Implications of the Regulatory Treatment of Sovereign Exposures for Bank Behavior

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Abstract

Using bank-level sovereign exposures published by the European Banking Authority between 2011 and 2020, this paper empirically explores the development of sovereign bond holdings of European banks. The heterogeneity in exposure, bank and macroeconomic characteristics is then exploited to identify factors that determine a bank's decision to invest in sovereign debt. Sovereign exposures build a sizable and stable share of banks' balance sheets and exhibit a home bias that by far exceeds regulatory large exposure limits. On average, banks react to rising sovereign bond yields by purchasing sovereign debt. Consistent with *regulatory arbitrage* in terms of capital and liquidity, this yield seeking behavior is more pronounced for less capitalized and less liquid banks. Contrarily, banks react similarly to yield changes of sovereign counterparties located in the European Union compared to third countries, contradicting the idea that privileges for member states of the European Union in banking regulation alter banks' behavior. Supporting *moral suasion* by the domestic sovereign, recently bailed-out and government-owned banks exhibit a stronger rise in their holdings of domestic sovereign bonds. Providing indirect evidence for the design of *carry trades*, periods of cheap *refinancing possibilities* reinforce yield seeking behavior.

Keywords: Sovereign exposures, sovereign bond yields, zero risk weight, credit risk, liquidity risk, risk concentration, Basel II, Basel III, CRR, CRD, regulatory arbitrage, moral suasion, carry trade.

JEL classification: G21 (Banks, Depository Institutions, Micro Finance Institutions, Mortgages), G28 (Government Policy and Regulation).

1 Introduction

European banking regulation incentivizes banks to invest in bonds issued by member states of the European Union (EU) through zero capital charges in minimum requirements for credit risk, highest liquidity status in minimum requirements for liquidity risk and exclusion from size limits in the large exposures framework. Thus, understanding potential repercussions of these regulatory privileges on the composition of banks' sovereign bond portfolios is important to avoid unwanted side effects. In this paper, bank-level sovereign exposures are used to investigate two related research questions: First, how are banks' sovereign exposures composed? Second, does the regulatory treatment of sovereign exposures affect bank behavior?

As a starting point, this paper empirically explores the development of sovereign exposures of 68 banks located in 21 different member states of the EU to 23 different sovereign counterparties from 2010 to 2019 based on the disclosures of the European Banking Authority (EBA) as part of its Stress Tests as well as Capital and Transparency Exercises. Confirming stylized facts known in the literature, sovereign exposures build a sizable and stable part of 11.4% of banks' total assets, equaling 54.6 billion Euro per bank on average. Of these, a large share of 6.5% of total assets, equivalent to 19.0 billion Euro, is attributed to exposures to the domestic sovereign. This home bias exceeds prudential regulatory large exposure limits by 13.4 billion Euro. The remaining share is distributed over foreign sovereigns. These are considerably smaller and comparably large for foreign EU and third country counterparties at 1.2 and 2.7 billion Euro on average, respectively.

Based on this, the impact of regulatory requirements for sovereign exposures on bank behavior is investigated by exploiting the heterogeneity in exposure, bank and macroeconomic characteristics in a panel regression following Altavilla et al. (2017). As main contribution, it adds to the literature by taking a holistic view on banks' sovereign exposures and expanding previous research from domestic to foreign sovereign counterparties. As benchmark reaction to a 1 percentage point (PP) increase in a foreign sovereign's

bond yield, banks increase their exposure to the respective counterparty by 12.7% relative to their average exposure, or 0.3 billion Euro in absolute terms. Consistent with *regulatory arbitrage* in terms of capital and liquidity, weaker capitalized and less liquid banks behave more yield seeking by increasing their exposure by 12.2% to 14.2% compared to 5.7% to 7.0 % for stronger capitalized and more liquid banks. Contrarily, this yield seeking behavior is similar for sovereigns located in the EU compared to third countries. Thus, no evidence for *regulatory arbitrage* in terms of privileges for EU sovereigns is found. Providing evidence for *moral suasion* by the domestic sovereign, banks under stronger government influence purchase more domestic sovereign bonds. Banks that recently received state aids raise their holdings of domestic sovereign bonds by 12.9% while an increase in bank equity held by the domestic sovereign of 1 PP induces an exposure increase of 0.4%. Periods of cheap *refinancing possibilities* reinforce banks' yield seeking behavior, indirectly supporting the idea that banks engaged in *carry trades*. On the one hand, banks' reaction to rising sovereign bond yields falls from an exposure increase of 4.8% to 0.2% as the price of German sovereign bonds appreciates, reflecting a *flight to quality* with simultaneous evaporation of short-term funding. On the other hand, banks increased their sovereign exposures at year-end 2011 and in the first half of 2012 by 29.4 PP more compared to other periods in coincidence with the irregular Longer-Term Refinancing Operations (LTRO) conducted by the European Central Bank (ECB).

The remainder of this paper is organized as follows: Section 2 reviews related literature. Section 3 derives hypotheses and specifies the methodological approach. Section 4 describes the main data sources, presents descriptive analyzes on the development of banks' sovereign exposures and provides regression analyzes as well as robustness tests regarding banks' reaction to sovereign bond yield changes. Section 5 concludes.

2 Literature Review and Contribution

This section reviews related literature regarding banks' sovereign exposures and accentuates the research gap that this paper aims to close. Basel Committee on Banking Supervision (2017) provides a structured overview of the holistic role of sovereign debt for the whole economy as well as for individual banks. From a macroeconomic perspective, sovereign debt fulfills pivotal functions in the economy and financial markets. A first function is *fiscal policy* of sovereigns, who are usually funded to a large extent by issuing bonds, which can help to stabilize the economy through the economic cycle.

A second function is the implementation of *monetary policy* of central banks and its transmission through the economy. In context of Open Market Operations, this can involve transactions in sovereign bonds (Governing Council of the European Central Bank, 2014). On the one hand, the ECB provides liquidity to banks by granting unlimited lending at fixed interest rates up to the amount that banks provide eligible collateral minus collateral-specific haircuts through regular Main Refinancing Operations (MRO) with a maturity of one week and Longer-Term Refinancing Operations (LTRO) with a maturity of three months as well as non-regular LTRO with a maturity longer than three months. One the other hand, the ECB provides liquidity to sovereigns through the possibility to buy eligible securities in secondary markets through Outright Monetary Transactions (OMT). Figure 1 sketches the functioning of the Open Market Operations of the ECB and the role of sovereign bonds as eligible securities.

[INSERT FIGURE 1 ABOUT HERE]

A third function is the use of sovereign bond yields as a *risk-free benchmark* in asset pricing and to determine cost of funding, due to the perceived low credit and liquidity risk of sovereign bonds.

From a bank perspective, banks engage in sovereign debt for a variety of purposes. As a first purpose, sovereign bonds are an *investment opportunity*, since they may be

perceived as assets with attractive risk-return profiles and allow banks to diversify their asset portfolios.

A second purpose is *liquidity management*, as sovereign bonds are widely used and accepted as collateral in refinancing operations in private markets and at central banks.

A third purpose is *regulatory compliance*, caused by a favorable treatment of debt issued by member states of the EU in banking regulation. Regarding credit risk, art. 114(4), 150(1d), 160(1) and 336(1) European Parliament and Council (2013) set risk weights and thus corresponding minimum capital requirements to 0%. Addressing liquidity risk, art. 10(1c), 10(2), 11(1b) and 11(2) European Commission (2014) assign highest liquidity status, leading to haircuts of 0% in the stock of High Quality Liquid Assets (HQLA) of the Liquidity Coverage Ratio (LCR), which in combination with art. 428r(1a), 428x, 428ad(c) and 428ag(c) European Parliament and Council (2019) induces a Required Amount of Stable Funding (RSF) factor of 0% in the Net Stable Funding Ratio (NSFR). Concerning risk concentrations, art. 395(1) and 400(1a) European Parliament and Council (2013, 2019) exempt exposures with a risk weight of 0% from limits to large exposures, effectively allowing banks to engage in EU sovereign debt in unlimited size. Table 1 summarizes the regulatory treatment of third country sovereign exposures as well as privileges for exposures to member states of the EU. Through these regulatory privileges, sovereign debt allows banks to comply with regulatory minimum requirements more easily than other asset classes.

[INSERT TABLE 1 ABOUT HERE]

As a consequence of the micro- and macro-prudential relevance of sovereign debt, banks can generally be expected to hold sizable sovereign bond portfolios. However, their composition is potentially biased towards the EU, since the non-conventional monetary policy of the ECB as well as privileges in banking regulation incentivize banks to hold bonds issued by member states of the EU and increases their attractiveness as investment opportunity further. This is the research gap that this paper aims to close. Especially, it

adds to the literature by analyzing potentially different behavior of banks towards foreign sovereigns located in the EU and compared to third countries.

