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Abstract

We analyze domestic, foreign, and central banks holdings of public debt for 31 countries for the period of 1989-2022, applying panel regressions and quantile analysis. We conclude that an increase in sovereign risk raises the share of domestic banks' portfolio of public debt and reduces the percentage holdings in the case of central banks. Better sovereign ratings also increase (decrease) the share of commercial (central) banks' holdings. Furthermore, the effects of an increment in the risk for domestic investors have increased since the 2010 financial crisis.

JEL-Codes: C210, E580, G240, G320, H630.

Keywords: banking, sovereign debt, sovereign risk, financial crisis, ratings.

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1. Introduction

Sovereign debt represents a crucial instrument through which governments finance budget imbalances, and their operations, infrastructure projects, and several other public services. In line with this, economists have sought to understand how the accumulation of debt by governments can either stimulate economic growth or hinder it. Optimal debt levels represent a fundamental concept within this context, i.e., identifying the ideal level of sovereign debt that maximizes economic growth and minimizes risk (see the discussion of the effects of government debt in economic growth in Afonso et al., 2013; Alves and Afonso, 2015; Eberhardt and Presbitero, 2015, among others). Therefore, the level of sovereign indebtedness and the composition of the debt holders in the sovereign debt market can significantly impact a nation's economic growth trajectory, financial stability, and overall fiscal resilience.

However, the holding of public debt by various economic agents, namely banks, entails a series of macroeconomic risks and uncertainties. Although sovereign debt can be considered a safe haven asset, the increasing of sovereign risks can pressure notably commercial banks to change their holding composition over time. For instance, changes in the political and economic climate can lead banks to reassess the risk-return trade-off associated with sovereign debt and reallocate their assets accordingly.

Since 2015, the European Central Bank has raised its holdings of public debt, buying close to EUR 2 trillion in government bonds of Eurozone countries (Haan et al. 2021). This important increase of ECB holdings was part of a comprehensive program of Quantitative Easing (QE), which included the purchase of bonds issued by euro area governments, agencies, and European institutions with the objective of moderating the downside of the economic cycle, address low inflation, keeping low interest rates, thereby creating conditions to foster economic growth.

For the US and the UK, the increasing intervention of the Federal Reserve Bank and the Bank of England started earlier, as central banks increased their share of public debt while domestic banks reduced their holdings since 2010. Central banks' intervention has changed the configuration of the sovereign debt holdings, as in 2020, in the outburst of the health pandemic, when central banks' holdings surpassed the domestic holds, as a share of total outstanding sovereign debt, per country, which is in line with Fang et al. (2023).

The decisions made by banks in response to sovereign risk developments can have profound implications for the overall stability of financial markets and the effectiveness of monetary policy (Dell'Ariccia et al., 2014). This is justified by the fact that sovereign debt risk encompasses the potential for defaults, credit rating downgrades, and market volatility, all of which can lead to significant losses for financial institutions (De Marco, 2019). To the best of our knowledge, there is no specific study analyzing the impact of sovereign risk on banks' holdings of sovereign debt.

Therefore, we contribute to the literature by examining the composition of bank holdings of sovereign debt and the intricate interplay between sovereign debt risks and banks' portfolio decisions. By drawing upon empirical evidence and theoretical insights, we seek to elucidate how sovereign risks influence banks' portfolios of public debt and, in turn, how these changes impact financial markets and the broader economy.

Section 2 presents the data and the methodology. Section provides our empirical analysis. Section 4 concludes.

2. Data and Methodology

We use data from 31 economies, spanning the period from 1989 to 2022. The countries included in the analysis are Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, the United Kingdom, and the United States. The selection of these countries is dictated by the data availability.

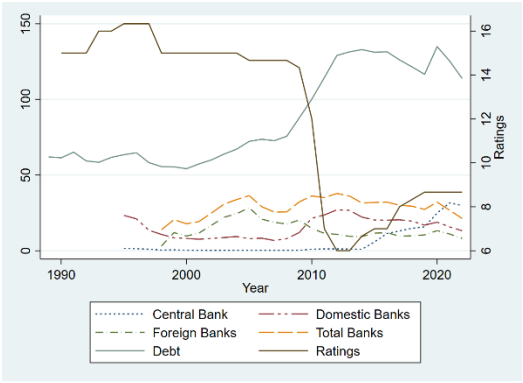
The key independent variable is the sovereign risk, which is proxied by the *sovereign credit default swaps* (*CDS*) with maturities of 5 years, *CDS spreads* against the United States, *the 10-year bond yields*, and *bond yield spreads* against the United States. All of these variables are used as natural logarithms. Data for these variables are sourced from the World Bank Database and the AMECO data warehouse.

