et al., 2019). We do not investigate the causes that influence purchasing decisions, but we do try to look into the consequences of this public debt holding by directly observing the output that these securities produce on the bank's credit risk.

2. Data and methodology

2.1. Data

We retrieve quarterly consolidated information from *Bureau van Dijk*'s Bankscope for a sample of 81 Eurozone listed banks[2] for the 2008Q1–2016Q4 period.[3] Additionally, we use Refinitiv Eikon to obtain information to compute credit-risk measures and weighted risk sovereign debt. Inflation, GDP and Maastricht Criterion Bond Yield are obtained from Eurostat. Then, we create an unbalanced panel of 2916 observations. All the variables are inflation-adjusted. Table 1 summarizes the variables employed and their sources.

2.2. Credit-risk measures

We start by using the so-called BSM measure. Assuming the theoretical distribution implied by Merton's model, the theoretical probability of default is given by the following expression (see Vassalou and Xing, 2004):

$$P_{i,t}^{BSM} = N\left(-\frac{\ln\left(\frac{V_{A_{i,t}}}{D_{i,t}}\right) + \left(\mu_{i,t} - \frac{\sigma_{A_{i,t}}^2}{2}\right)(T-t)}{\sigma_{A_{i,t}}\sqrt{T-t}}\right) \tag{1}$$

where $V_{A_{i,t}}$ is the market value of the firm's assets at time t; $\mu_{i,t}$ is the expected immediate rate of return on $V_{A_{i,t}}$; $\sigma_{A_{i,t}}$ is asset return volatility; $D_{i,t}$ is the debt's face value; T is debt maturity and $N(\cdot)$ is the cumulative probability of the Normal distribution. To implement this model, since $V_{A_{i,t}}$ and $\sigma_{A_{i,t}}$ are unobservable variables, we calculate both variables using an iterative process starting from the market price of the firm's shares and its stock-return volatility (see Abinzano et al., 2014).

Then, we implement a derivation of the aforementioned model proposed by Chan-Lau and Sy (2006), who point out that the application of the BSM measure to quantify risks in financial institutions is not straightforward, partly due to the differences between the liabilities of banks and non-financial firms. They introduce the distance-to-capital, which accounts for pre-default regulatory actions. Rather than assuming that the relevant barrier is the face value of the bank's liabilities, they choose a barrier consistent with the prevalent prompt corrective action frameworks (PCARs). Then, the distance-to-capital is given by:

$$DC_{i,t} = \frac{\ln\left(\frac{V_{A_{i,t}}}{\lambda D_{i,t}}\right) + \left(\mu_{i,t} - \frac{\sigma_{A_{i,t}}^2}{2}\right)(T-t)}{\sigma_{A_{i,t}}\sqrt{T-t}} \tag{2}$$

[1] This approach has been used by Daly et al. (2019) and Khan and Ahmad (2021), among others.

[2] Eurozone members included in our sample are Austria, Belgium, Cyprus, Finland, France, Germany, Greece, Ireland, Italy, Lithuania, Malta, Netherlands, Portugal, Slovakia, and Spain.

[3] This period includes the Global Financial crisis, the Eurozone Sovereign Debt crisis, and the stabilization period up to the end of 2016.

Table 1
Variable definition and sources.