This paper is related to different strands of the literature on banks' sovereign exposures. Studies in this regard tend to suffer from a lack of publicly available bank-level sovereign exposures differentiated by sovereign counterparty on a sufficiently high observation frequency. The analyzes presented here are closest to two papers regarding *determinants of banks' sovereign exposures*. As an indirect approach, Acharya and Steffen (2015) proxy banks' sovereign exposures by the sensitivity of banks' equity price returns to sovereign bond price returns. They find a positive factor loading for bonds issued by Greece, Ireland, Italy, Portugal and Spain (GIIPS) and a negative factor loading for bonds issued by Germany between 2007 and 2013 and take this as evidence that banks hold a long position in GIIPS and a short position in German sovereign bonds. Assuming that an appreciation of German bond prices reflects a *flight to quality* mentality in capital markets with a simultaneous evaporation of the supply of short-term capital, they conclude that banks designed *carry trades* with an investment leg consisting of sovereign debt with high economic risks and returns and a funding leg consisting of short-term financing with low economic costs. More detailed, they show that carry trade behavior is stronger for riskier banks measured by high short-term leverage, high Risk-Weighted Assets (RWA) as well as low capital ratios and offer three explanations. First, regulatory privileges for member states of the EU offer weakly capitalized banks incentives for *regulatory capital arbitrage* by holding assets with the highest returns and lowest risk weights in order to increase return on equity while complying with regulatory requirements. Second, a stressed sovereign could put pressure on domestic banks to buy its debt in an attempt of *moral suasion* in order to reduce its financing costs and be able to continue to borrow. Third, *risk shifting* of banks located in stressed countries expressed through a substitution of safer foreign by riskier domestic sovereign bonds would shift profits into states of the world where the bank is solvent and losses into states where the bank would probably be insolvent due to a bank run caused by a default of the domestic sovereign.

Based on this, Altavilla et al. (2017) discuss that the indirect conclusions of Acharya and Steffen (2015) drawn from the sensitivity of banks' equity returns to sovereign bond returns only hold if their estimated factor loadings actually proxy for banks' sovereign exposures. Consequently, they directly estimate determinants of banks' sovereign exposures and their effect on bank lending using a data set provided by the ECB covering monthly observations of banks' sovereign bond portfolios between 2007 and 2015. Due to data restrictions, they only take domestic sovereign exposures into account, since their data set only provides total domestic and total foreign sovereign exposures but does not differentiate foreign counterparties in more detail. They show that banks with relatively low regulatory capital ratios located in stressed countries as well as banks (partly) owned by the state and banks that received state aids increase their exposure to the domestic sovereign more in times of sovereign stress than other banks. This yield seeking behavior is reinforced in times of cheaply available funding from the ECB. In combination, this provides further evidence for *carry trades* and *moral suasion*. These effects then crowd out loans to corporations, as banks with high domestic sovereign exposures located in stressed countries reduce lending to the non-financial sector more than less exposed banks. The analyzes conducted here build on their approach and aim to close the research gap by explicitly differentiating between domestic and foreign counterparties using a broad data set of sovereign exposures of European banks to domestic and foreign sovereign counterparties disclosed by the EBA between 2011 and 2020. This advantage comes with the disadvantage of lower bank coverage and lower observation frequency.

Other studies find mixed results regarding yield seeking behavior of banks. Battistini et al. (2014) link the dynamics of sovereign bond yields to simultaneous adjustments of banks' sovereign bond portfolios using data from the ECB on monthly exposures of banks from ten different Eurozone countries to the respective domestic sovereign aggregated at the country level between 2007 and 2013. As foreign sovereign exposures by sovereign counterparty are not available in their data set, they base their analyzes on exposures to domestic sovereigns. In a first step, they decompose sovereign bond yield spreads into a country-specific and a systemic, Eurozone-wide component. In a second step, they

analyze to what extent these components can explain changes in banks' exposures to the domestic sovereign. Initially, they show that banks generally respond to an increasing domestic sovereign bond yield by raising their domestic sovereign exposure. However, this reaction varies with the country-specific risk component. Only banks located in the relatively high-risk Eurozone periphery increase their domestic sovereign exposures in response to rising country-specific risks, while banks located in the relatively low-risk Eurozone core do not.[1] This observation is explained by high-risk sovereigns exerting *moral suasion* on local banks and weakly capitalized banks engaging in *carry trades*, as these are mainly located in risky countries. Contrasting this, banks located in almost all Eurozone countries respond to rising systemic, Eurozone-wide risks by increasing their domestic sovereign exposure. This is explained by a *comparative advantage* that hedges domestic banks against a breakup of the Eurozone, since their claims on the domestic sovereign as well as their liabilities would be converted into a new national currency at the same time.

To isolate the *moral suasion* channel from other channels that affect a bank's domestic sovereign exposure, Ongena et al. (2019) consider country characteristics regarding a sovereign's refinancing needs in addition to bank characteristics on the susceptibility to *moral suasion* based on ECB data on domestic sovereign exposures of banks located in five financially stressed countries. In months where the sovereign has to refinance a substantial share of maturing sovereign debt, banks that a more susceptible for *moral suasion* measured by weak capitalization, low liquidity and receipt of government support buy more domestic sovereign bonds than other banks, providing further evidence for the existence of this channel.

In addition to the size of a bank's sovereign exposure, Affinito et al. (2019) use monthly transaction data from the Bank of Italy to investigate the determinants of sovereign bond purchases of Italian banks between 2007 and 2013. Especially, banks with weak balance

[1]The authors define Austria, Belgium, Germany, France and the Netherlands as Eurozone core and Spain, Greece, Ireland, Italy and Portugal as Eurozone periphery.

sheets measured by a broad range of capital, liquidity, profitability and credit quality indicators buy domestic sovereign bonds. This supports *regulatory capital arbitrage*, *risk shifting* and *comparative advantage* motives. Opposing this, external pressure through *moral suasion* by the domestic sovereign as well as *carry trades* seem to be less relevant, since sovereign bonds are attractive investment opportunities for banks despite these channels.

Further evidence for *regulatory arbitrage* is provided by Acharya et al. (2021), who show that undercapitalized European banks improved their regulatory capital ratios between 2010 and 2012 not only by reducing lending to risky borrowers with high regulatory risk weights but also by increasing purchases of risky European sovereign bonds with zero risk weights.

Lamers et al. (2022) confirm that the decision of European banks to invest in sovereign bonds was indeed driven by *moral suasion* between 2011 and 2014. However, from 2015 on, their returned to economically sound risk-return considerations in their investment decisions measured by the Sharpe Ratio.

According to the *moral suasion*, *risk shifting* and *comparative advantage* hypotheses, banks' sovereign bond portfolios are expected to be biased towards the domestic sovereign. Saka (2020) questions the role of these channels and suggests that this home bias might be caused by *informational asymmetries* between domestic and foreign banks.

Buch et al. (2016) take a granular view on sovereign bond holdings of German banks based on Data from the Deutsche Bundesbank between 2005 and 2013. To identify the determinants of banks' sovereign exposures, they predict the likelihood that a bank holds a specific sovereign bond as well as the size of the corresponding position. Regarding bank characteristics, large, weakly capitalized and capital market-oriented banks hold more sovereign debt. Addressing country characteristics, the authors do not find evidence for yield seeking behavior of banks. Contrarily, German banks reduced their exposures to countries with high inflation, high debt level and high sovereign bond yields. Based on this, they find a positive relation between the riskiness of these predicted sovereign

exposures and the riskiness of banks measured by the Z-Score as well as credit default swaps (CDS) and conclude that sovereign bond holdings can have a stabilizing effect on banks.

Chronopoulos et al. (2020) expand the examination of *determinants of banks' domestic sovereign exposure* beyond the EU to third countries using various data sources with a total of 295 banks from 35 different countries between 2002 and 2013. In support of the *moral suasion* hypothesis, the share of domestic sovereign exposures to total assets is higher for state-owned banks as well as in countries with a less-developed institutional environment, less efficient governance and higher sovereign bond yields. This home bias is an international phenomenon and not significantly different between banks located in the EU compared to third countries. From this, the authors conclude that regulatory privileges for member states of the EU do not significantly alter banks' domestic sovereign exposure. Again, the research presented here allows to broaden the view on foreign sovereign exposures.

Besides this home bias of banks expressed by a high concentration of sovereign bond portfolios on domestic sovereign counterparties, De Marco et al. (2021) find a concentration within foreign sovereign counterparties based on EBA Stress Test data from 2010 to 2015. The portfolio weights that a bank assigns to different foreign sovereign counterparties vary between banks depending on forecasts of future sovereign bond yields of the same bank reported to the Consensus Economics Survey. Banks assign high portfolio weights to foreign sovereign counterparties for which they have precise and optimist yield expectations and thus use their comparative advantage in information production.