The key dependent variable in this study is the investor holdings of general government debt as percentage of GDP. The investor base is grouped into four classes: central banks, domestic commercial banks, foreign commercial banks, and total commercial banks. The data are retrieved from Arslanalp and Tsuda (2014). We incorporate several control variables. From the World Bank, we use the logarithm of the

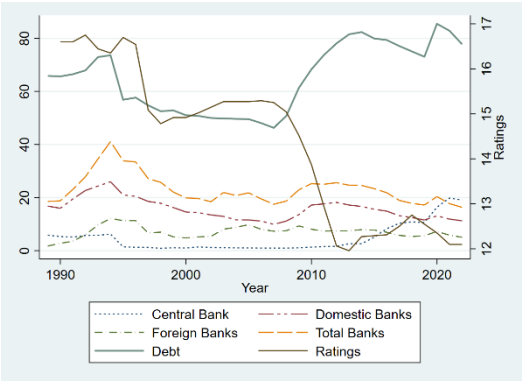
average of the 360-day volatility of the national stock market index *(VOL)* to capture international market-related volatility, and the inflation rate *(inflation*).

Figure 1 shows that, for instance, the relative holdings of Portuguese domestic sovereign bonds increased during this period. This is possibly justified by governments formally or informally expected the financial sector to absorb new issues of debt as sovereign risk rises, at below-market interest rates, a phenomenon known as financial repression (Shaw, 1973, and McKinnon, 1973). Moreover, in response to the global financial crisis, economies increased government debt, which created general economic stress, fall in tax revenues and bank-credit availability (Becker et al., 2018). During this period, rating agencies revised their sovereign ratings downward globally (Figure 1). After these downgrades, sovereign credit ratings remained at lower levels compared to pre-crisis ratings. Contrarily, Figure 1 graphically shows that foreign banks seem to have reduced their share of public debt during the turmoil period, especially in Europe.

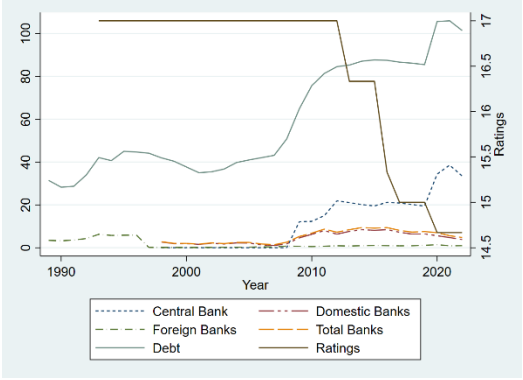
Figure 1: Sovereign Debt Composition (% of GDP)



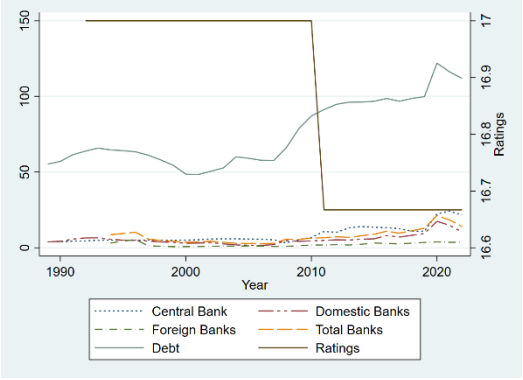
Panel A: Portugal



Panel B: Eurozone



Panel C: UK



Panel D: US

Source: Authors' calculations.

In addition, Figure 1 illustrates the dynamics of bank holdings' composition over the last three decades. We can see that before the Global and Financial Crisis (GFC) the domestic and central banks holdings of sovereign debt (% of GDP) were relatively stable. However, after the GFC, the share of government debt held by the banking sector of Eurozone economies increased substantially, which was not seen since the start of the Economic and Monetary Union. Particularly, banks from stressed economies such as Portugal, had the largest holdings of sovereign debt (Molyneux et al., 2021).

