

What drives banks' appetite for sovereign debt in CEE countries?

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Article**

JEL: H63, C23

<https://doi.org/10.3326/pse.44.2.2>

* The authors want to thank the anonymous reviewers for insightful comments and suggestions. This work was supported by Croatian Science Foundation under the project *Public Finance Sustainability on the path to the Monetary Union* (IP-2016-06-4609).

** Received: June 1, 2019

Accepted: November 18, 2019

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Abstract

In this paper, we provide the first analysis of the level and determinants of sovereign exposure of banking systems in Central and Eastern European (CEE) countries, thus contributing to the existing literature on sovereign exposures and the sovereign-bank nexus. Results of descriptive analysis showed that exposure to sovereign debt securities in CEE countries is substantially higher than in euro area countries, which can be explained by the lower development of financial markets in this region. We also found evidence of home-bias in CEE and emphasized the role of different monetary policy regimes in explaining differences in exposure among CEE countries. Results of panel analysis showed that changes of debt securities in bank balance sheets in CEE countries are mostly determined by broader macroeconomic conditions and to a lesser extent by their regulatory frameworks. In addition, we did not find evidence of so-called reach-for-yield behaviour. Our results indicate that efforts to reduce sovereign exposure in CEE countries require strong collaboration of not only regulators, but also of fiscal authorities and other policy makers able to contribute to the development of financial markets in this region. Moreover, regulators should especially focus on reducing the home-bias in CEE.

Keywords: sovereign-bank nexus, banks' exposure to sovereign debt, CEE, panel regressions

1 INTRODUCTION

The European sovereign debt crisis, triggered by the global financial shock of 2008, exposed the strong links between European banks and governments, which became known popularly as the “sovereign-bank nexus”.

The sovereign-bank nexus operates through various channels. According to Dell’Ariccia et al. (2018), banks hold large amounts of sovereign debt on their balance sheets so they are not only directly exposed to sovereign risk but also play an important role in financing government needs. Next, an increase in sovereign risk lowers the government’s ability to assist the banking system if it runs into trouble, thereby hurting banks, while on the other hand, banking crises lead to costly resolution policies with negative effects on fiscal balances. Finally, increases in sovereign risk have contractionary effects on economic activity and can lead to losses and weakening of banks’ capital position, which negatively affects banking system stability. Regardless of the channel, countries the banking systems of which have greater exposure to sovereign debt have a higher risk of the negative “doom loop” between bank risk and sovereign risk (Alogoskoufis and Langfield, 2018).

Thus, the problem of bank exposure to sovereign debt has come to the top of the agenda for European policy makers and regulators in recent years. Regulation (EU) no 575/2013 brought important changes in the treatment of sovereign debt securities in bank balance sheets as, according to this new regulation, risk weight of 0% can be applied only for local currency and not all sovereign debt securities.

In 2015 the European Systemic Risk Board (ESRB) published a detailed analysis and discussion of the regulatory treatment of sovereign exposures (ESRB, 2015). In 2017 the European Parliament intensively discussed the proposal of regulatory disincentives against highly concentrated sovereign exposures of the euro area banking system in 2017 (Veron, 2017). Also, as Veron (2017) and Gros and de Groen (2018) stress, reduction of sovereign exposure in banks is one of the key elements and goals of the Banking Union. Therefore, although there is still no consensus on the new regulatory framework, we can expect that the completion of the Banking Union will bring various regulations and a mechanism aimed at breaking the bank-sovereign vicious circle (Schnabel and Veron, 2018).

Problems of sovereign exposure and the sovereign-bank nexus have also attracted the attention of the academic community. The research papers that address these problems have grown rapidly in number in the past decade, especially focusing on the euro area as a whole or periphery countries (e.g. De Bruyckere et al, 2013; Battistini, Pagano and Simonelli, 2014; Schnabel and Schüwer, 2017; Gomez-Puig, Singh and Rivero, 2019).

However, to our knowledge, there is no research concentrating on Central and Eastern European (CEE) countries, although the exposure of banks in the CEE region to sovereign debt is substantially higher than in most other EU and euro area countries. In addition, current discussions on sovereign exposures in the euro area will become even more relevant for those CEE countries that are preparing to join the ERM II and the euro area in the near future¹. In this paper we seek to fill this gap in the literature by analysing the degree of exposure of banking systems in CEE to sovereign debt and by investigating the main determinants of banks' appetite for sovereign debt securities in this region.

This paper addresses two main research questions. First, why are banks in the CEE region more exposed to sovereign debt than euro area countries? Second, which theories of bank behaviour can explain the motivation for banks in the CEE region to accumulate sovereign debt in their balance sheets? These questions have not yet been posted in the literature. Besides the fact that this paper represents some pioneering research on banks' exposure to sovereign debt in CEE countries, we also contribute to the literature by expanding the set of potential explanatory variables of bank exposure to sovereign debt and by focusing on macro-level analysis, while most previous research has been based on bank-level micro data.

The following section presents a brief overview of factors that affect banks' appetite for sovereign debt securities. The third section provides an exploration of the level of bank balance sheet exposures to sovereign debt in CEE countries. The fourth section presents data and methodology, while the fifth provides discussion

¹ Bulgaria and Croatia have each sent a letter on participation in ERM II, while Romania has prepared the strategy on euro adoption.

of the empirical results. The paper ends with conclusions, based on descriptive analysis and econometric results.

2 WHY WOULD BANKS WANT TO HOLD SOVEREIGN DEBT SECURITIES?

Governments can borrow funds through various instruments, such as loans provided by local banks, bonds issued on the domestic bond market, international bonds and loans provided by international banking groups (Bajo, Primorac and Andabaka Badurina, 2011). In all these cases banks play important roles as they directly (by accumulating debt in their balance sheets) or indirectly (e.g. through the role of investment banks) finance the increasing financing needs of governments. However, in this paper we focus only on one instrument, debt securities, as the conceptual framework of our analysis is based on the “sovereign-bank nexus” that emphasizes the role of debt securities in bank balance sheets. So why would banks want to hold sovereign debt securities in their balance sheets?