The crowding out of lending to corporates by lending to sovereigns described by Altavilla et al. (2017) is further detailed in another strand of the literature on the *implications of banks' sovereign exposures for bank lending.* As a consequence of the deteriorating creditworthiness of GIIPS after 2010, Popov and van Horen (2015) show that banks located in 11 European non-GIIPS countries with sizable exposures to GIIPS reduced syndicated lending to foreign corporates more than less-exposed banks using EBA Stress

Test data.

Acharya et al. (2018) explain this crowding-out of syndicated loans to corporates by *risk shifting* behavior of financially weak banks with already pre-crisis existing high exposures to GIIPS, which have incentives to increase these exposures further and thereby substitute corporate loans. On the other hand, the authors assess the influence of *moral suasion* on bank lending to be less relevant, as banks susceptible to this – i.e., financially weak banks under government control – did not reduce their corporate loans significantly. As a consequence for the European real economy, this credit crunch impaired the growth of employment and sales as well as investments.

Contrasting this, Becker and Ivashina (2018) assume that the reduced credit supply for corporates in Europe between 2007 and 2015 was a consequence of increased investments in domestic sovereign bonds caused by *moral suasion* as part of *financial repression* by the domestic sovereign, which led firms in need for debt financing switch from bank loans to bond issuances.

Complementary to the *carry trades* of banks postulated by Acharya and Steffen (2015), another strand of the literature explores the *impact of monetary policy on banks' sovereign exposure*. Drechsler et al. (2016) point out that the ECB serves as a lender of last resort (LOLR) for EU banks through its MRO and LTRO and ask which banks borrow from the LOLR and for what they use the funds for. They show that weakly capitalized banks took out more LOLR loans between 2007 and 2011 and backed these by riskier collateral than other banks. The funds generated were then partly used to buy risky assets such as distressed sovereign bonds and especially issuances of the home country. This resulted in a reallocation of risky assets from strongly to weakly capitalized banks.

Arnold and Soederhuizen (2018) support these findings and the *moral suasion* hypothesis by providing evidence for a positive relation between central bank liquidity uptake and banks' domestic sovereign exposures. Central bank liquidity was particularly used in countries from which foreign investors withdrew.

Crosignani et al. (2020); Carpinelli and Crosignani (2021) emphasize that besides the explicitly stated goals of the irregular LTRO conducted by the ECB in 2011 and 2012 to support bank lending an liquidity, these monetary policy measures had the unstated goal to support sovereign bond markets, as Italian and Portuguese banks used the majority of central bank liquidity to buy Italian sovereign bonds. Financing high-yield domestic sovereign bonds with maturity-equivalent cheap ECB funding generated profitable *carry trade* as well as *regulatory arbitrage* opportunities for banks due to the regulatory risk weight of zero percent and additionally fulfilled potential *risk shifting* preferences of banks as well as *moral suasion* motives of the domestic sovereign.

Contrarily, Peydro et al. (2021) find that less capitalized Italian Banks bought sovereign bonds with lower yields during times of expansive monetary policy and thereby weaken the role of *regulatory arbitrage*.

Acharya et al. (2021) provide evidence that the concentration of risky sovereign debt in risky banks caused by the LTRO of the ECB increased the risk of fire sales in the bond market and point out that the ECB also serves as a buyer of last resort (BOLR) for EU sovereign debt besides it function as LOLR, which reduced fire sale risk.

Analogously, Krishnamurthy et al. (2018) confirm that the LTRO and OMT programs of the ECB reduced sovereign bond yields of GIIPS with the latter having a greater effect.

3 Hypotheses and Methodology

3.1 Hypotheses Development

This section derives hypotheses regarding the implications of the regulatory treatment of sovereign exposures for banks' investment decisions and outlines the methodological approach to test them. The identification strategy is based on the adjustments of banks' sovereign exposures as reaction to changes in sovereign bond yields and aims to identify different behavior caused by exposure, bank and macroeconomic characteristics

using interaction effects in multiple regression models. Figure 2 visualizes the interaction approach as suggested by Jaccard and Turrisi (2003).

[INSERT FIGURE 2 ABOUT HERE]

As benchmark reaction to rising sovereign bond yields, it can be expected that banks invest in sovereign debt and thereby increase their sovereign exposures due to the attractive risk-return profile in combination with the acceptance in refinancing operations as well as low regulatory requirements:

BM *Banks react to a rising sovereign bond yield by increasing their sovereign exposure.*

The heterogeneity in exposure, bank and macroeconomic characteristics is then exploited to investigate whether this benchmark reaction is influenced by *regulatory arbitrage*, *moral suasion* and *refinancing possibilities*. Hypothesis *H1* investigates potential *regulatory arbitrage* motives of banks and is split into three sub-hypotheses. Referring to exposure characteristics, banks' *yield seeking behavior* could be more pronounced for sovereign counterparties located in the EU compared to third countries outside the EU, since privileges for member states of the EU in banking regulation improve their attractiveness as investment opportunity further through zero capital requirements, highest liquidity status and no exposure limits:

H1a *The reaction of banks to rising sovereign bond yields of member states of the EU is more pronounced compared to third countries.*

Turning to bank characteristics, *regulatory arbitrage* motives might be particularly prevalent among banks with low capital and liquidity ratios, as these banks aim to invest in high yielding assets while complying with regulatory minimum capital and liquidity requirements:

H1b *The reaction of banks with low capital ratios to rising sovereign bond yields is more pronounced compared to banks with higher capital ratios.*

H1c The reaction of banks with low liquidity ratios to rising sovereign bond yields is more pronounced compared to banks with higher liquidity ratios.

Hypothesis *H2* captures potential *moral suasion* by the domestic sovereign. Government influence could affect the composition of banks' sovereign exposures as pressure by the domestic sovereign might make recently bailed-out and government-owned banks particularly susceptible to buy domestic sovereign debt:

H2 Banks under high government influence increase their domestic sovereign exposure more compared to banks under low government influence.

Addressing macroeconomic characteristics, hypothesis *H3* isolates periods of favorable *refinancing possibilities* that could encourage banks to invest in high-yield sovereign bonds financed with cheap funding in order to maximize the difference between the investment and funding leg of potential *carry trades*:

H3 The reaction of banks to rising sovereign bond yields is more pronounced in times of cheaply available funding.

3.2 Estimating Determinants of Banks' Sovereign Exposures

Following Altavilla et al. (2017), equation 1 defines the primary dependent variable as the change (Δ) in the exposure of bank i to country k from time $t-1$ to t ($\Delta Exposure^{Sov}_{i,k,t}$). In contrast to the authors, exposure changes are normalized by bank i's average exposure to country k ($\overline{Exposure^{Sov}_{i,k}}$) instead of its exposure to country k in $t-1$ to avoid losing zero exposures, as banks might not be exposed to all different foreign sovereigns throughout the entire observation period:[2]

$$\Delta Exposure^{Sov}_{i,k,t} = \left(\frac{Exposure^{Sov}_{i,k,t} - Exposure^{Sov}_{i,k,t-1}}{\overline{Exposure^{Sov}_{i,k}}} \right) \cdot 100. \tag{1}$$

[2]Differently scaled exposure changes are applied in a robustness test.

Equation 2 defines the primary independent variable as the change in the 10-year sovereign bond yield of country k from time $t-1$ to t ($\Delta Yield^{Sov}_{k,t}$). Absolute changes are used since these directly reflect the impact on a bank's earnings:

$$\Delta Yield^{Sov}_{k,t} = Yield^{Sov}_{k,t} - Yield^{Sov}_{k,t-1}. \tag{2}$$

Altavilla et al. (2017) trim changes in banks' domestic sovereign exposure at ± 100% to eliminate outliers. Here, banks' sovereign exposures, sovereign bond yields as well as the corresponding changes are instead winsorized at the 1% and 99% level of the empirical distribution of the respective variable to mitigate arbitrary cut off values in line with Chronopoulos et al. (2020).[3] Equation 3 estimates the benchmark for banks' reaction to changes in sovereign bond yields:

$$\begin{aligned} \Delta Exposure^{Sov}_{i,k,t} = {} & \beta^{\mathbf{Y}}_{\mathbf{1}} \cdot \mathbf{\Delta Yield^{Sov}_{k,t}} \\ & + \beta^{C}_{1} \cdot \Delta FXRate^{Counterparty}_{k \neq j,t} + \beta^{C}_{2} \cdot ln(TotalAssets^{Bank}_{i,j,t}) \\ & + \beta^{C}_{3} \cdot LoansAssets^{Bank}_{i,j,t} + \beta^{C}_{4} \cdot DepLiab^{Bank}_{i,j,t} \\ & + \beta^{C}_{5} \cdot \Delta EqIndex^{Domestic}_{k=j,t} + \beta^{B}_{i} \cdot Bank_i + \beta^{T}_{t} \cdot Date_t + \alpha + \epsilon_{i,k,t}. \end{aligned} \tag{3}$$

β^{Y}_{1} estimates the change in bank i's exposure to country k relative to its average exposure to country k if country k's bond yield changes by 1 PP. A positive coefficient β^{Y}_{1} would provide evidence that banks react to rising sovereign bond yields by increasing their exposure to the respective counterparty. Opposing this, a negative coefficient would indicate an exposure reduction.[4] Further, a set of control variables derived from related research and economic considerations is added. $\Delta FXRate^{Counterparty}_{k \neq j,t}$ captures currency

[3] This treatment of outliers is relaxed in a robustness test.