Variable	Acronym	Definition	Source
Dependent variables: Credit-risk measures.			
Black–Scholes–Merton measure	$P_{i,t}^{BSM}$	$P_{i,t}^{BSM} = N\left(-\frac{\ln\left(\frac{V_{A_{i,t}}}{D_{i,t}}\right)+\left(\mu_{i,t}-\frac{\sigma_{A_{i,t}}^2}{2}\right)(T-t)}{\sigma_{A_{i,t}}\sqrt{T-t}}\right)$ where $V_{A_{i,t}}$ is the value of the firm's asset at time t, $\mu_{i,t}$ is the expected immediate rate of return on $V_{A_{i,t}}$, $\sigma_{A_{i,t}}$ is asset return volatility, $D_{i,t}$ is the debt's face value, T is the maturity period and $N(\cdot)$ is the cumulative probability of the Normal distribution.	Refinitiv Eikon & Eurostat
Chan-Lau and Sy measure	$P_{i,t}^{CS}$	$P_{i,t}^{CS} = N\left(-\frac{\ln\left(\frac{V_{A_{i,t}}}{\lambda D_{i,t}}\right)+\left(\mu_{i,t}-\frac{\sigma_{A_{i,t}}^2}{2}\right)(T-t)}{\sigma_{A_{i,t}}\sqrt{T-t}}\right)$ where $\lambda = \frac{1}{1-PCAR}$, being PCAR is the capital adequacy threshold set by the supervisor, and the rest of the variables are defined above.	Refinitiv Eikon & Eurostat
Z-index	$Z_{i,t}$	$Z_{i,t} = \left(E(ROA_{i,t}) + \frac{\text{Equity}_{i,t}}{\text{Total Assets}_{i,t}}\right)/\sigma_{ROA_{i,t}}$ being $E(ROA_{i,t})$ the expected return on assets, and $\sigma_{ROA_{i,t}}$ its standard deviation.	Refinitiv Eikon
Bank's sovereign debt proxies.			
Sovereign debt holdings	$Sov_{i,t}$	Bank's sovereign debt to total assets ratio.	Bankscope
Sovereign debt weighed by 10-yrs sovereign CDSs	$Sov_{i,t}^{CDS}$	$Sov_{i,t}^{CDS} = Sov_{i,t} \times \frac{CDS_{h,t}}{\sum_{j=1}^{n} CDS_{j,t}}$ being $CDS_{h,t}$ the 10-year sovereign CDS for the country h.	Bankscope & Refinitiv Eikon
Sovereign debt weighed by the Standardized Approach	$Sov_{i,t}^{R}$	$Sov_{i,t}^{R} = Sov_{i,t} \times w_{h,t}$ where $w_{h,t}$ represents the weight given by the Standardized Approach for sovereign debt of country h.	Bankscope & Refinitiv Eikon
Control variables.			
Inefficiency	$Ineff_{i,t}$	The operating costs to gross income ratio.	Bankscope
Leverage	$Lev_{i,t}$	The bank's total assets to total equity ratio.	Bankscope
Profitability	$ROE_{i,t}$	The Return on Equity ratio.	Bankscope
Size	$Size_{i,t}$	Natural logarithm of total assets.	Bankscope
Economic growth	$GDP_{h,t}$	The variation rate of GDP at the country level.	Eurostat

Notes: i, t and h refer to bank, time and country, respectively.

where λ is a correction factor that accounts for the different triggers embedded in the PCAR, which is defined as $\lambda = \frac{1}{1-PCAR}$, where PCAR is the capital adequacy threshold set by the supervisor. Since under the Basel regulation the minimum capital adequacy ratio that banks must maintain is 8%, we take that number as PCAR and obtain the probability of default as follows:

$$P_{i,t}^{CS} = N\left(-\frac{\ln\left(\frac{V_{A_{i,t}}}{\lambda D_{i,t}}\right)+\left(\mu_{i,t}-\frac{\sigma_{A_{i,t}}^2}{2}\right)(T-t)}{\sigma_{A_{i,t}}\sqrt{T-t}}\right) \tag{3}$$

In line with other studies (Crouhy et al., 2000; Vassalou and Xing, 2004; Gharghori et al., 2006), the time to maturity in expressions (1) and (3) is set to one year and the book value of short-term debt plus 50 percent of long-term debt is taken as the default point, $D_{i,t}$.