Firstly, sovereign debt securities represent attractive assets to satisfy bank liquidity requirements, along with other important regulatory liquidity standards. This factor implies that banks are motivated to hold government debt due to regulatory requirements (Dell’Ariccia et al., 2018). In addition, the Basel Committee standardized approach to credit risk provides a widely used regulatory exemption that allows banks to apply zero risk weight to domestic government bonds in the local currency, whatever the sovereign risk, making them more attractive to banks (Acharya and Steffen, 2015). Rocamora (2018) refers to the importance of the co-called “flight to safety” effect that occurs when banks increase their preference for risk-free assets during times of crisis. Sovereign debt securities are also often used as collateral and are used in central bank open market operations (Brutti and Sauré, 2016). Similarly, Horváth, Huizinga and Ioannidou (2015) draw attention to cases in which central banks “create” additional demand for government bonds by accepting certain types of bonds as collateral for repo operations. Next, weak institutions and poor enforcement of creditor rights hamper the supply of financial assets by the private sector, so government debt may provide a store of liquidity to transfer idle resources to future use Dell’Ariccia et al., 2018). In addition, banks may hold debt securities as a part of an opportunistic strategy or so-called reach-for-yield behaviour (Altavilla, Pagano and Simonelli, 2016; Lamas and Mencia, 2018). Similarly, ESRB (2015) indicates that banks can also engage in carry trades during crises, meaning that they borrow at relatively low interest rates in the capital market of non-stressed countries to invest in the comparatively higher-yielding sovereign bonds of stressed countries.

As for other factors, Schnabel and Schüwer (2017) highlight the strong bias of banks to local government debt as an important determinant of the level of banks’ exposures to government, and this view is also shared by some other authors (Schneider and Steffen, 2017; Dermine, 2018). Moreover, Asonuma, Bakhache and Hesse (2015) conclude that such home bias could postpone fiscal consolidation until after it is too late to avoid a crisis.

The collection of literature addressing credit crunches – which in some cases might be caused by government borrowing crowding out the private sector – also reflects some aspects of banks' preference for government debt. In this regard, Shetta and Kamaly (2014) explore the “lazy bank hypothesis”, which suggests that governments with high financing needs discourage banks from granting riskier loans to the private sector in favour of government debt.

Finally, Dell'Ariccia et al. (2018) show that stronger economic growth encourages banks to increase lending to the private sector. On the other hand, in times of recession demand for private sector loans could be subdued, which leaves sovereign debt as the only investment opportunity for banks. Similarly, ESRB (2015) points out that any worsening of macroeconomic and fiscal conditions in some countries can lead local banks to absorb more domestic sovereign debt as “buyers of last resort” (Gros, 2017), because of moral suasion by governments or for the motive of self-preservation (to prevent the sovereign default that could lead to systemic crisis). These results indicate that macroeconomic and fiscal conditions strongly affect bank behaviour.

3 SOME STYLIZED FACTS ON BANKS' EXPOSURE TO SOVEREIGN DEBT IN THE CEE REGION

As previously noted, in this paper we focus on debt securities held by local banks because the conceptual framework presented in the previous section indicates that debt securities are the key concept in the sovereign-bank nexus literature². However, before we continue with the analysis it is important to define the concept of debt securities. In this paper we use ECB Statistical Warehouse Database (SDW) data on debt securities held by banks, which are defined according to ESA 2010 methodology (AF.3). Local banks can hold both, domestic sovereign securities and eligible foreign sovereign securities. We discuss the structure of securities held by banks in CEE countries below, but first we start with data on the level of exposure.

In that regard, motivation for this analysis largely came from data presented in Figure 1. This figure shows the average share of sovereign debt securities in bank total assets in twenty-five members of the European Union (EU)³ in the period from 2006 to 2018⁴. The data presented indicate that in most CEE countries there are substantially higher shares of sovereign debt securities in banks' balance sheets than there are in other EU countries. Slovakia, Hungary, Romania, Poland, Slovenia and Czechia are the countries with the highest shares, ranging between 12% and 17% of total assets. Although the share is somewhat less pronounced in Bulgaria (6.6%) and Croatia (7.7%), these countries are still above the median of the EU (6% of total assets). The right side of the figure shows that median share

² However, to get a complete picture on banks' exposure to sovereign debt one should also include data on loans to general government units. In addition, many banks are indirectly exposed to sovereign risk through assets of pension funds as banks are usually founders of pension funds.

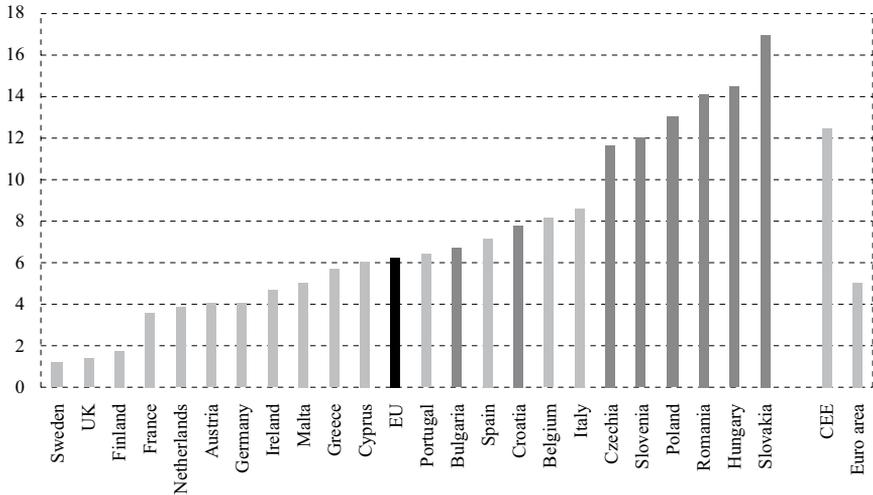
³ Data for Lithuania, Estonia and Latvia not available.