[4] It could be argued that using time lags in a dynamic panel data model might be more appropriate to model banks' reaction to changes in sovereign bond yields. However, since the data set used here covers half-yearly observations, this would result in estimating the change in a bank's sovereign exposure due to a change in the sovereign counterparty's bond yield half a year before, which does not seem to be an economically reasonable time span.

risks via the change in the exchange rate between the currency of the sovereign counterparty k and the Euro if the counterparty is not bank i's home country j. A devaluation of a foreign currency is reflected by an increasing exchange rate. In this case, coupon and principal payments paid out in foreign currency become worth less measured in the bank's local currency. This potentially leads banks to reduce their exposure to country k, exhibited by a negative coefficient β_1^C. This relation should also be supported by currency conversion in banks' balance sheets, which reduces the value of an exposure denominated in an impaired currency measured in local currency. $ln(TotalAssets_{i,j,t}^{Bank})$ is the natural logarithm of bank i's total assets to control for banks size, $LoansAssets_{i,j,t}^{Bank}$ and $DepLiab_{i,j,t}^{Bank}$ are the ratios of loans to total assets and deposits to liabilities to addresses different business models as in Chronopoulos et al. (2020) and Altavilla et al. (2017). $\Delta EqIndex_{k=j,t}^{Domestic}$ models the macroeconomic environment by the return on the leading equity index of bank i's home country j. As banks potentially base their asset allocation on market-wide performance, a trade-off between debt and equity markets indicated by a negative coefficient β_5^C is expected. $Bank_i$ and $Date_t$ are bank and time fixed effects to control for unobserved factors that are constant over time and different across banks and constant across banks but different over time, respectively. α and $\epsilon_{i,k,t}$ are the constant and residual of the regression model. Standard errors are clustered at the bank level to mitigate overstated precision due to autocorrelation of observations within entities and to allow for heteroscedasticity of unknown form.[5]

This benchmark model is then expanded by exposure, bank and macroeconomic characteristics to investigate whether banks engage in *regulatory arbitrage*, are subject to *moral suasion* and design *carry trades* involving sovereign bonds. First, these different channels are analyzed in isolation and finally, their joint significance is assessed. A major advantage of the data set used here compared to previous studies is a differentiation between domestic and foreign sovereign exposures including a detailed breakdown by sovereign counterparty. This allows to identify potential *regulatory arbitrage in terms of privileges*

[5]Differently clustered standard errors are applied in a robustness test.

for member states of the EU. In a first step, equation 4 disentangles different behavior towards domestic and foreign sovereigns by interacting a sovereign's bond yield change with an indicator variable equal to 1 if the sovereign counterparty k is bank i's home country j and 0 otherwise ($Domestic_{i,k=j,t}^{Counterparty}$). Simultaneously, exposures to foreign sovereigns located in third countries outside the EU are isolated by an interaction term including an indicator variable equal to 1 if the sovereign counterparty k is a third country and 0 otherwise ($ThCountry_{i,k\neq j,t}^{Counterparty}$). As reference group, β_1^Y then estimates a bank's reaction to a bond yield change of a foreign sovereign located in the EU and β_4^A adds the additional reaction to yield changes of foreign third countries. In order to accept hypothesis *H1a*, β_4^A would need to exhibit a negative coefficient sign. This would indicate that banks buy less bonds issued by foreign third countries compared to foreign EU countries, potentially due to stricter regulatory requirements. Addressing *regulatory arbitrage in terms of capital*, an interaction term between the change in country k's bond yield and bank i's regulatory total capital ratio ($CapitalRatio_{i,j,t}^{Bank}$) is added to evaluate potentially different behavior of banks with varying levels of capitalization. A negative coefficient β_6^A would show that weaker capitalized banks tend to buy more sovereign bonds in response to rising sovereign bond yields, supporting hypothesis *H1b*. Analogously, *regulatory arbitrage in terms of liquidity* is captured by an interaction term between the change in country k's bond yield and bank i's ratio of cash to total assets ($CashRatio_{i,j,t}^{Bank}$) to estimate potentially different behavior of banks with varying levels of liquidity. A negative coefficient β_8^A would provide evidence that less liquid banks tend to buy more sovereign bonds in response to rising sovereign bond yields, confirming hypothesis *H1c*:

$$
\begin{aligned}
\Delta Exposure^{Sov}_{i,k,t} = {} & \beta^{Y}_{1} \cdot \Delta Yield^{Sov}_{k,t} \\
& + \beta^{A}_{1} \cdot Domestic^{Counterparty}_{i,k=j,t} \\
& + \boldsymbol{\beta^{A}_{2}} \cdot \mathbf{\Delta Yield^{Sov}_{k,t}} \cdot \mathbf{Domestic^{Counterparty}_{i,k=j,t}} \\
& + \beta^{A}_{3} \cdot ThCountry^{Counterparty}_{i,k\neq j,t} \\
& + \boldsymbol{\beta^{A}_{4}} \cdot \mathbf{\Delta Yield^{Sov}_{k,t}} \cdot \mathbf{ThCountry^{Counterparty}_{i,k\neq j,t}} \\
& + \beta^{A}_{5} \cdot CapitalRatio^{Bank}_{i,j,t} + \boldsymbol{\beta^{A}_{6}} \cdot \mathbf{\Delta Yield^{Sov}_{k,t}} \cdot \mathbf{CapitalRatio^{Bank}_{i,j,t}} \\
& + \beta^{A}_{7} \cdot CashRatio^{Bank}_{i,j,t} + \boldsymbol{\beta^{A}_{8}} \cdot \mathbf{\Delta Yield^{Sov}_{k,t}} \cdot \mathbf{CashRatio^{Bank}_{i,j,t}} \\
& + \beta^{C}_{1} \cdot \Delta FXRate^{Counterparty}_{k\neq j,t} + \beta^{C}_{2} \cdot ln(TotalAssets^{Bank}_{i,j,t}) \\
& + \beta^{C}_{3} \cdot LoansAssets^{Bank}_{i,j,t} + \beta^{C}_{4} \cdot DepLiab^{Bank}_{i,j,t} \\
& + \beta^{C}_{5} \cdot \Delta EqIndex^{Domestic}_{k=j,t} + \beta^{B}_{i} \cdot Bank_{i} + \beta^{T}_{t} \cdot Date_{t} + \alpha + \epsilon_{i,k,t}.
\end{aligned}
\tag{4}
$$

Equation 5 addresses a bank's susceptibility to *moral suasion* by the domestic sovereign twofold. First, via an indicator variable equal to 1 if bank i received state aids at time t ($StateAid^{Bank}_{i,j=k,t}$) and second by the share of bank equity held by its home country j ($Ownership^{Sov}_{i,j=k,t}$), given that the sovereign counterparty k is its home country j, and 0 otherwise. If hypothesis *H2* is true that banks that received state aids and are government-controlled buy more domestic sovereign bonds, β^{S}_{1} and β^{S}_{2} would exhibit positive coefficient signs:

$$
\begin{aligned}
\Delta Exposure^{Sov}_{i,k,t} = {} & \beta^{Y}_{1} \cdot \Delta Yield^{Sov}_{k,t} \\
& + \boldsymbol{\beta^{S}_{1}} \cdot \mathbf{StateAid^{Bank}_{i,j=k,t}} \cdot \mathbf{Domestic^{Counterparty}_{i,k=j,t}} \\
& + \boldsymbol{\beta^{S}_{2}} \cdot \mathbf{\Delta Ownership^{Sov}_{i,j=k,t}} \cdot \mathbf{Domestic^{Counterparty}_{i,k=j,t}} \\
& + \beta^{C}_{1} \cdot \Delta FXRate^{Counterparty}_{k\neq j,t} + \beta^{C}_{2} \cdot ln(TotalAssets^{Bank}_{i,j,t}) \\
& + \beta^{C}_{3} \cdot LoansAssets^{Bank}_{i,j,t} + \beta^{C}_{4} \cdot DepLiab^{Bank}_{i,j,t} \\
& + \beta^{C}_{5} \cdot \Delta EqIndex^{Domestic}_{k=j,t} + \beta^{B}_{i} \cdot Bank_{i} + \beta^{T}_{t} \cdot Date_{t} + \alpha + \epsilon_{i,k,t}.
\end{aligned}
\tag{5}
$$