Moreover, we also include the logarithm of the *real effective exchange rate (reer)* to capture credit risk arising from general macroeconomic imbalances. Therefore, a rise (decrease) in *reer* indicates real exchange rate appreciation (depreciation), which is projected to increase (decrease) spreads, as theoretically supported by Arghyrou and Tsoukalas (2011) and Afonso et al. (2015). Data for this variable in the form of 1 USD = *x* National currency and was retrieved from the IMF's IFS. Additionally, we added the three-month *short-term interest rate (interest rat*e) obtained from the OECD; the *output gap (output gap)* computed as actual GDP less potential GDP, as a percent of potential GDP, collected from the IMF; the logarithm of the sovereign credit ratings *(Ratings)* retrieved from Thomson Reuters Datastream following the linear 17's scale approach of Afonso et al. (2014)[4]. The descriptive statistics of the abovementioned variables are presented in Table A1, in the Appendix.

For testing the annual relationship between the sovereign debt holding and the risk that governments face, we estimate equation (1):

$$Debt_{i,t,k} = \alpha_0 + \beta_1 . risk_{i,t,n} + \beta_2 . X_{i,t} + \phi_i + \eta_t + \varepsilon_{i,t} \quad (1)$$

where $Debt_k$ represents the debt holdings by each type of *k* banks, where *k* is domestic, foreign, total (the sum of debt hold by domestic and foreign) and central banks, $risk_n$ is each type of risk *n*, where *n* is CDS, CDS spreads, bond yields, and bond spreads, X are the set of the abovementioned control variables, ϕ and η are the country (*i*) and time (*t*) specific effects and ε is the error term. Equation (1) is estimated employing a fixed-effect panel data approach for each bank type. Moreover, standard errors are corrected for heteroskedasticity and serial correlation. Additionally, we estimate equation (1) using

[4] This approach categorizes qualitative ratings from Moody's, Standard & Poor's, and Fitch rating agencies on a scale from 1 (low quality) to 17 (high quality). The overall measure is the simple average of the sovereign credit ratings of these three rating agencies for each country.

Machado and Santos Silva (2019) quantile regression approach to assess possible non-linear relationships between debt holders composition and sovereign risks[5].

3. Empirical Analysis

To understand the impact of debt risk on the composition of banks' portfolios, Table 1 provides the results for the considered bank types. From Table 1, we can see that the effect of sovereign risk on domestic banks holdings of sovereign debt is significantly positive. This result is particularly relevant as national banks have played a crucial role in supporting government debt during stressful periods. The participation of these banks could be justified by a home bias effect that push national banks to play a key role in financing their own governments. We argue that this could come from local information advantages, political pressures, funding relative reasons, direct government ownership, and, lastly, the influence of executive boards by politicians (Becker et al. 2018). Additionally, the accumulation of own country debt may be associated with their attitude toward risk. When risk is high, banks from stressed economies may accumulate sovereign debt, especially if their capital requirements are low (Buch et al., 2016; Ongena et al. 2019).

Foreign banks also increase their demand for other countries public debt when the risk measures increase, with the only exception of bond yields. This could be justified by banks being increasingly international and may be subject to the same conditions as national banks. Not surprisingly, the only exception are Central Banks, with bond yields impinging negatively of their holdings of sovereign debt. This suggests that Central Banks in the past may have moved away from public debt securities when the risk increases.

Another interesting result is that an increase in the interest rate reduces the domestic banks debt holding but increases central bank participation. Further, an increase in the ratings of a given nation leads to an increase in the increase in the portfolio of domestic banks and foreign banks but leads to a reduction in the case of the Central Banks. This can be justified by the fact that possibly Central Banks do not "step in" as much in the secondary market when ratings increase. Lastly, we observe that an appreciation in

[5] For more details see the xtqreg package in STATA. Moreover, we only show the CDS Spread as a proxy of risk in the quantile regression results. The results regarding the remaining risks are also available on request.

the US dollar would increase the sovereign risk and reduce the domestic participation of banks in the public debt market, and contrarily, it would increase the central banks holdings.

Table 1: Panel results for sovereign debt bank holdings, by type.