⁴ ECB SDW data on sovereign debt securities held by banks for most CEE countries are available only from 2006.

of debt securities in total assets of banks in CEE countries stands at around 12.5%, which is 2.5 times as much as that of the euro area countries (5% of total assets). Such differences clearly provoke research interest.

FIGURE 1

Share of sovereign debt securities in total assets (%), average 2006 to 2018 in the EU



Source: ECB SDW.

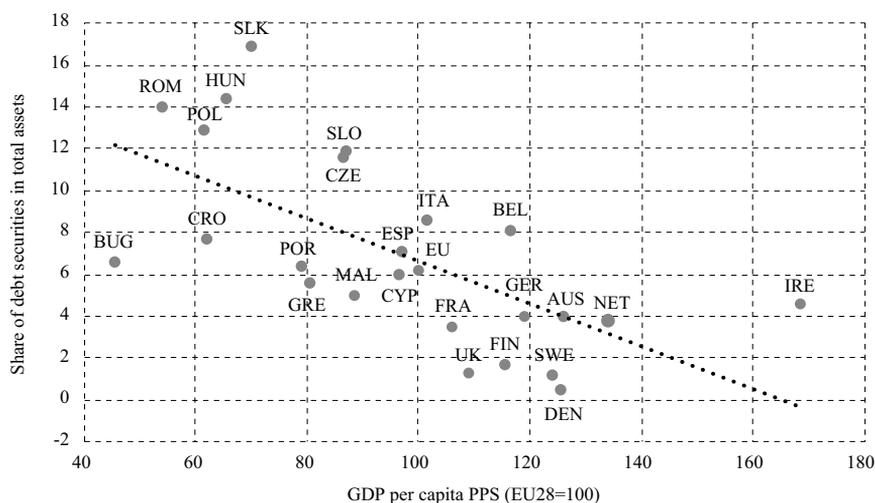
However, although surprising at first, these differences should be interpreted in terms of the level of economic development. As pointed out by Gennaioli, Martin and Rossi (2018), banks operating in less developed countries tend to have shares of government debt in their balance sheets during normal times that are high compared to those in more developed countries. Dell’Ariccia et al. (2018) explain that less developed countries also tend to have less developed financial markets, which limits (private) investment opportunities so sovereign debt securities play important role in financial markets.

Figure 2 shows the relation between level of economic development, measured by GDP per capita in PPS (EU 28=100) and the share of sovereign debt securities in total assets. Fitted line points to a relatively strong negative relation between the level of development and sovereign exposure, in line with the previous discussion. This additionally confirms the relevance of our focus on a relatively homogeneous group of CEE countries in terms of the level of economic development. The figure also indicates that we can identify three “clusters” of countries. The first cluster (black fill) includes CEE countries, which are in the focus of this analysis. The second cluster (no fill) includes the so-called PIGS countries (acronym for Portugal, Italy, Greece and Spain), Malta and Cyprus, most of which were in the focus of previous research (e.g. De Bruyckere et al, 2013; Battistini, Pagano and Simionelli, 2014; Schnabel and Schüwer, 2017; Gomez-Puig, Singh and Rivero, 2019),

as these countries were in the centre of the European debt crisis. The third cluster (grey fill) includes most of the developed old-members of the EU, with low shares of sovereign debt securities in bank total assets.

FIGURE 2

Level of development and the share of sovereign debt securities in total assets (%) (average 2006 to 2018)



Source: ECB SDW; Eurostat.

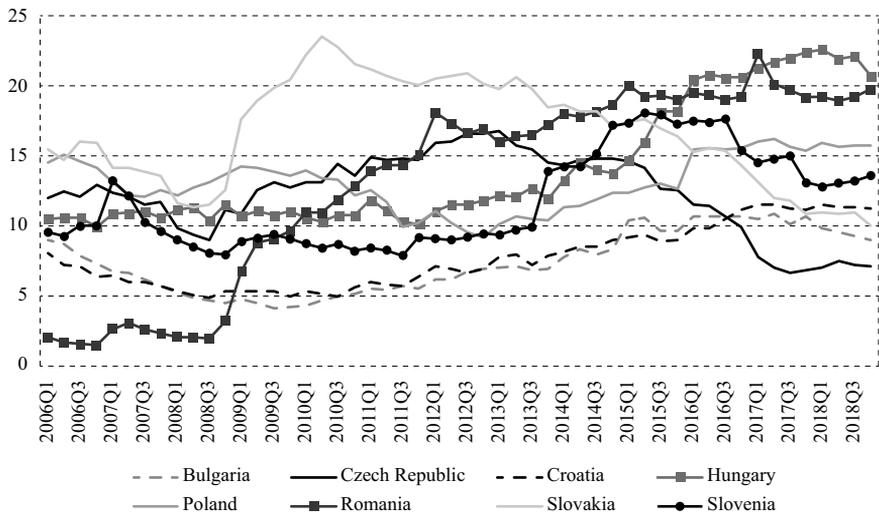
Using the fitted line, we can compare the recorded shares of sovereign debt securities in total assets with the share suggested by the level of economic development. In this context, the figure shows that Slovakia, Hungary, Slovenia, Czechia, Poland and Romania have excessive shares of debt securities in their balance sheets, while the share in Bulgaria and Croatia is below the share suggested by the level of economic development. Thus, we can conclude that sovereign exposure in most CEE countries is very marked, even after taking into account the level of development.