Banks' *refinancing possibilities* and construction of *carry trades* are taken into account

in equation 7. On the one hand, it indirectly models the availability of short-term funding following the intuition of Acharya and Steffen (2015) by an interaction between the sovereign bond yield change and the price of 10-year German sovereign bonds ($Price_t^{Germany}$). The idea behind this variable is that a *flight to quality* in financial markets would induce an increase in German sovereign bond prices – respectively a reduction in German sovereign bond yields – with a simultaneous evaporation in the supply of short-term funding. The interaction term allows to assess banks' yield seeking behavior at different levels of the empirical distribution of the German sovereign bond price. This variable is calculated in equation 6 in line with Lamers et al. (2022) by transforming the yield to maturity of a 10-year sovereign bond ($Yield_t^{Sov}$) to a zero coupon bond price:

$$Price_t^{Sov} = \frac{100}{(1 + Yield_t^{Sov})^{10}}. \tag{6}$$

On the other hand, monetary policy interventions by the ECB are indirectly isolated by an interaction between the sovereign bond yield change and a dummy variable equal to 1 during the irregular LTRO in the second half of 2011 as well as first half of 2012 and 0 otherwise ($LTRO_t$) as in Battistini et al. (2014) and Acharya and Steffen (2015). In indirect support of hypothesis *H3* that banks especially invest in sovereign bonds during times of cheaply available funding, a negative coefficient β_1^R would indicate that banks behave less yield seeking as the price of German sovereign bonds appreciates while a positive coefficient β_2^R would indicate that banks behaved particularly yield seeking in 2011 and 2012:[6]

[6] $LTRO_t$ and $Price_t^{Germany}$ are only included as interaction terms because they are constant over all banks but different through time and thus the effects of the individual variables are subsumed in the time fixed effects.

$$
\begin{aligned}
\Delta Exposure^{Sov}_{i,k,t} = {} & \beta^{Y}_{1} \cdot \Delta Yield^{Sov}_{k,t} \\
& + \beta^{\mathbf{R}}_{\mathbf{1}} \cdot \mathbf{\Delta Yield^{Sov}_{k,t}} \cdot \mathbf{Price^{Germany}_{t}} + \beta^{\mathbf{R}}_{\mathbf{2}} \cdot \mathbf{\Delta Yield^{Sov}_{k,t}} \cdot \mathbf{LTRO_{t}} \\
& + \beta^{C}_{1} \cdot \Delta FXRate^{Counterparty}_{k \neq j,t} + \beta^{C}_{2} \cdot ln(TotalAssets^{Bank}_{i,j,t}) \\
& + \beta^{C}_{3} \cdot LoansAssets^{Bank}_{i,j,t} + \beta^{C}_{4} \cdot DepLiab^{Bank}_{i,j,t} \\
& + \beta^{C}_{5} \cdot \Delta EqIndex^{Domestic}_{k=j,t} + \beta^{B}_{i} \cdot Bank_{i} + \beta^{T}_{t} \cdot Date_{t} + \alpha + \epsilon_{i,k,t}.
\end{aligned} \tag{7}
$$

Finally, the full regression model combines the effects of *regulatory arbitrage*, *moral suasion* and *refinancing possibilities* in equation 8 to assesses their joint significance:

$$
\begin{aligned}
\Delta Exposure^{Sov}_{i,k,t} = {} & \beta^{Y}_{1} \cdot \Delta Yield^{Sov}_{k,t} \\
& + \beta^{A}_{1} \cdot Domestic^{Counterparty}_{i,k=j,t} \\
& + \beta^{A}_{2} \cdot \Delta Yield^{Sov}_{k,t} \cdot Domestic^{Counterparty}_{i,k=j,t} \\
& + \beta^{A}_{3} \cdot ThCountry^{Counterparty}_{i,k \neq j,t} \\
& + \beta^{A}_{4} \cdot \Delta Yield^{Sov}_{k,t} \cdot ThCountry^{Counterparty}_{i,k \neq j,t} \\
& + \beta^{A}_{5} \cdot CapitalRatio^{Bank}_{i,j,t} + \beta^{A}_{6} \cdot \Delta Yield^{Sov}_{k,t} \cdot CapitalRatio^{Bank}_{i,j,t} \\
& + \beta^{A}_{7} \cdot CashRatio^{Bank}_{i,j,t} + \beta^{A}_{8} \cdot \Delta Yield^{Sov}_{k,t} \cdot CashRatio^{Bank}_{i,j,t} \\
& + \beta^{S}_{1} \cdot StateAid^{Bank}_{i,j=k,t} \cdot Domestic^{Counterparty}_{i,k=j,t} \\
& + \beta^{S}_{2} \cdot \Delta Ownership^{Sov}_{i,j=k,t} \cdot Domestic^{Counterparty}_{i,k=j,t} \\
& + \beta^{R}_{1} \cdot \Delta Yield^{Sov}_{k,t} \cdot Price^{Germany}_{t} + \beta^{R}_{2} \cdot \Delta Yield^{Sov}_{k,t} \cdot LTRO_{t} \\
& + \beta^{C}_{1} \cdot \Delta FXRate^{Counterparty}_{k \neq j,t} + \beta^{C}_{2} \cdot ln(TotalAssets^{Bank}_{i,j,t}) \\
& + \beta^{C}_{3} \cdot LoansAssets^{Bank}_{i,j,t} + \beta^{C}_{4} \cdot DepLiab^{Bank}_{i,j,t} \\
& + \beta^{C}_{5} \cdot \Delta EqIndex^{Domestic}_{k=j,t} + \beta^{B}_{i} \cdot Bank_{i} + \beta^{T}_{t} \cdot Date_{t} + \alpha + \epsilon_{i,k,t}.
\end{aligned} \tag{8}
$$

To investigate potentially different behavior of banks located in relatively risky countries compared to banks located in relatively save countries, all regression specifications are estimated over the full sample of European banks as well as core and peripheral EU

sub-samples.[7]

4 Empirical Findings

4.1 Publication of Sovereign Exposures by the EBA

This section gives an overview of the Stress Tests as well as Capital and Transparency Exercises conducted by the EBA used as main data sources for this study, available in European Banking Authority (2020). Table 2 summarizes the different EBA investigations. Reporting date refers to the closing date of banks' balance sheets and publication date to the date on which the EBA made the information available to the public. As part of these investigations, the EBA disclosed sovereign exposures of large European banks to 38 different counterparties between 31 Dec. 2010 and 31 Dec. 2019 on a half-yearly basis. As an exception, the EBA did not disclose sovereign exposures for the first half of 2011 and 2014, leading to a maximum of 17 exposure observations per bank and sovereign counterparty.

[INSERT TABLE 2 ABOUT HERE]

A major advantage of this data set compared to previous studies is a detailed breakdown of banks' sovereign exposures by sovereign counterparty. Hereinafter, sovereign counterparties are categorized as presented in figure 3. On a first level, a bank's total sovereign exposure is split into domestic and foreign counterparties. Since the EBA supervises EU banks, all domestic sovereign counterparties are located in the EU.[8] On a second level, foreign sovereign counterparties are differentiated between member states of the EU and third countries outside the EU. This allows to analyze different bank behavior caused

[7] Following an established convention in the literature, the periphery of the EU comprises Greece, Ireland, Italy, Portugal and Spain (GIIPS) and the other member states are labeled as core, see for example Podstawski and Velinov (2018).

[8] As exception, the EBA also includes non-EU banks located in Iceland and Norway. These are excluded from the analyzes to avoid mixing different regulatory regimes.

by privileges for member states of the EU in banking regulation. On a third level, EU member states are divided into relatively safe core and relatively risky peripheral EU countries as in Battistini et al. (2014) and others.

[INSERT FIGURE 3 ABOUT HERE]

Following this categorization, the 38 sovereign counterparties covered by the EBA are assigned to the different categories in table 3.