	Domestic Banks				Central Banks			
	CDS	CDS spreads	Bond yields	Bond spreads	CDS	CDS spreads	Bond yields	Bond spreads
Risk Key variable	2.838***	1.183**	5.289***	1.107***	-0.255	-0.694	-3.280**	-0.237
	(0.929)	(0.572)	(0.630)	(0.362)	(0.939)	(0.713)	(1.650)	(0.216)
Inflation	-0.037	0.007	-0.041	0.161***	-0.051	-0.052	-0.014	0.026
	(0.029)	(0.054)	(0.044)	(0.060)	(0.048)	(0.079)	(0.075)	(0.022)
Interest rate	-0.615	-1.936	-0.922***	-0.580**	5.644***	5.163**	1.093**	0.091
	(0.533)	(1.181)	(0.239)	(0.227)	(1.380)	(2.063)	(0.443)	(0.137)
Output gap	-0.233	-0.594*	-0.119	-0.096	0.345	0.722	0.254	0.094
	(0.205)	(0.312)	(0.143)	(0.161)	(0.324)	(0.448)	(0.166)	(0.102)
Ratings	6.100***	3.907	5.055**	5.184**	-1.823	-4.991	-5.511**	1.124
	(2.257)	(3.285)	(1.987)	(2.109)	(2.916)	(3.687)	(2.467)	(1.137)
Vol	3.715	-3.331	-0.585	0.396	-1.923	0.499	-0.320	-0.248
	(2.260)	(3.202)	(1.209)	(1.326)	(3.071)	(4.281)	(1.278)	(0.891)
Reer	-11.446	-11.065	-1.936	5.369**	12.252	45.310**	13.558***	13.285***
	(7.748)	(14.431)	(3.538)	(2.702)	(11.009)	(22.556)	(4.829)	(3.336)
Constant	-21.752*	-4.079	-12.103	-8.385	1.147	47.385*	23.501**	4.677
	(11.122)	(20.346)	(7.638)	(8.427)	(15.734)	(26.540)	(9.370)	(4.785)
Obs.	323	161	518	254	323	161	520	253
R-squared	0.894	0.926	0.849	0.830	0.805	0.807	0.751	0.739
	Foreign Banks				Total Banks			
	CDS	CDS spreads	Bond yields	Bond spreads	CDS	CDS spreads	Bond yields	Bond spreads
Risk Key variable	1.387***	0.437*	0.006	0.540**	4.225***	1.620***	5.110***	1.705***
	(0.519)	(0.244)	(0.440)	(0.239)	(1.128)	(0.606)	(0.852)	(0.502)
Inflation	-0.006	-0.029	-0.000	0.028	-0.043	-0.022	-0.037	0.232***
	(0.016)	(0.029)	(0.020)	(0.037)	(0.035)	(0.067)	(0.047)	(0.074)
Interest rate	0.081	0.366	-0.329	-0.438	-0.534	-1.570	-1.234***	-0.968**
	(0.231)	(0.328)	(0.204)	(0.307)	(0.594)	(1.079)	(0.316)	(0.419)
Output gap	-0.076	-0.089	-0.127	-0.163	-0.309	-0.683	-0.254	-0.305
	(0.157)	(0.229)	(0.116)	(0.153)	(0.282)	(0.462)	(0.208)	(0.264)
Ratings	14.396***	10.250***	12.422***	13.495***	20.497***	14.157***	15.662***	15.702***
	(2.019)	(2.563)	(1.624)	(1.864)	(3.155)	(4.977)	(2.976)	(3.484)
Vol	-2.725**	-2.597	-0.717	0.988	0.990	-5.928	-1.495	0.434
	(1.085)	(1.813)	(0.872)	(0.975)	(2.564)	(3.966)	(1.624)	(1.820)
Reer	1.742	1.535	-0.046	-0.975	-9.704	-9.530	-2.785	1.583
	(1.803)	(3.195)	(1.411)	(1.980)	(7.549)	(13.473)	(4.074)	(3.951)
Constant	-31.939***	-20.428*	-28.519***	-37.937***	-61.119***	-24.507	-36.973***	-35.904***
	(8.269)	(11.527)	(6.691)	(6.299)	(14.751)	(25.306)	(10.583)	(11.587)
Obs.	321	161	495	234	321	161	480	224
R-squared	0.863	0.836	0.785	0.864	0.876	0.905	0.845	0.882

Notes: *, **, and *** represent statistical significance at levels of 10%, 5% and 1%, respectively (robust standard errors in brackets). *Key variable* represents the risk measure for the independent variable labelled at the top row of each regression.