It is also interesting to notice that Bulgaria and Croatia have a relatively low share of sovereign debt securities in total assets, compared to CEE peers. This can be, at least partially explained, by the fact that these countries operate under specific monetary policy regimes (peg and quasi-peg) while other CEE countries operate under inflation-targeting regimes (IT). The key difference between these monetary policy regimes is that in IT regimes sovereign debt securities play one of the key roles in the monetary policy transmission mechanism as eligible securities in repo operations that are usually a dominant monetary policy instrument in IT countries. On the other hand, in (quasi-)peg countries the key policy instruments are foreign exchange interventions, where sovereign debt securities do not play an important role. Box plots and mean differences tests presented in the Appendix confirm the significant difference in exposure to sovereign debt securities between non-IT and IT countries in the CEE region.

Next, we focus on the dynamics of the share of sovereign debt securities in total bank assets in CEE countries from 2006 to 2018. Figure 3 shows that the share of sovereign debt securities in total bank assets in the observed period increased in most CEE countries, with the strongest rise recorded in Hungary and Romania. In most countries the share of debt securities stayed on pronounced levels in the post-crisis period, except for Slovenia, Slovakia and Czechia. In these countries banks gradually decreased the exposure to sovereign debt. In Slovakia and Slovenia, this reduction can be explained by effects of the asset purchases program in the euro area launched in 2015⁵. On the other hand, trends in Czechia could be a result of the decision made by the Czech National Bank in 2015 to start applying an internal methodology for reviewing and evaluating the risk of systemic concentration of sovereign exposures under Pillar 2⁶ (CNB, 2018).

FIGURE 3

Share of debt securities in total assets in CEE 2006-2018 (%)



Source: ECB SDW.

Finally, we turn to the structure of debt securities held by banks in CEE countries as the structure of sovereign debt holdings can also give useful information on banks' motives for holding sovereign debt. Figure 4 shows that domestic securities play a dominant role in all CEE countries, with the lowest average share of domestic securities in Croatia and Slovenia standing at the still high 87% and 70%, respectively. The relatively low share of domestic securities in Croatia can be explained by the Croatian domestic bond market having been relatively underdeveloped, with the government massively relying on external financing in the past. However, supply of domestic debt notably increased after 2010, leading to an increase in the share of

⁵ Bechtel, Eisenschmidt and Ranaldo (2019) show that banks swap sovereign debt securities for reserves.

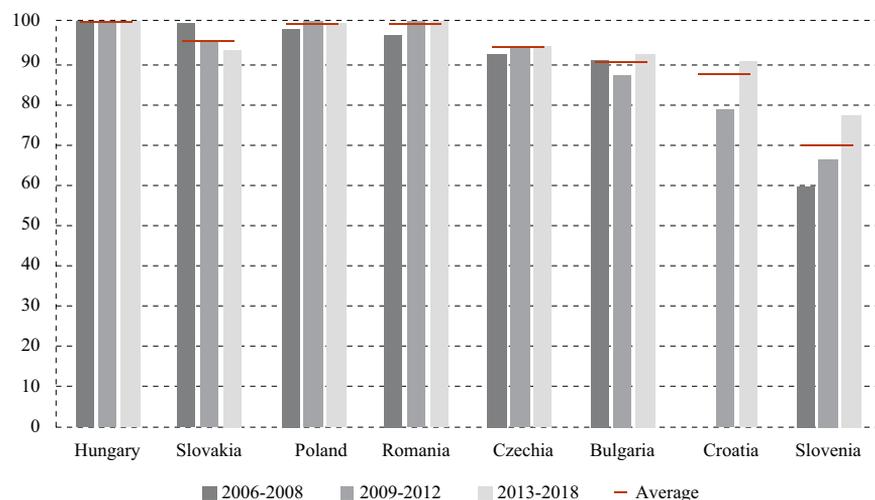
⁶ Pillar 2 refers to bank-specific requirements imposed by the supervisor in addition to the generally applicable Pillar 1 (minimum capital requirement).

domestic sovereign securities in banks' balance sheets. Also, there were changes in asset-liability (A/L) requirements that led Croatian banks to reduce exposure to foreign debt securities, while Regulation (EU) no 575/2013 also motivates banks in Croatia to hold more domestic debt. As for Slovenia, the low share of domestic debt is mostly the result of a substantial increase in euro area securities in bank balance sheets in 2007, when Slovenia joined the euro area.

Thus, we can conclude that there is a clear case of home bias in CEE countries (see also Gereben, 2016). As Horváth, Huizinga and Ioannidou (2015) stress, home bias can be either voluntary or involuntary. In our view, home bias in CEE can be explained by both factors, as banks' decisions on the structure of debt securities portfolio depend on the level of development (size and liquidity) of domestic bond market, supranational and national regulations, supply of domestic debt, monetary policy instruments⁷, yield differentials etc.

FIGURE 4

Share of domestic debt securities in total debt securities held by banks (%)



Source: ECB SDW.

In the methodological part of the analysis, presented in the next section, we use data on total sovereign debt securities held by banks, as we do not expect that splitting the bond holdings into the domestic and the euro area part will affect results due to pronounced dominance of domestic bond holdings in most countries⁸.

⁷ For example, the Hungarian National Bank announced a new interest swap facility in April 2014 that was designed to provide incentives to Hungarian banks to hold additional domestic public debt.

⁸ Data on the structure of domestic bond holdings (LCY, FX, FX-linked) are not available.

4 DATA AND METHODOLOGY

Having shown that banks in the CEE region are strongly exposed to sovereign debt, in this section we turn to the question of what drives their appetite for debt securities. We focus on various fiscal, economic and regulatory determinants important for understanding sovereign exposures in CEE countries.