[INSERT TABLE 3 ABOUT HERE]

4.2 Descriptive Statistics

This section summarizes the data set descriptively. The EBA investigations determine the banks, countries as well as observation period and observation frequency considered. The differentiation of banks' sovereign exposures by sovereign counterparties allows to expand the analyzes of Altavilla et al. (2017) from domestic to foreign sovereigns. The observation period starts on 31 Dec. 2010 with Stress Test 2011 and ends on 31 Dec. 2019 with Transparency Exercise 2020. During this time more than 200 entities were part of one or more EBA investigations. 85 of these banks have balance sheet and regulatory data available in the Refinitiv Worldscope data base.[9] For these banks, gross direct long sovereign exposures are hand-collected from the different EBA investigations, as also used by Becker and Ivashina (2018) and others.[10] 3 of these banks are located

[9]The number of banks considered in the different EBA investigations is not constant. Thus, a constant sample of banks that were part of all EBA investigations is used in a robustness test to exclude the possibility that the results are driven by bank entry and exit.

[10]Accounting treatment of sovereign debt held in the banking book can be different from the trading book. While positions in the banking book are booked at amortized costs, positions in the trading book could be booked at fair value. For the latter, this might induce a mechanically negative relationship between sovereign bond yields and sovereign exposures, as falling bond prices – respectively increasing yields – are potentially followed by impairments in banks' balance sheets. This might prevent to identify yield seeking behavior of banks. The data does not differentiate between banking and trading book exposures. However, Committee on the Global Financial System (2011) point out that across the EU 85% of domestic sovereign exposures are held in the banking book.

outside the EU (Arion Banki HF from Iceland as well as DNB Bank ASA and Sparebank 1 SR Bank ASA from Norway) and therefore not considered further to avoid mixing different regulatory regimes. As banks might not be exposed to all countries considered by the EBA, exposure time series that are equal to zero throughout the entire observation period are eliminated to ensure that the sample banks have non-zero demand for sovereign debt, as in Becker and Ivashina (2018). This results in a loss of 1 bank. Government influence is measured two-fold. First, by state aid cases for domestic banks hand-collected from European Commission (2021), excluding cases of country-wide guarantees for an entire banking sector, as in Altavilla et al. (2017). Second, by the percentage share of bank equity held by the domestic sovereign gathered from Refinitiv Workspace, as e.g. also used by Becker and Ivashina (2018). For 23 of the 38 sovereign counterparties covered by the EBA, 10-year benchmark bond yield indices are available in Refinitiv Datastream.[11] Of these, 12 are located in the core of the EU (Austria, Belgium, Czech, Denmark, Finland, France, Germany, Hungary, Netherlands, Poland, Sweden and UK), 5 are located in the periphery of the EU (Greece, Irland, Italy, Portugal and Spain) and 6 are third countries outside the EU (Canada, China, Japan, Norway, Switzerland and USA). To model the macroeconomic environment, exchange rates and local equity indices are added from Refinitiv Datastream. In the final sample selection step, 7 banks with incomplete and/or inconsistent balance sheets and regulatory data are removed to ensure data accuracy.[12] Additionally, 6 banks with exposure observations for only one point int time are eliminated, since it is not possible to calculate changes for these banks. The final sample covers 68 banks. Figure 4 sketches the development from the raw data to the final sample in a waterfall plot.

[INSERT FIGURE 4 ABOUT HERE]

The data is organized as an unbalanced panel of half-yearly sovereign exposure obser-

[11] For more information on Refinitiv government bond indices see Refinitiv (2022).

[12] I.e., observations with a negative sovereign exposure, a (total) sovereign exposure greater than total assets and a ratio of loans to assets as well as deposits to liabilities greater than 100% are eliminated.

vation (obs.) of European banks. It covers a total of 12,869 exposure observations of 68 banks located in 21 EU countries to 23 different sovereign counterparties between 31 Dec. 2010 and 31 Dec. 2019. Table 4 shows the banks included in the sample.

[INSERT TABLE 4 ABOUT HERE]

Table 5 shows the sample distribution grouped by banks' home countries as well as by sovereign counterparties.[13] 39 banks with a total of 8,660 exposure observations are located in 16 different core EU countries. The remaining 29 banks with 4,209 exposure observations are located in 5 different peripheral EU countries, namely GIIPS. These banks are exposed to 12 sovereigns from the EU core, 5 sovereigns from the EU periphery as well as 6 third countries.

[INSERT TABLE 5 ABOUT HERE]

Table 6 summarizes descriptive statistics. Focusing on bank characteristics, the banks in the sample hold average total assets of 587.7 billion Euro with a regulatory total capital ratio of 17.1%. Measuring government influence, banks received state aids in 0.1% of all observed half-years with a standard deviation (std. dev.) of 3.2 PP and the share of bank equity owned by the government averages at 0.3% with a minimum (min.) of 0.0% and maximum (max.) of 99.9%.

[INSERT TABLE 6 ABOUT HERE]

Detailing exposure characteristics, figure 5 depicts the development of banks' sovereign exposures from 2010 to 2019. The full area equals the average total sovereign exposure per bank. It is then differentiated between exposures to the domestic sovereign (dark gray area), foreign EU countries (gray area) as well as foreign third countries (light gray

[13]Table 5 counts one bank more compared to table 4 due to Nordea Bank Abp relocating from Sweden to Finland in 2019 and thus being double counted.

area). Panel (a) is scaled in billion Euro and panel (b) in percent of total assets. Total sovereign exposures represent a substantial and stable share of banks' balance sheets of 54.6 billion Euro or 11.4% of total assets on average per bank. These sovereign bond portfolios consist of exposures to 23 different counterparties with an average exposure of 2.5 billion Euro. Exposures to foreign sovereign counterparties are relatively equally distributed and comparably large with an average exposure to EU sovereigns of 1.2 and to third countries of 2.7 billion Euro per counterparty, respectively. Opposing this, banks' sovereign bond portfolios exhibit a considerable home bias with an average exposure to the domestic sovereign of 19.0 billion Euro.

[INSERT FIGURE 5 ABOUT HERE]

Figures 6 and 7 connect banks' sovereign exposures to the regulatory large exposures framework. The full bars equal banks' average sovereign exposures by sovereign counterparty in billion Euro. The black part shows the prudential exposure share that complies with the regulatory large exposures limit of 25% of banks' core capital and the gray part shows the excess sovereign exposure calculated from equation 9:

$$\underset{Exposure}{Excess} = max[Exposure - \underbrace{0.25 \cdot Core\ Capital}_{Limit\ to\ Large\ Exposures}; 0]. \tag{9}$$

For exposures to foreign sovereigns, banks generally comply with large exposure limits except for the USA, independent of regulatory exemptions for member states of the EU.

[INSERT FIGURE 6 ABOUT HERE]

However, for exposures to the domestic sovereign, banks' exceed prudential large exposures limits by 13.4 billion Euro on average.

[INSERT FIGURE 7 ABOUT HERE]

To check the representativeness of the sample, figure 8 divides the total volume of sovereign debt held by the sample banks by total sovereign debt outstanding. The 68 banks included in the sample hold a sizable share of bonds issued by member states of the EU, ranging between 5% and 50%. For third countries, shares are lower at up to approximately 5%. Since a relevant share of sovereign debt is not held by our sample banks, there should be sufficient trading of sovereign bonds in- and outside the sample.

[INSERT FIGURE 8 ABOUT HERE]

This paper is mainly interested in the impact of different regulatory requirements for sovereign counterparties located in the EU compared to third countries on bank behavior. These in turn are primarily derived from external credit ratings. Figure 9 depicts the median sovereign issuer credit rating from Standard & Poor's Ratings Services, Fitch Ratings and Moody's Investors Service for the sovereign counterparties covered in the data set.[14] Moreover, the corresponding risk weight according to the Standardized Approach for Credit Risk is marked by the horizontal gray dashed lines. Sovereign risks diverge substantially within the EU with a dichotomous distribution of financially strong ratings in most of the core and weak ratings in the periphery of the EU. Notably, all EU member states are treated identically from a regulatory perspective with a risk weight of 0%, independent of their riskiness. The third countries covered in the analysis are all relatively strongly-rated and thus have comparably low regulatory minimum requirements as member states of the EU. Although banks might take the risk of downgrades of third countries and resulting higher regulatory requirements into account, this might bias the analyzes towards similar behavior towards member states of the EU compared to third countries.

[INSERT FIGURE 9 ABOUT HERE]

[14] In case of split ratings, the second-best rating was chosen in line with regulatory requirements in annex VI, part 3, 1(5-7) European Parliament and Council (2006) and page 86 of European Banking Authority (2019).

Figure 10 compares the development of average 10-year sovereign bond yields of EU countries in the solid dark gray line to third countries in the solid light gray line. The EU is further split into core and peripheral countries in the dotted and dashed dark gray lines, respectively. Moreover, the German sovereign bond yield is depicted by the solid black line. Throughout the observation period, a steady decline of sovereign bond yields can be observed. Between 2010 and 2014, sovereign risks diverged between the three groups of countries. Bond yields of core EU and third countries were comparably low between 3% to 4%, while yields in the EU periphery rose to 14%. From 2015 onwards, yields aligned at around 2%. The German sovereign bond yield was consistently below the peer groups and thus acts as a risk-free benchmark.