Table 2 presents the panel results for debt holders after and before the subprime crisis in 2010. Following the start of the GFC, domestic banks reinforce their share of public debt as risk increases (evidence consistent with Ongena et al., 2019). These buys of national government debt by domestic banks could help reduce financial instability and stabilize yields and spreads. However, this connection might have a less positive outcome, which is the increase in the systematic risk that banks face by increasing the risk of banks' balance sheets. This situation can risk leading to a sovereign bank doom loop, which is well documented in the literature (see for example Brunnermeier et al.,

2016, and Soenen and Vennet, 2022). Interestingly, the effect of interest rate on debt holding of these banks increased after the crisis. For instance, the estimated magnitude of the coefficient of the interest rate, for domestic banks, when the risk key variable of interest is bond yields, more than doubled after the crisis, -0.721 before and -2.564 after the crisis), which is an indicator that the impact of sovereign financing of government increased after 2010. For central banks, this impact is higher before the crisis (and no statistically significant after the GFC).

Regarding foreign banks, the results show that interest rates have no longer a negative impact on the composition of their portfolios and they began to increase their share after the GFC. Nevertheless, sovereign ratings and exchange rates went from influencing these banks to reduce their percentage of public debt in their portfolios to increasing it after the crisis (Keyser and Paczos, 2023), notably when considering bond yields as the key risk variable.

In order to understand how the dynamics of holding public debt change depending on its share in banks' portfolios, Table 3 shows the results of the quantile regression estimations for the four types of investors analyzed. What can be seen is that risk has less impact on public debt holdings as the percentage of public debt held by domestic investors and total banks increases, but more impact on central banks who hold higher shares. Nevertheless, the impact of risk is still symmetric for these banks, being positive for domestic banks and negative for central banks.

Furthermore, the output gap negatively impacts the shareholding of domestic and total banks and positively the central banks, especially for those who have higher levels of debt in their portfolios. Lastly, better credit risk assessment by rating agencies seem to attract foreign banks who are more invested in public debt and to repel central banks from such holdings. Market volatility is relevant for domestic and total banks, as more unstable periods push away these investors from holding more sovereign debt in their portfolios, a non-linear result that was not perceived from the previous overall panel.

Table 2 . Panel results for sovereign debt bank holdings, by type, before and after 2010.