4.1 DATA

As mentioned above, our sample includes eight Central and Eastern European (CEE) countries – Bulgaria, Croatia, Czechia, Hungary, Poland, Romania, Slovakia, and Slovenia. Due to limited data availability, the time dimension of our sample includes quarterly data from Q1 2006 to Q4 2018. To make our methodological approach more clear, in this subsection we group data in three main categories, dependent variable, main explanatory variables and control variables (graphical representation of control and explanatory variables is presented in the Appendix).

The dependent variable in our analysis is the yearly change in sovereign debt securities, calculated from ECB SDW data. As previously noted, debt securities are defined according to ESA 2010 methodology (AF.3) and we use total debt securities (domestic and euro area) held by banks.

Choice of our explanatory variables is based on the conceptual framework presented in Section 2. Following the literature cited in this paper we investigate which of the most common theories on banks' motivation for holding government debt can explain sovereign exposure in CEE countries.

To test the *deficit absorption hypothesis*, we use data on fiscal deficit (fiscal balance multiplied by -1) as a share of GDP, retrieved from Eurostat⁹. According to this hypothesis, rising deficits lead to higher financing needs and thus to a higher supply of government debt on domestic markets. In such circumstances banks act as “buyers of last resort” (Gros, 2017) or residual buyers of government debt ESRB (2015). To test the robustness of our results in the analysis we change deficit figures with change in public debt (obtained from Eurostat) as a proxy of *deficit* developments.

Next, we test the *reach-for-yield hypothesis*, based on data on yields on ten-year domestic government bonds, retrieved from Eurostat (convergence criteria interest rates). Higher yields are attractive for banks because they can improve their PNLs (profit and loss statements) and interest margins, especially if yields are higher than suggested by macroeconomic fundamentals as in such situation there is no real trade-off between risk and return (Altavilla, Pagano and Simonelli, 2016; Lamas and Mencia, 2018). As we use data on yields on domestic government bonds we also indirectly test the potential *carry trade behaviour* of CEE banks as these banks have access to favourable funding on core euro area markets,

⁹ Due to volatility in the series we calculated four quarter moving averages.

which could have been used for investments in relatively high-yield bonds in some CEE countries, especially during the crisis. To test the robustness of our results and gain a better understanding of bank behaviour, in our models we change yields with spreads calculated over a German ten-year government benchmark bond yield, also obtained from Eurostat.

As for the *lack of opportunities hypothesis*, we use data on lending to the corporate sector as an indicator of the main alternative investment opportunity for banks. More precisely, we use data on yearly changes in loans to non-financial corporations from ECB SDW. If there is falling demand for corporate loans, banks will be motivated to invest more in sovereign debt (Dell'Ariccia et al., 2018). Also, the relation between changes in sovereign debt securities and corporate loans can provide some insights into the *lazy bank hypothesis* (Shetta and Kamaly, 2014).

The *Regulatory "arbitrage" hypothesis* and the *flight to safety hypothesis* indicate that banks are motivated to invest in sovereign debt in order to improve their capital adequacy ratios, which is mostly pronounced during a crisis (Acharya and Steffen, 2015; Rocamora, 2018). Thus, we expect a positive relation between CAR and sovereign debt securities. Data on CAR are obtained from IMF Financial Soundness Indicators Database¹⁰.

Finally, according to ESRB (2015) and Dell'Ariccia et al. (2018) GDP developments, as an indicator of broader *macroeconomic conditions*, can have notable effect on bank behaviour. During expansions, fiscal deficits are low and demand for private credit is strong, which demotivates banks from investment in sovereign debt securities. On the other hand, negative GDP growth rates during recessions are strongly related to higher deficits and lower demand for private credit, which can motivate banks to increase their exposure to sovereign. Thus, in our analysis we use calendar-adjusted GDP growth rate from Eurostat to investigate the effects macroeconomic conditions on banks' investment in sovereign debt securities. However, as GDP growth rate is strongly related to deficits and demand for private credit, we do not include these variables in same models.

Finally, as regulators monitor sovereign exposures, as an indicator of the level of exposure we include data on the share of sovereign debt securities in the previous period. Here we expect that higher exposures in the previous period should reduce the growth rate of sovereign securities in banks' balance sheets. We treat this variable as a key control variable in our models.

A description of data and sources, along with expected effects of all explanatory variables on dependent variable, is presented in Table 1.

¹⁰ We could not retrieve methodologically comparable data on capital adequacy ratios for all quarters in some countries. Thus, our models are unbalanced.

TABLE 1
Data description

Category	Variable	Unit	Source	Expected effect	Mechanism
Dependent variable	Sovereign debt securities	% change	ECB Statistical Data Warehouse		
	Budget deficit Change in public debt	% of GDP	Eurostat	+	Rise in deficit increases financing needs of the government, which leads to higher supply of government bonds.
Main explanatory variables	Yields Spreads	%	Eurostat	+	Higher yields on local government bonds make them more attractive for banks.
	Capital adequacy ratio (CAR)	%	IMF Financial Soundness Indicators	+	Banks are motivated to hold debt securities to improve their CAR.
	Private sector loans	% change	ECB Data Warehouse	-	Rising of corporate loans indicates that banks see investment opportunities in private sector.
	GDP	growth rate %	Eurostat	-	Stronger GDP growth has positive effect on demand for loans from private sector, i.e. during expansions banks have more investment opportunities.
	Exposure	%	Eurostat	-	Higher exposure to sovereign debt in previous period reduces the absorption capacity for additional sovereign bonds in banks' balance sheets.
Control variables					

Source: Authors.