Finally, although we focus on measures based on market information, we also use the accounting-based Z-index (e.g., Agoraki et al., 2011; Laeven and Levine, 2009; Lepetit and Strobel, 2015; Khan et al., 2017), which is defined as follows:

$$Z_{i,t} = \frac{E(ROA_{i,t}) + \frac{E_{i,t}}{A_{i,t}}}{\sigma_{ROA_{i,t}}} \tag{4}$$

where $E(ROA_{i,t})$ is the expected return on assets, $\sigma_{ROA_{i,t}}$ is the standard deviation of the return on assets, and $E_{i,t}$ and $A_{i,t}$ are the bank's equity and total assets, respectively. The widespread use of Z-index is due to its relative simplicity and because it can be calculated using only accounting information.[4]

2.3. Measuring sovereign debt holding

The first proposal to proxy for the sovereign debt holding is just the proportion of sovereign debt in the bank's assets, regardless of its credit risk. The variable $Sov_{i,t}$ is measured as the sovereign securities to total assets ratio, and proxies for bank i's involvement in public finances at t.

Because a higher risk of such securities could translate into a higher risk of the bank's assets, we propose two additional variables to take into account simultaneously the proportion of sovereign debt and its credit risk. Thus, our second proposal, $Sov^{CDS}_{i,t}$, is calculated by weighting the proportion of sovereign debt in the bank's asset by the weight that the CDSs of this sovereign debt has over the whole sovereign CDSs considered in the sample at time t. That is:

$$Sov^{CDS}_{i,t} = Sov_{i,t} \times \frac{CDS_{h,t}}{\sum_{j=1}^{n} CDS_{j,t}} \tag{5}$$

where $CDS_{h,t}$ is the CDS spread of country h, in which the bank i is located, at time t, and n is the number of Eurozone sovereign issuers included in the sample at t.

Our third proposal, $Sov^{R}_{i,t}$, consists of using the weighting contained in the Standardized Approach of Basel II to calculate credit risk-weighted assets. Basel II introduced, among other novelties, the substitution of the zero weight for sovereign debt for different weights depending on the credit rating of said debt.

Using these last two proposals for weighting sovereign debt holdings by credit risk, we are in line with the Basel regulation's proposal to reflect the credit risk of the sovereign issuer, without regarding sovereign debt as a risk-free asset by default.

2.4. Model

We base our empirical strategy on the Arellano and Bond (1991)'s GMM estimation of the following model:

$$y_{it} = \alpha + \beta y_{i,t-1} + \delta S_{i,t-1} + X'_{i,t-1}\Gamma + \mu_i + \nu_{i,t} \tag{6}$$

where i and t represent the bank and the period, respectively.

The dependent variable ($y_{i,t}$) measures banks' credit risk and is calculated by using alternative indicators: the BSM measure ($P^{BSM}_{i,t}$), the Chan-Lau and Sy's measure ($P^{CS}_{i,t}$) as a derivation of the former, and the Z-index. We use the opposite of the Z-index ($\check{Z}_{i,t}$) to allow the estimates to be easily comparable.

As for the variable of interest $S_{i,t}$, which represents our banks' sovereign debt proxy, we use alternatively the three variables defined in Section 2.3: $Sov_{i,t}$, $Sov^{CDS}_{i,t}$ and $Sov^{R}_{i,t}$. We include the one-period-lagged regressors to avoid endogeneity issues.

The matrix $X'_{i,t-1}$ is a set of control variables that includes bank characteristics such as the inefficiency ratio ($Ineff_{i,t}$); the bank's leverage ratio ($Lev_{i,t}$); the return on equity ($ROE_{i,t}$) and the bank's size ($Size_{i,t}$). Additionally, to control for business cycle effects, we include $GDP_{h,t}$, which represents the quarterly variation rate of the gross domestic product for country h.