	Domestic Banks								*Central Banks*							
	Prior 2010				*After 2010*				*Prior 2010*				*After 2010*			
	CDS	CDS spreads	Bond yields	Bond spreads	CDS	CDS spreads	Bond yields	Bond spreads	CDS	CDS spreads	Bond yields	Bond spreads	CDS	CDS spreads	Bond yields	Bond spreads
Risk Key variable	-0.500	11.925	4.464*	0.168	2.940**	1.023*	5.177***	0.887	-0.830	-0.819	-4.971***	-0.275	0.908**	0.055	-1.153	0.078
	(1.175)	(0.000)	(2.641)	(0.359)	(1.182)	(0.596)	(0.840)	(0.542)	(1.096)	(0.761)	(1.750)	(0.449)	(0.353)	(0.086)	(0.832)	(0.132)
Inflation	-0.070	-12.784	-0.027	-0.034	-0.022	-0.033	-0.027	0.090	-0.018	0.032	0.003	0.011	0.033	0.070	0.036	0.167
	(0.135)	(0.000)	(0.085)	(0.056)	(0.026)	(0.062)	(0.040)	(0.075)	(0.039)	(0.098)	(0.066)	(0.047)	(0.070)	(0.097)	(0.064)	(0.175)
Interest rate	0.635	7.945	-0.721**	-0.290	-2.338*	-5.288***	-2.564***	1.641	4.412*	10.087***	3.831*	-0.375	-0.027	0.014	0.096	-0.038
	(1.484)	(0.000)	(0.304)	(0.246)	(1.251)	(1.996)	(0.915)	(1.328)	(2.275)	(3.523)	(1.971)	(0.971)	(0.661)	(0.143)	(0.081)	(0.081)
Output gap	-0.206	5.807	-0.138	-0.148	-0.104	-0.381	-0.182	-1.011	-0.234	-0.245	-0.209	0.121	-0.021	-0.045	0.007	-0.001
	(0.299)	(0.000)	(0.144)	(0.128)	(0.286)	(0.417)	(0.338)	(0.645)	(0.363)	(0.438)	(0.499)	(0.455)	(0.141)	(0.053)	(0.034)	(0.047)
Ratings	16.738	101.471	26.126	3.378	5.167	3.891	5.886*	11.167**	-4.369	-1.729	-7.353**	-2.548	0.157	0.727	-4.826	4.494
	(24.814)	(0.000)	(20.436)	(18.305)	(3.246)	(3.997)	(3.199)	(5.344)	(3.786)	(3.854)	(3.339)	(3.281)	(7.183)	(4.932)	(4.313)	(6.471)
Vol	3.011	-69.050	-0.619	-1.004	1.410	-0.711	3.216	8.617*	-5.264	-2.763	-6.033	-5.869	-0.907	0.478	0.406	0.626*
	(2.940)	(0.000)	(1.196)	(1.129)	(2.453)	(3.029)	(2.403)	(4.363)	(4.165)	(4.167)	(4.052)	(4.167)	(0.783)	(0.318)	(0.276)	(0.377)
Reer	-11.505	-95.931	2.786	4.786*	-14.930	-19.237	-14.508**	1.480	30.207	57.776**	24.365	-5.478	-1.572	3.979	3.209	3.123
	(10.009)	(0.000)	(3.326)	(2.862)	(12.734)	(15.915)	(7.282)	(9.853)	(24.962)	(27.816)	(16.944)	(8.512)	(4.847)	(3.333)	(3.105)	(3.385)
Constant	-49.778	-5.114	-71.243	0.805	-21.564	-7.545	-26.456**	-59.637**	35.477	44.849	53.184***	35.562*	8.357	3.233	19.761	-8.941
	(74.538)	(69.195)	(61.291)	(53.854)	(15.786)	(20.026)	(12.594)	(25.346)	(22.938)	(27.493)	(17.455)	(19.841)	(19.880)	(14.010)	(12.486)	(18.849)
Obs.	100	232	291	162	223	141	227	92	223	141	227	92	100	226	293	161
R-squared	0.964	0.845	0.897	0.896	0.919	0.930	0.934	0.906	0.855	0.843	0.845	0.868	0.940	0.792	0.901	0.767