4.2 METHODOLOGY

Most empirical papers that focus on determinants of banks' sovereign exposure use bank-level micro data for the country of interest (e.g. Lamas and Mencia, 2018; Gomez-Puig, Singh and Rivero, 2019). In this paper we follow an alternative approach presented in Dell'Ariccia et al. (2018) where authors use country-level panel regressions to investigate the determinants of banks' government debt holdings in the panel of developed and emerging markets. However, our model

differs in having a broader selection of explanatory variables¹¹ and a focus on a relatively homogenous group of countries.

Before selecting the appropriate model, we employed several identification tests¹². According to the Lagrangian multiplier test (Breusch and Pagan, 1980) a random effects estimator was not appropriate, while the F-test for fixed effects model confirmed that the fixed effect model is suitable for our data. Additionally, F-test (Torres-Reyna, 2010) showed that time effects are significant so they were included in the model. Such an approach is also appropriate as the number of time periods (46) in our analysis is larger than the number of cross-section units (8) (Kiviet, 1995).

We estimate a fixed effects model of the following form:

$$y_{i,t} = \alpha_i + \beta X_{i,t} + \delta Z_{i,t} + \gamma_t + \epsilon_{i,t}; i = 1, \dots, 8, t = 2007q1, \dots, 2018q2 \quad (1)$$

where $y_{i,t}$ is the dependent variable, $X_{i,t}$ includes the main explanatory variables, $Z_{i,t}$ represents the vector of control variables, α_i are country fixed effects, γ_t time effects and $\epsilon_{i,t}$ is an error term.

In order to obtain robust estimates, we employed tests for serial correlation, contemporaneous correlation across units and group-wise heteroscedasticity. The Wooldridge test for autocorrelation in panel data confirmed first order autocorrelation within units. According to the Breusch-Pagan test for cross-sectional independence in the residuals of a fixed effects regression model (Baum, 2001), the null of cross-sectional independence was rejected, while the modified Wald test for unit-based homoscedasticity in the residuals of a fixed effects regression model (Baum, 2001) rejected the null of homoscedasticity across units. To control for all the above issues, we employed ordinary least square (OLS) estimates with panel corrected standard errors proposed by Beck and Katz (1995), therefore addressing heteroscedasticity across panels, contemporaneous correlation across panels and autocorrelation within panels. This estimator proved to have acceptable properties in longitudinal panels when $T > N$.

5 RESULTS

In this section we present the results of panel analysis. The estimation results are presented in Table 2. Here we present the results of our baseline specifications and robustness tests, while additional robustness tests are presented in the Appendix.

¹¹ As main explanatory variables Dell'Ariccia et al. (2018) use T-bill interest rates, real GDP growth, inflation, nominal exchange rate, public debt and several indicators of the level of financial development (as they base the analysis on heterogeneous sample of countries).

¹² All tests are available upon request.

TABLE 2
Estimation results

	(1)	(2)	(3)	(4)	(5)	(6)
Deficit	1.771*** (0.271)	1.771*** (0.271)				
Change in debt			3.300*** (0.719)	3.300*** (0.719)		
Yield	0.0688 (0.838)		0.559 (0.993)		0.328 (0.991)	
Spread		0.0688 (0.838)		0.559 (0.993)		0.328 (0.991)
Loans growth	-0.0251** (0.0119)	-0.0251** (0.0119)	-0.0260** (0.0125)	-0.0260** (0.0125)		
GDP growth					-0.758** (0.363)	-0.758** (0.363)
CAR (lagged)	0.277*** (0.0969)	0.277*** (0.0969)	0.175 (0.109)	0.175 (0.109)	0.226** (0.106)	0.226** (0.106)
Exposure (lagged)	-1.716*** (0.324)	-1.716*** (0.324)	-1.316*** (0.354)	-1.316*** (0.354)	-1.740*** (0.394)	-1.740*** (0.394)
_cons	12.10 (8.382)	11.83 (7.903)	13.45 (9.146)	11.22 (8.599)	20.57** (10.44)	21.89** (9.876)
Country FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
N	286	286	286	286	286	286

Standard errors in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Source: Authors.

Regarding the *deficit absorption hypothesis* our results indicate that there is a positive and statistically significant relation between deficit and change in debt (*proxy* for deficit) and growth of debt securities in all model specifications, meaning that the supply of sovereign debt securities is an important determinant capable of explaining the exposure of banks in the CEE region to sovereign debt. On the other hand, coefficients that show the relationship between yields and spreads and growth in debt securities have the expected sign, but they are not statistically significant. Such results suggest that bank behaviour in CEE in this respect cannot be explained by the *reach-for-yield* and/or the *carry trade hypothesis*. Relation between growth of private sector loans and growth of debt securities is negative and statistically significant in all specifications, meaning that these instruments can be understood as substitutes and that banks tend to invest less in sovereign debt securities when there is a demand for private loans. Thus, we can conclude that the *lack of opportunities hypothesis* contributes to the understanding of sovereign exposure in CEE region. This result is also supported by statistically significant and negative effect of GDP growth on the dependent variable, meaning that during economic expansions, when there is solid demand for private credit, banks invest less in sovereign debt securities. Also, this result is also supportive of

the deficit absorption hypothesis, as stronger economic growth implies lower public deficits and thus a lower supply of government bonds on the market. Statistically significant effects of GDP growth on sovereign debt securities growth in bank balance sheets support the view that *macroeconomic conditions* have a notable effect on sovereign exposure in CEE. Finally, there is a positive and statistically significant relation between capital adequacy ratio and debt securities growth, which indicates that bank exposure to sovereign debt in the CEE region can be, at least partially, explained by the *regulatory "arbitrage"* and/or the *flight to safety hypothesis*.