[INSERT FIGURE 10 ABOUT HERE]

Figure 11 combines the change in banks' sovereign exposures on the vertical axis with the change in the corresponding sovereign bond yield on the horizontal axis in a scatter plot. To get a first descriptive indication of banks' reaction to sovereign bond yield changes, data points are differentiated by sovereign counterparties. The shades from darkest to lightest depict exposures to the domestic sovereign, foreign EU countries and foreign third countries. Yield changes range between -3.4 and +2.4 PP per half-year and corresponding exposure changes between -535.6 and +510.0 PP with no clear relation. Domestic exposure changes cluster nearer to zero and exhibit a lower variation.

[INSERT FIGURE 11 ABOUT HERE]

Currencies of sovereigns outside the Eurozone devalued slightly compared to the Euro during the observation period.

Concerning macroeconomic characteristics, the price of German zero-coupon sovereign bonds averaged at 94.7% and domestic equity indices returned on average 7.2% per half year.

4.3 Regression Results

This section presents the regression results. To get a benchmark for banks' general reaction to sovereign bond yield changes, table 7 summarizes regression results for equation 3. As average reaction to a 1 PP increase in the bond yield of country k, banks increase their exposure to country k by 12.7% (relative to their average exposure to country k) over the full sample in model (1). This effect is statistical significance at the 1% level and with an average sovereign exposure of 2.5 billion Euro translates into an economically significant increase of approximately 0.3 billion Euro. This provides first empirical evidence for yield seeking behavior of banks. Notably, these estimates hold irrespective of potential mark-to-market losses booked on sovereign debt held in the trading book and thus provide a lower bound for a bank's reaction to sovereign bond yield changes. Estimations for sub-samples of core and peripheral EU banks in models (2) and (3) are similar, indicating that this behavior is an EU-wide phenomenon. The effects of the control variables are partly in line with expectations. Devaluations of foreign currencies induce decreasing exposures to affected countries. This can be explained by banks actively reducing their exposures due to coupon and principal payments becoming worth less converted into local currency. Alternatively, this effect can occur passively from currency conversion in banks' balance sheets without a change in foreign currency exposures.[15] The effects of changes in banks' total assets as well as their ratios of loans to assets and deposit to liabilities are statistically not significantly different from zero at conventional levels. As these are rather stable variables measuring a bank's business model, their effects might already be captured in the bank fixed effects. Positive returns in equity markets are negatively related to exposure changes. As equity investments become more profitable, banks seem to shift liquidity from debt to equity markets and vice versa. With an adjusted R^2 between 1.3% and 2.4%, there is substantial variation in banks' sovereign exposures that is not explained by the benchmark model.

[15]The EBA publishes sovereign exposures already converted into Euro. Thus, no information on the size of foreign currency exposures is available.

[INSERT TABLE 7 ABOUT HERE]

The heterogeneity in exposure, bank and macroeconomic characteristics is then exploited to expand the benchmark model via an interaction approach to assess whether *regulatory arbitrage*, *moral suasion* and *refinancing possibilities* impact banks' yield seeking behavior. Does *regulatory arbitrage* impact bank behavior? This question is answered from three perspectives in table 8 as specified in equation 4.

[INSERT TABLE 8 ABOUT HERE]

First, *regulatory arbitrage in terms of privileges for member states of the EU* is investigated by taking counterparty location into account via interaction terms between the sovereign bond yield change and indicator variables for domestic as well as third country counterparties. For the reference group foreign EU sovereign counterparty, the average reaction of banks to a sovereign bond yield change of 1 PP is estimated at 9.3% and stays statistically significant at the 1% level.[16] The additional reaction to yield changes of the domestic sovereign is negative at -14.3 and statistically significant at the 1% level, equaling an exposure change to the domestic sovereign of -5.0%. Although this effect is lower from a relative perspective, with substantially higher domestic sovereign exposures of 19.0 billion Euro on average, it is larger from an absolute perspective with an exposure change of -1.0 billion Euro as reaction to an increase in the domestic sovereign's bond yield of 1 PP. From a regulatory standpoint, investments into third country sovereign bonds are less attractive for banks due to stricter regulatory requirements compared to bonds issued by member states of the EU, which should be expressed by smaller exposure changes. However, the interaction term for third country counterparties turns out statistically insignificant at conventional levels. Thus, bank behavior does not seem to be

[16] This marginal effect is calculated from model (1) of table 8 at means of banks' capital and cash ratios:

$$9.3 = 41.4130 - \underbrace{14.3429 \cdot 0}_{\substack{Home \\ Country}} + \underbrace{3.0174 \cdot 0}_{\substack{Third \\ Country}} - \underbrace{1.3834 \cdot 17.09}_{\substack{Capital \\ Ratio}} - \underbrace{1.4130 \cdot 5.98}_{\substack{Cash \\ Ratio}}.$$

statistically significantly different from the reference group foreign EU sovereigns. Figure 12 visualizes the estimated slopes of the regression function for the different sovereign counterparty types. The dark gray line explains the change in the exposure to the domestic sovereign by a change in the domestic sovereign bond yield of 1 PP. The gray and light gray lines display exposures to foreign EU sovereigns as well as third countries with steeper and approximately equal slopes. The data suggests that banks react similarly to yield changes of foreign sovereigns independent of their location. Thus, no convincing empirical evidence for hypothesis *H1a* can be found. However, the lack of evidence might be due to only well-rated third-country sovereigns with comparably low regulatory requirements as EU sovereigns being included in the data set.

[INSERT FIGURE 12 ABOUT HERE]

Second, *regulatory arbitrage in terms of capital* is investigated by distinguishing between different levels of bank capitalization via an interaction term between the sovereign bond yield change and banks' total capital ratio. The interaction term is negative and statistically significant at the 1% level, indicating that financially weaker banks are more yield seeking than stronger ones. As reaction to a rising bond yield of a foreign sovereign, weakly capitalized banks – represented by the 25^{th} percentile of the empirical distribution of the capital ratio (15.0%) – raise their respective exposure by 12.2%. This effect falls to 5.7% for strongly capitalized banks – represented by the 75^{th} percentile (19.7%). For domestic sovereigns, estimations are shifted downwards by 14.3 PP to -2.1% for weakly and -8.6% for strongly capitalized banks, indicating that banks decrease their exposure to the domestic sovereign in times of rising sovereign risks, but weakly capitalized ones do so to a lesser extent. Figure 13 depicts this marginal effect of a change in a sovereign's bond yield on the change in a bank's exposure to the corresponding sovereign at different percentiles of the empirical distribution of banks' regulatory total capital ratio including 90% confidence intervals. Panel (a) refers to foreign and panel (b) to domestic sovereign counterparties. The vertical dashed black lines represent the mean as well as 25^{th} and 75^{th} percentiles of the capital ratio and estimations range from its minimum to maximum.

The falling line indicates that as capital ratios increase, banks engage less in sovereign debt if sovereign bond yields increase, providing empirical evidence for hypothesis *H1b*.

[INSERT FIGURE 13 ABOUT HERE]

Third, *regulatory arbitrage in terms of liquidity* is investigated analogously by distinguishing between different levels of bank liquidity via an interaction term between the sovereign bond yield change and banks' cash ratio. A negative, comparably large and highly significant interaction effect is found. Less liquid banks – represented by the 25^{th} percentile of the empirical distribution of the cash ratio (2.5%) – increase their exposure by 14.2% in response to rising bond yields of foreign sovereigns compared to 7.0% for more liquid banks – represented by the 75^{th} percentile (7.7%). Figure 14 depicts this falling marginal at different percentiles of the empirical distribution of banks' cash ratio including 90% confidence intervals, supporting hypothesis *H1c*. Notably, both the effects of bank capitalization and bank liquidity are driven by the core EU sub-samples and are statistically insignificant in the periphery.

[INSERT FIGURE 14 ABOUT HERE]

Does *moral suasion* by the domestic sovereign impact bank behavior? This question is examined in table 9 as specified in equation 5. The amount of government influence on domestic banks is measured by a state aid indicator specifying whether a bank received public support in the respective half-year as well as by the change in bank equity held by the domestic sovereign. Both coefficients are positive and statistically significant at the 5% and 10% level, respectively, indicating that banks under higher government influence raise their exposure to the domestic sovereign more than banks under lower influence. State aids induce an exposure increase of 12.9%, while an increase in bank equity held by the domestic sovereign of 1 PP translates into an exposure of 0.4%.