3. Results

Table 2 offers the results when the banks' credit risk is proxied by the BSM measure and Tables 3 and 4 display the estimations using the Chan-Lau and Sy's probability and the Z-index[5] as a proxy of bank's credit risk, respectively. We observe that the coefficient of the lagged dependent variable in all models is positive and significant, which suggests that the probability of default is persistent over time. Estimates on the non-weighted sovereign debt variable $Sov_{i,t-1}$ are expectedly negative and significant. Consequently, this result suggests that increases in sovereign debt holdings imply lower levels of default risk. Regarding the coefficients associated with risk-weighted sovereign debt ($Sov^{CDS}_{i,t-1}$ and $Sov^{R}_{i,t-1}$), they are positive and significant in Tables 2 and 3, supporting the idea that holding sovereign debt can increase default risk if this debt is relatively risky. These relationships remain broadly similar under the two market-based measures of bank credit risk. This similarity might be expected since Chan-Lau and Sy's measure is a derivation of the BSM measure and the distance-to-capital differs only from the distance-to-default in $\frac{ln(\lambda)}{\sigma_{A_{i,t}}\sqrt{T-t}}$. Regarding the Z-index, we observe that the relationships between this variable and risk-weighted sovereign debt measures are not significant (Table 4). This exception may perhaps be because the Z-index measure, based uniquely on accounting data, does not relate to the nature of market risk associated with CDS and credit rating as clearly as market-based measures of bank credit risk do. Remarkably, although some of the control variables might not be statistically significant, we hold them for coherence with previous research.

[4] The NPL ratio has also been widely used in the literature as an indicator of a bank's strength as it reflects the quality of its loan portfolio. Nonetheless, we do not use this indicator since we attempt to measure the comprehensive banks' credit risk, and this ratio represents the risk of only a portion of the bank's credit portfolio. What is more, the NPL ratio could have a more complex relationship with sovereign debt holding. Indeed, Boumparis et al. (2019) find a bidirectional relationship between sovereign credit ratings and NPLs.

[5] We drop $ROE_{i,t-1}$ from the regression to avoid endogeneity issues with the dependent variable $\check{Z}_{i,t-1}$.

Table 2
The impact of banks' sovereign debt holdings on the Black–Scholes–Merton probability of default. This table displays the results when one-period-lagged banks' sovereign securities ($Sov_{i,t-1}$) and the risk incorporated to sovereign securities are regressed against the Black–Scholes–Merton probability of default ($P_{i,t}^{BSM}$) as the dependent variable. Quarterly observations for Eurozone listed banks are applied from 2008Q1 to 2016Q4 in all specifications. The estimations are conducted using the Arellano and Bond (1991) GMM estimator. The set of instruments includes $t-2$, $t-3$, and $t-4$ lagged variables. Overall significance is tested using the Wald test under the null that the whole set of regressors are simultaneously equal to zero. Instrument validity is tested using the Sargan test and serial correlations tests (*p-values*). Column (1) shows the baseline regression, column (2) incorporates the sovereign debt holding ($Sov_{i,t-1}$), and columns (3) and (4) include contribution of the 10-year sovereign CDS for each country to sovereign debt securities ($Sov_{i,t-1}^{CDS}$) and the contribution of country ratings to banks' securities ($Sov_{i,t-1}^{R}$), respectively. Standard errors are presented in parenthesis and clustered at the country level. Estimates followed by *, **, *** are statistically significant at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
$P_{i,t-1}^{BSM}$	0.443***	0.589***	0.672***	0.770***
	(0.059)	(0.106)	(0.073)	(0.138)
$Sov_{i,t-1}$		−0.729***		
		(0.117)		
$Sov_{i,t-1}^{CDS}$			0.975*	
			(0.536)	
$Sov_{i,t-1}^{R}$				1.718**
				(0.736)
$Lev_{i,t-1}$	0.141	1.116	−0.506	−1.527
	(0.639)	(0.750)	(0.515)	(1.263)
$Inef f_{i,t-1}$	0.236**	0.103*	0.144*	0.334*
	(0.103)	(0.057)	(0.087)	(0.172)
$ROE_{i,t-1}$	0.176	0.207	−0.055	0.126
	(0.272)	(0.273)	(0.117)	(0.114)
$Size_{i,t-1}$	0.027*	−0.021	0.076**	0.001
	(0.016)	(0.026)	(0.031)	(0.035)
$GDP_{h,t-1}$	−3.220***	−2.037**	−1.869***	−0.308
	(0.602)	(0.856)	(0.636)	(1.673)
Wald test (*p-value*)	0.000	0.000	0.000	0.000
Sargan test (*p-value*)	0.426	0.529	0.163	0.355
m_2	0.486	0.490	0.761	0.904
m_3	0.299	0.349	0.358	0.500