To test the robustness of our results we conducted several adjustments to our baseline model specifications. First, as already noted, we used change in public debt and spreads as proxies for fiscal deficit and yields, respectively. Also, by including GDP growth we additionally tested the credibility of results related to the effects of fiscal deficit and loans to the private sector. These changes did not affect the main results, as was shown in the above table. Next, we excluded yields and spreads from the analysis, as the effects of these variables are not statistically significant. Exclusion of these variables did not have a significant effect on the main results. In addition, we estimated models only on the sample of non-euro area countries (i.e. excluding Slovenia and Slovakia) and only on the sample of inflation-targeters (i.e. excluding Bulgaria and Croatia). The results of these robustness tests, presented in the Appendix, show that our main results did not change notably.

6 CONCLUSIONS

In an attempt to reveal new insights into the determinants that contribute to high shares of sovereign debt in banks' balance sheets in the CEE region, we show that the level of development plays an important role in the explanation of differences between the sovereign exposures of banks in CEE countries and those of other EU and euro area members. Sovereign debt securities seem to have a more important role in the financial systems of less developed countries, which strongly affects the behaviour of both the government and banks themselves. We also found evidence of home-bias in CEE countries, which poses a challenge for regulators. As for differences in sovereign exposure among CEE countries, we showed that banks in IT countries tend to have higher shares of sovereign debt securities in their balance sheets than (quasi-)peggers (Bulgaria and Croatia) as these financial instruments are used for repo operations, which are the key policy instrument in IT countries.

Our empirical results indicate that changes in bank holdings of debt securities in CEE countries are mostly affected by the broader macroeconomic conditions that determine fiscal balances and demand for credit in the private sector. As our sample is marked by recession in most CEE countries, we can conclude that such a negative economic environment has significantly contributed to the increasing share of sovereign debt securities in banks' balance sheets. We also found a positive relation between capital adequacy ratios and changes in sovereign debt securities. Such findings support the view that banks use these instruments to improve

their capitalization indicators, especially during crisis periods. Finally, we did not find evidence of reach-for-yield and/or carry trade behaviour of banks in CEE. However, since our results are based on country-level data, we cannot exclude the possibility that some banks have been engaged in such trades.

These empirical findings bring us to a slightly provocative conclusion (in light of current high-level discussions) that regulators alone have fairly limited power over sovereign exposures in CEE countries because these exposures mostly depend on broader macroeconomic and fiscal conditions. Thus, all future efforts to reduce sovereign exposure in CEE countries require strong collaboration among the many stakeholders. These include the regulators, which can impose stricter regulations and/or monitoring of sovereign exposures on the national level (as Czechia), the fiscal authorities, that should pursue a prudent and counter-cyclical fiscal policy, and other policy makers that can contribute to the development of financial markets in this region. Diversified investment opportunities, solid credit demand from the private sector and a prudent counter-cyclical fiscal policy would probably demotivate banks from hoarding sovereign debt securities in their balance sheets. In addition, as well as ensuring that the regulatory framework does not strongly favour government bonds, regulators should focus on reducing the home-bias in CEE.

Finally, for better understanding of the level and determinants of exposure of financial systems in CEE to sovereign debt, future research should be extended to include other types of debt instruments (primarily loans to government and SOEs) and non-banking financial institutions, primarily pension funds and insurance companies. Instead of on countries, the analysis could also be done on CEE banks.

Disclosure statement

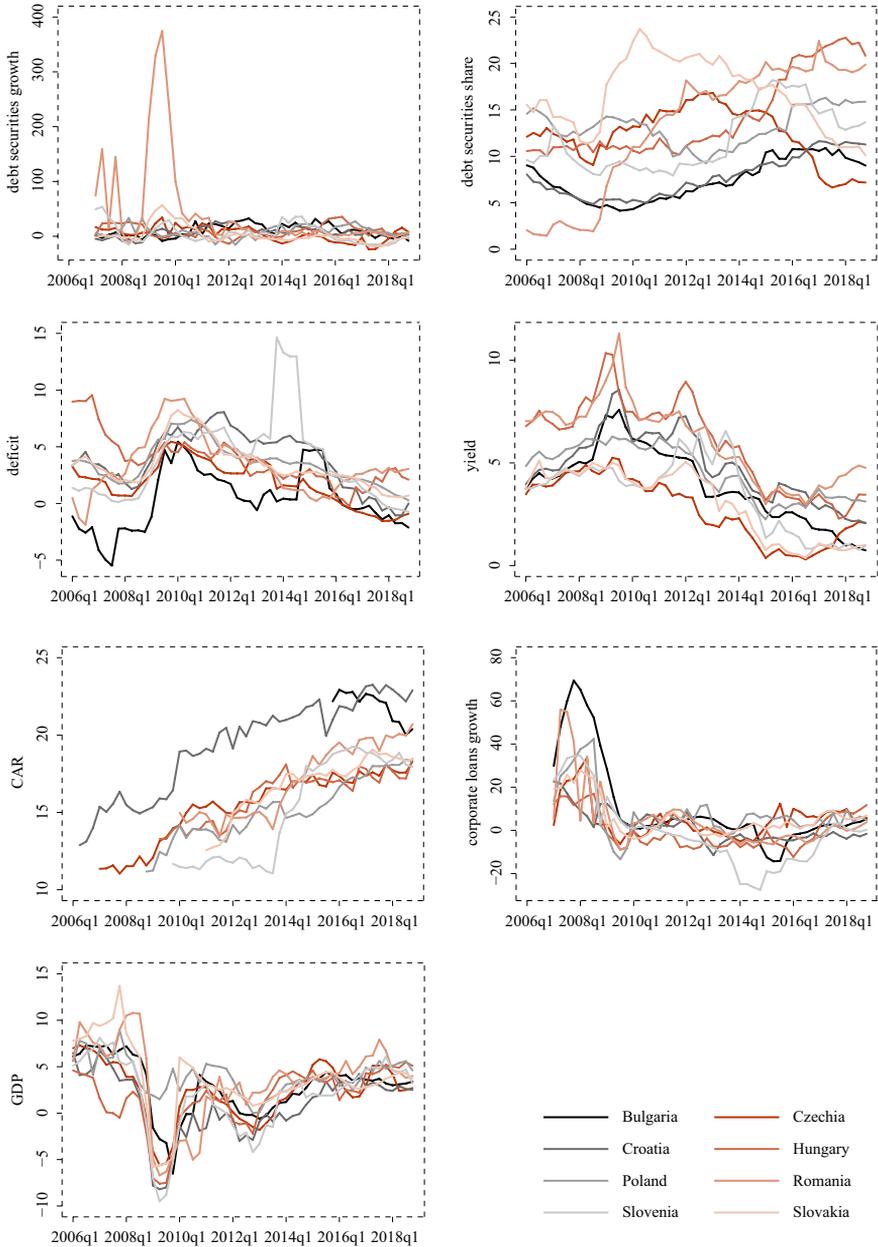
No potential conflict of interest was reported by the authors.