	Foreign Banks								*Total Banks*							
	Prior 2010				*After 2010*				*Prior 2010*				*After 2010*			
	CDS	CDS spreads	Bond yields	Bond spreads	CDS	CDS spreads	Bond yields	Bond spreads	CDS	CDS spreads	Bond yields	Bond spreads	CDS	CDS spreads	Bond yields	Bond spreads
Risk Key variable	0.819	0.687*	4.592**	0.860*	1.688***	0.710***	0.430	0.201	4.628***	1.734***	5.608***	1.088	0.319	0.545	6.322*	0.493
	(0.704)	(0.355)	(1.953)	(0.442)	(0.483)	(0.196)	(0.295)	(0.260)	(1.478)	(0.646)	(0.867)	(0.729)	(1.348)	(0.508)	(3.746)	(0.679)
Inflation	-0.034	0.865	-0.041	0.664	-0.005	0.012	0.001	0.038	-0.026	-0.021	-0.026	0.128	-0.105	0.477	-0.084	0.155
	(0.050)	(0.624)	(0.040)	(0.403)	(0.011)	(0.032)	(0.013)	(0.038)	(0.028)	(0.073)	(0.044)	(0.107)	(0.171)	(0.731)	(0.162)	(0.843)
Interest rate	-0.895	-1.752***	-1.010***	-1.193***	0.596**	0.775*	0.826**	1.900**	-1.742	-4.513**	-1.738*	3.541*	-0.259	-2.792***	-1.809***	-1.673***
	(0.544)	(0.607)	(0.299)	(0.380)	(0.270)	(0.452)	(0.331)	(0.880)	(1.363)	(2.043)	(1.048)	(2.093)	(1.736)	(0.672)	(0.502)	(0.513)
Output gap	-0.111	-0.741***	-0.334**	-0.413**	-0.180	-0.360	-0.214	-0.306	-0.284	-0.741	-0.396	-1.317	-0.318	-0.476	-0.395*	-0.420*
	(0.185)	(0.274)	(0.153)	(0.171)	(0.162)	(0.225)	(0.164)	(0.368)	(0.378)	(0.573)	(0.440)	(0.971)	(0.377)	(0.378)	(0.231)	(0.243)
Ratings	-2.585	-22.216	-23.658*	-17.941	6.268**	7.584**	4.520*	8.579**	11.434**	11.475*	10.407*	19.746**	14.154	-54.671*	-21.343	-55.106**
	(9.584)	(18.227)	(14.169)	(12.586)	(2.894)	(3.155)	(2.698)	(3.485)	(5.742)	(6.792)	(5.542)	(8.661)	(28.796)	(32.656)	(30.006)	(27.542)
Vol	-0.030	-2.168	-1.139	0.667	-1.036	-2.579	-2.027*	1.365	0.374	-3.291	1.189	9.982	2.981	-3.311	-1.841	-1.596
	(1.326)	(1.646)	(1.190)	(1.031)	(0.955)	(1.676)	(1.138)	(2.391)	(2.792)	(3.916)	(2.878)	(6.074)	(3.180)	(2.073)	(1.627)	(1.550)
Reer	1.782	-9.993***	-6.743***	-4.135	2.813	2.412	3.842*	4.670	-12.118	-16.826	-10.666	6.150	-9.723	-3.021	-5.382	-2.784
	(3.621)	(3.653)	(2.561)	(2.968)	(1.857)	(2.922)	(1.971)	(5.172)	(12.365)	(14.859)	(7.471)	(13.219)	(11.844)	(5.625)	(4.672)	(4.629)
Constant	7.999	82.621	70.171	56.040	-18.765*	-15.039	-5.288	-28.089*	-40.329*	-22.584	-31.744	-87.726**	-48.072	181.739*	68.813	174.720**
	(28.937)	(53.989)	(42.942)	(36.743)	(10.757)	(12.295)	(9.485)	(15.594)	(23.627)	(27.973)	(20.036)	(38.830)	(88.796)	(95.200)	(88.165)	(80.153)
Obs.	98	204	268	142	223	141	227	92	223	141	227	92	98	196	253	132
R-squared	0.980	0.876	0.868	0.934	0.835	0.853	0.823	0.910	0.902	0.910	0.908	0.905	0.970	0.921	0.921	0.958

Notes: *, **, and *** represent statistical significance at levels of 10%, 5% and 1%, respectively (robust standard errors in brackets). *Key variable* represents the risk measure independent variable labelled at the top row of each regression.

Table 3 . Quantile results for sovereign debt bank holdings, by type.