Table 3
The impact of banks' sovereign debt holdings on the Chan-Lau and Sy (2006)'s probability of default. This table displays the results when one-period-lagged banks' sovereign securities ($Sov_{i,t-1}$) and the risk incorporated to sovereign securities are regressed against the Chan-Lau and Sy (2006)'s probability of default ($P_{i,t}^{CS}$) as the dependent variable. Quarterly observations for Eurozone listed banks are applied from 2008Q1 to 2016Q4 in all specifications. The estimations are conducted using the Arellano and Bond (1991) GMM estimator. The set of instruments includes $t-2$, $t-3$, and $t-4$ lagged variables. Overall significance is tested using the Wald test under the null that the whole set of regressors are simultaneously equal to zero. Instrument validity is tested using the Sargan test and serial correlations tests (*p-values*). Column (1) shows the baseline regression, column (2) incorporates the sovereign debt holding ($Sov_{i,t-1}$), and columns (3) and (4) include contribution of the 10-year sovereign CDS for each country to sovereign debt securities ($Sov_{i,t-1}^{CDS}$) and the contribution of country ratings to banks' securities ($Sov_{i,t-1}^{R}$), respectively. Standard errors are presented in parenthesis and clustered at the country level. Estimates followed by *, **, *** are statistically significant at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
$P_{i,t-1}^{CS}$	0.432***	0.630***	0.717***	0.849***
	(0.147)	(0.152)	(0.113)	(0.166)
$Sov_{i,t-1}$		−0.476***		
		(0.101)		
$Sov_{i,t-1}^{CDS}$			0.889*	
			(0.471)	
$Sov_{i,t-1}^{R}$				1.445**
				(0.639)
$Lev_{i,t-1}$	0.353	0.072	−0.595	−1.672
	(0.326)	(0.599)	(0.444)	(1.090)
$Inef f_{i,t-1}$	0.075*	0.066	0.073	0.302**
	(0.040)	(0.076)	(0.092)	(0.142)
$ROE_{i,t-1}$	0.038	0.142	−0.105	0.065
	(0.370)	(0.220)	(0.075)	(0.094)
$Size_{i,t-1}$	0.068	0.003	0.059**	−0.010
	(0.071)	(0.023)	(0.027)	(0.031)
$GDP_{h,t-1}$	−2.435*	−1.786*	−1.146**	−0.118
	(1.345)	(1.077)	(0.577)	(1.275)
Wald test (*p-value*)	0.000	0.000	0.000	0.000
Sargan test (*p-value*)	0.294	0.224	0.109	0.123
m_2	0.616	0.358	0.573	0.827
m_3	0.400	0.370	0.202	0.358