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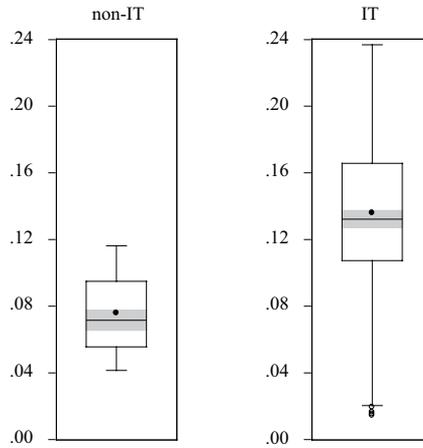
FIGURE A1
Graphical representation of variables



Source: Authors.

FIGURE A2

Difference in sovereign exposure between IT and non-IT countries in CEE region



Source: Authors.

TABLE A2

t-test for difference of two means (non-IT vs IT)

t-Test: Two-sample assuming unequal variances

Mean (%)	7.6	13.6
Variance (%)	0.05	0.20
Observations	103	311
Hypothesized Mean Difference	0.00	
df	350	
t Stat	-17.93	
P(T<=t) two-tail	0.00	
t Critical two-tail	1.97	

Source: Authors.

TABLE A3.1

Estimation results (yields and spreads excluded)

	(1)	(2)	(3)
Deficit	1.763*** (0.257)		
Change in debt		3.245*** (0.705)	
Loans growth	-0.0250** (0.0119)	-0.0259** (0.0125)	
GDP growth			-0.767** (0.364)
CAR (lagged)	0.278*** (0.0965)	0.178* (0.107)	0.217** (0.108)
Exposure (lagged)	-1.701*** (0.316)	-1.293*** (0.353)	-1.785*** (0.403)
_cons	11.80 (7.939)	11.19 (8.585)	22.00** (10.01)
Country Fe	YES	YES	YES
Time FE	YES	YES	YES
N	286	286	286

Standard errors in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Source: Authors.

TABLE A3.2
Estimation results (Slovenia and Slovakia excluded)

	(1)	(2)	(3)	(4)	(5)	(6)
Deficit	2.794*** (0.651)	2.794*** (0.651)				
Change in debt			2.284** (1.058)	2.284** (1.058)		
Yield	1.266 (1.443)		0.765 (1.457)		0.264 (1.468)	
Spread		1.266 (1.443)		0.765 (1.457)		0.264 (1.468)
Loans growth	-0.0343** (0.0141)	-0.0343** (0.0141)	-0.0295** (0.0148)	-0.0295** (0.0148)		
GDP growth					-0.464 (0.446)	-0.464 (0.446)
CAR (lagged)	0.229** (0.101)	0.229** (0.101)	0.157 (0.111)	0.157 (0.111)	0.201* (0.115)	0.201* (0.115)
Exposure (lagged)	-3.169*** (0.529)	-3.169*** (0.529)	-2.570*** (0.562)	-2.570*** (0.562)	-2.687*** (0.555)	-2.687*** (0.555)
_cons	24.75*** (9.289)	19.69** (8.362)	21.06** (9.958)	18.00** (8.797)	25.54** (11.14)	24.49** (10.00)
Country FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
<i>N</i>	219	219	219	219	219	219

Standard errors in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Source: Authors.

TABLE A3.3

Estimation results (Bulgaria and Croatia excluded)

	(1)	(2)	(3)	(4)	(5)	(6)
Deficit	1.795*** (0.486)	1.795*** (0.486)				
Change in debt			3.849*** (0.792)	3.849*** (0.792)		
Yield	0.786 (1.430)		2.172* (1.299)		1.191 (1.480)	
Spread		0.786 (1.430)		2.172* (1.299)		1.191 (1.480)
Loans growth	-0.0331** (0.0158)	-0.0331** (0.0158)	-0.0348** (0.0159)	-0.0348** (0.0159)		
GDP growth					-0.640 (0.495)	-0.640 (0.495)
CAR (lagged)	1.908** (0.919)	1.908** (0.919)	0.722 (0.903)	0.722 (0.903)	1.367 (1.009)	1.367 (1.009)
Exposure (lagged)	-1.811*** (0.369)	-1.811*** (0.369)	-1.154*** (0.318)	-1.154*** (0.318)	-1.612*** (0.385)	-1.612*** (0.385)
_cons	13.41 (15.23)	10.01 (12.95)	27.74* (15.00)	18.34 (12.97)	25.00 (16.75)	19.84 (14.72)
Country FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
N	227	227	227	227	227	227

Standard errors in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Source: Authors.