	Domestic Banks			***Central Banks***		
	25th quantile	*50th quantile*	*75th quantile*	*25th quantile*	*50th quantile*	*75th quantile*
CDS Spread	1.930***	1.715***	1.387**	-0.913	-1.135**	-1.345*
	(0.466)	(0.367)	(0.565)	(0.850)	(0.569)	(0.766)
Inflation	-0.028	-0.006	0.027	-0.007	-0.060	-0.110
	(0.063)	(0.049)	(0.076)	(0.160)	(0.107)	(0.144)
Interest rate	-1.395*	-1.457**	-1.551	2.966*	2.931**	2.898*
	(0.813)	(0.635)	(0.985)	(1.716)	(1.142)	(1.547)
Output gap	-0.544*	-0.651**	-0.816**	0.613	0.910**	1.190**
	(0.328)	(0.258)	(0.398)	(0.581)	(0.395)	(0.523)
Ratings	2.930	4.576	7.083	-3.643	-8.595*	-13.274**
	(3.846)	(3.050)	(4.669)	(6.378)	(4.449)	(5.733)
Vol	-3.878**	-3.322**	-2.476	-1.333	-2.471	-3.545
	(1.969)	(1.543)	(2.384)	(3.463)	(2.324)	(3.120)
Reer	-6.189	-8.031	-10.835	41.202**	33.934**	27.067
	(8.561)	(6.703)	(10.367)	(19.845)	(13.365)	(17.879)
Obs.	160	160	160	160	160	160
	Foreign Banks			***Total Banks***		
	25th quantile	*50th quantile*	*75th quantile*	*25th quantile*	*50th quantile*	*75th quantile*
CDS Spread	0.563	0.461*	0.347	2.174***	2.132***	2.066**
	(0.369)	(0.256)	(0.313)	(0.641)	(0.516)	(0.839)
Inflation	-0.003	-0.012	-0.023	-0.022	-0.016	-0.005
	(0.052)	(0.036)	(0.044)	(0.100)	(0.080)	(0.130)
Interest rate	-0.065	0.083	0.245	-1.360	-1.376*	-1.400
	(0.435)	(0.304)	(0.369)	(0.964)	(0.776)	(1.261)
Output gap	-0.392	-0.343*	-0.289	-1.078**	-1.026**	-0.948
	(0.277)	(0.192)	(0.235)	(0.500)	(0.403)	(0.655)
Ratings	9.655**	12.122***	14.855***	12.744*	16.421***	22.052**
	(4.579)	(3.329)	(3.923)	(7.296)	(6.062)	(9.556)
Vol	-0.816	-0.915	-1.025	-4.504	-4.189*	-3.707
	(1.467)	(1.017)	(1.244)	(2.855)	(2.298)	(3.735)
Reer	1.635	3.050	4.617	-5.486	-5.331	-5.094
	(3.439)	(2.420)	(2.922)	(9.478)	(7.630)	(12.400)
Obs.	160	160	160	160	160	160

Notes: *, **, and *** represent statistical significance at levels of 10%, 5% and 1%, respectively (robust standard errors in brackets).

4. Conclusion

In our paper, we investigate how sovereign risk affects the composition of bank holdings of sovereign debt. Therefore, we consider four types of banks, domestic, foreign, total (domestic plus foreign), and central banks of 31 countries for the period of 1989-2022, resorting to panel data and quantile techniques.

Our results show that domestic banks' portfolio holdings of public debt rises when the risk is higher while central banks' decrease their share of sovereign debt. This result is remarkably relevant as national banks play a crucial role in supporting government debt during stressful periods. Additionally, and as a result of banks being increasingly international, foreign banks also increase their demand for other countries' public debt when the risk of it is high. Moreover, an increase in the sovereign rating of a given country leads to an increase in the holdings of government debt by domestic banks and foreign banks but reduces the participation of the central banks.

Lastly, we analyze the dynamics of debt holdings before and after the GFC. Following the start of the crisis, domestic banks increased their share of public debt as risk increases. These buys of national government debt by domestic banks could help reduce financial instability and stabilize yields and spreads. However, this connection might have a less positive outcome, which is the increase in the systematic risk that banks face by increasing the risk of banks' balance sheets. When employing quantile estimations, we can conclude that risk has less impact on public debt holdings as the percentage of public debt held by domestic investors and total banks increases, but more impact on central banks when they hold higher shares. Nevertheless, the impact of risk is still symmetric for these banks, being positive for domestic banks and negative for central banks.

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Appendix

Table A1 - Summary statistics

Variable	*Mean*	*Std.Dev.*	*Min.*	*Max.*	*Obs.*
*Total Banks **	17.723	14.911	0.081	102.683	766
*Central Bank *s*	5.141	10.431	0.000	101.339	860
*Domestic Banks **	12.436	11.625	0.000	79.954	829
*Foreign Banks **	4.885	6.101	0.000	50.016	813
Bond spreads	0.545	2.439	-4.286	20.695	879
Bond yield	4.654	3.354	-0.500	23.917	879
CDS	209.812	2457.251	1.771	50990.610	432
CDS spreads	297.610	3181.698	-19.137	50951.600	257
Inflation	0.173	6.832	-102.755	112.895	1012
Interest rate	3.754	4.041	-0.819	27.883	893
Output gap	-0.456	3.046	-19.402	11.829	768
Ratings	15.177	2.887	1.000	17.000	774
Vol	19.100	8.179	6.756	99.040	890
Reer	43.177	190.961	0.499	1415.2	1050

* Sovereign debt as a % of GDP.