Table 4
The impact of banks' sovereign debt holdings on the Z-index. This table displays the results when one-period-lagged banks' sovereign securities ($Sov_{i,t-1}$) and the risk incorporated to sovereign securities are regressed against the opposite of the Z-index ($\check{Z}_{i,t}$) as the dependent variable. Quarterly observations for Eurozone listed banks are applied from 2008Q1 to 2016Q4 in all specifications. The estimations are conducted using the Arellano and Bond (1991) GMM estimator. The set of instruments includes $t-2$, $t-3$, and $t-4$ lagged variables. Overall significance is tested using the Wald test under the null that the whole set of regressors are simultaneously equal to zero. Instrument validity is tested using the Sargan test and serial correlations tests (*p-values*). Column (1) shows the baseline regression, column (2) incorporates the sovereign debt holding ($Sov_{i,t-1}$), and columns (3) and (4) include contribution of the 10-year sovereign CDS for each country to sovereign debt securities ($Sov^{CDS}_{i,t-1}$) and the contribution of country ratings to banks' securities ($Sov^{R}_{i,t-1}$), respectively. Standard errors are presented in parenthesis and clustered at the country level. Estimates followed by *, **, *** are statistically significant at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
$\check{Z}_{i,t-1}$	0.802***	0.725***	0.894***	0.911***
	(0.052)	(0.052)	(0.033)	(0.108)
$Sov_{i,t-1}$		−3.193***		
		(1.147)		
$Sov^{CDS}_{i,t-1}$			−3.342	
			(2.711)	
$Sov^{R}_{i,t-1}$				−0.755
				(1.683)
$Lev_{i,t-1}$	−7.222	−4.106	9.064	−0.995
	(6.428)	(4.340)	(6.014)	(9.085)
$Inef f_{i,t-1}$	−0.217	−0.207	0.396	0.555
	(1.909)	(1.653)	(1.973)	(2.028)
$Size_{i,t-1}$	−0.042	−0.040	−0.011	−0.019
	(0.060)	(0.049)	(0.107)	(0.055)
$GDP_{h,t-1}$	−9.611***	−4.369***	−5.258**	−7.345**
	(2.843)	(1.681)	(2.103)	(3.464)
Wald test (*p-value*)	0.000	0.000	0.000	0.000
Sargan test (*p-value*)	0.540	0.925	0.909	0.469
m_2	0.299	0.871	0.867	0.174
m_3	0.260	0.911	0.275	0.561

These results point to the intuition that sovereign debt might have repercussions for banks' default risk. The holding of this asset on the balance sheet *per se* does not impair their level of risk; on the contrary, this asset can be seen as safe, and therefore it reduces the level of risk. However, the consideration of the risk associated with maintaining this asset does produce a significant deterioration in the bank's default risk. Moreover, we can state that this relationship holds specially when considering market-based measures of credit risk.

The results for this somewhat turbulent sample period, coinciding with the financial crisis, the sovereign debt crisis and the Basel regulatory changes, are within expectations and allow us to consider sovereign debt as a risk-free asset, but moderating this approach as it becomes necessary to take into account the associated risk.

4. Conclusions

This paper examines the role of holding sovereign debt as a determinant for banks' credit risk on the Eurozone banking system. The Eurozone is a relevant benchmark for investigating processes of sovereign debt exposures and their consequences for the banking crisis over the last decade. We find that holding sovereign debt improves the level of banks' credit risk, but this event is reversed when considering the risk associated with that debt in terms of the forward-looking credit-risk barometer. Although our backward-looking indicator reflects the fact of holding of sovereign debt, it fails to capture the transmission of the risk induced by sovereign securities on banks' credit risk. Thus, our results are sensitive to the credit-risk measure.

Our findings have several implications. In particular, we find evidence that sovereign debt cannot be considered a true risk-free asset overall. We show that moderating the amount of debt by its credit risk provides a truer picture of the essence of this asset. The results confirm the line initiated by regulators trying to incorporate sovereign debt's risk into capital requirements. Interestingly, the results determine the role of sovereign debt in financial stability through its impact on bank credit risk, and, therefore, feeding the "doom loop" effect. As long as holding sovereign debt might provoke changes in future credit risk, trying to advance along these lines should be on policy makers' agenda.

CRediT authorship contribution statement

Isabel Abinzano: Conceptualization, Methodology, Software, Formal analysis, Writing – original draft, Supervision. **Pilar Corredor:** Conceptualization, Formal analysis, Methodology, Validation, Writing – original draft, Supervision, Funding acquisition. **José Manuel Mansilla-Fernández:** Conceptualization, Data curation, Methodology, Software, Formal analysis, Writing – original draft.

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