[INSERT TABLE 9 ABOUT HERE]

Figure 15 shows the estimated slopes of regression function for a change in government ownership on banks' domestic sovereign exposures for bailed out and non-bailed out banks in the solid and dashed dark gray lines. Changes in domestic sovereign exposures range from -349.5% to +316.6% on the vertical axis and changes in government ownership from −28.8% to +93.6% on the horizontal axis. The data points cluster at 0, as the majority of banks were not government-owned throughout the observation period. However, for the few government-owned banks a positive slope of the regression function is estimated and state aids shift the entire regression function upwards, confirming hypothesis *H2*. Notably, these effects are driven by peripheral EU banks and are statistically insignificant in the core.

[INSERT FIGURE 15 ABOUT HERE]

Do *refinancing possibilities* impact bank behavior? This question is addressed in table 10 as specified in equation 7. Periods of cheaply available funding are indirectly isolated on the one hand by an interaction term between sovereign bond yield changes and the German sovereign bond price. Under the assumption that an evaporation of short-term funding possibilities and appreciation of prices of safe asset occur simultaneously as part of a *flight to quality*, low prices – respectively high yields – of German sovereign bonds are interpreted as periods of cheaply available funding and vice versa. On the other hand, sovereign bond yield changes are interacted with an indicator for year-end 2011 and the first half of 2012, during which the ECB improved refinancing possibilities for banks through its irregular LTRO.[17]

[INSERT TABLE 10 ABOUT HERE]

The effect of the German sovereign bond price is negative and statistically significant at the 1% level, indicating that banks behave less yield seeking as prices of safe assets appreciate. In times of widely available short-term funding – approximated by the 25^{th}

[17]The main effects of these variables are already included in the model via the time fixed effects.

percentile of the empirical distribution of the German sovereign bond price (92.6%) – banks increase their sovereign exposure by 4.8% in response to a sovereign bond yield increase of 1 PP. As refinancing possibilities deteriorate – approximated by the 25^{th} percentile (97.9%) – this effect falls to 0.2%. Figure 16 visualizes this marginal at different percentiles of the empirical distribution of German sovereign bond price including 90% confidence intervals.

[INSERT FIGURE 16 ABOUT HERE]

Moreover, banks were especially yield seeking during the irregular LTRO conducted by the ECB, implied by statistically significant and economically relevant stronger reaction of 29.4 PP than in other time periods. Both the effects of the German sovereign bond price and of the LTRO indirectly provide evidence that banks are particularly yield seeking during times of cheaply available funding. This supports hypothesis *H3* and the idea that banks engaged in *carry trades*.

The full model assesses the *joint significance* of *regulatory arbitrage*, *moral suasion* and *refinancing possibilities* in table 11 as specified in equation 8. Overall, the coefficient signs as well as significance levels remain stable except for the state aid indicator. This is potentially caused by multicollinearity between bank bailouts and the LTRO of the ECB, which mainly occurred simultaneously, resulting in inflated standard errors.

[INSERT TABLE 11 ABOUT HERE]

4.4 Robustness Tests

To test the reliability of the results, a variety of robustness tests are conducted. Are the results affected by bank entry and exit? The sample covers banks that were part of one or more EBA investigations. As the composition of banks changes in the different investigations, the results might be affected by banks entering and exiting the sample. To rule this possibility out, equation 7 is estimated again in table 12 on a constant sample

of banks that were part of all EBA investigations between 31 Dec. 2010 and 31 Dec. 2019. The coefficients signs and statistical significance stay stable for the capital ratio, German sovereign bond price as well as LTRO, while statistical significance is lost for the cash ratio as well as state aid indicator and government ownership, potentially due to the reduced number of banks and observations.

[INSERT TABLE 12 ABOUT HERE]

Do outliers change the results? The main analyzes winsorize sovereign exposure and sovereign bond yield changes at the 1% and 99% levels to eliminate outliers. Table 13 presents the regression results without winsorization. Coefficient signs generally remain stable with reduced statistical significance. For staid aids, government ownership and the German sovereign bond price, statistical significance is lost.

[INSERT TABLE 13 ABOUT HERE]

Is the precision of the regression coefficients overstated? Saka (2020) points out that existing studies in context of banks' sovereign exposures follow the convention to cluster standard errors at the bank level, as also done in the main analyzes here. This allows to address correlation of observations within banks. To investigate potential other correlation patterns, table 14 presents regression results with standard errors clustered at the sovereign exposure, home country and sovereign counterparty level. Clustering at more aggregated levels leads to larger standard errors and therefore lower statistical significance. Thus, clustering at the exposure level generally improves the statistical significance compared to the main analyzes, while it is slightly reduced at the home country level. Statistical significance is lowest with standard errors clustered at the counterparty level, especially in terms of macroeconomic characteristics.

[INSERT TABLE 14 ABOUT HERE]

Do the results hold under an alternative variable definition? The main analyzes use the change in the exposure of bank i to country k scaled by the average exposure of bank i to country k as primary dependent variable. Table 15 uses the relative exposure change following Altavilla et al. (2017) as well as the exposure change scaled by a bank's total sovereign exposure and a bank's total assets as alternative dependent variable. With relative changes, the coefficient signs generally allow for unchanged conclusions, but the statistical significance is impaired. This is potentially caused by a partial loss of observations, since banks are not exposed to all foreign sovereigns throughout the observation period and thus relative changes can partly not be calculated due to a position value of 0. With scaling by total sovereign exposure and by total assets, coefficient signs stay stable but statistical significance is especially lost for macroeconomic characteristics.

[INSERT TABLE 15 ABOUT HERE]

Are the results affected by the methodological approach? As an alternative to the interaction approach used in the main analyzes, banks' reaction to sovereign bond yield changes is estimated on sub-samples of foreign sovereign counterparties in table 16. Since only foreign sovereign counterparties are taking into account, the proxies for *moral suasion* by domestic sovereigns are excluded here. Model (1) covers all foreign sovereign counterparties and confirms the main findings. First, increases in sovereign bond yields lead banks to increase their sovereign exposures. Second, the reaction of weaker capitalized and less liquid banks to rising sovereign bond yields is more pronounced than that of financially stronger banks. Third, banks are particularly yield seeking during times of low German sovereign bond prices and the irregular LTRO of the ECB. Fourth, devaluations of foreign currencies lead banks to reduce their exposures to affected countries. Fifth, positive returns in equity markets are negatively connected to sovereign exposures. Model (2) focuses on foreign sovereign counterparties located in the EU and allows for comparable conclusions. Model (3) includes only foreign third countries. For this sub-sample, the variables measuring *regulatory arbitrage* lose their statistical significance, implying that less capitalized and less liquid banks only take advantage of favorable regulatory require-

ments of EU countries. Moreover, the coefficient of the LTRO indicator variable turns negative, indicating that banks reduced exposures to stressed third countries during 2011 and 2012.

[INSERT TABLE 16 ABOUT HERE]

5 Conclusion

Using data published by the EBA, this paper explores the impact of the regulatory treatment of sovereign exposures on bank behavior. Existing studies in this regard mainly focus on banks' exposures to the domestic sovereign due to limited data availability. This paper contributes to the literature by taking a holistic view on banks' sovereign bond portfolios with a focus on foreign sovereign counterparties. As main contribution, it differentiates between exposures to EU countries and to third countries in order to assess whether privileges for member states of the EU in banking regulation alter banks investment decisions.

The Paper shows descriptively that banks' sovereign exposures remained relatively stable between 2010 and 2019. Banks are substantially exposed to sovereign risks with 54.6 billion Euro or 11.4% of total assets on average per bank. A sizable share of 19.0 billion Euro stems from exposures to the domestic sovereign. This home bias exceeds prudential regulatory limits to large exposures by 13.4 billion Euro. The remaining share is distributed over foreign sovereigns with an average exposure of 1.2 to 2.7 billion Euro. These are relatively evenly distributed over foreign sovereigns located in the EU and in third countries.

Exploiting the heterogeneity in exposure, bank and macroeconomic characteristics, the findings suggest that banks' sovereign exposures are determined by *regulatory arbitrage*, *moral suasion* and *refinancing possibilities*. On average, banks react to rising bond yields of foreign sovereigns by increasing their respective sovereign exposure. Consistent with

regulatory arbitrage in terms of capital and liquidity, weakly capitalized and less liquid banks behave more yield seeking than financially stronger ones. Contrarily, bank behavior is similar for sovereigns located in the EU compared to third countries. Thus, no evidence for *regulatory arbitrage in terms of privileges for member states of the EU* is found. Providing evidence for *moral suasion* by the domestic sovereign, banks that recently received state aids as well as government owned banks hold more domestic sovereign debt than other banks. Indirectly supporting the design of *carry trades* consisting of investments in high-yield sovereign debt that are funded by cheap financing sources, banks are particularly yield seeking in coincidence with low German sovereign bond prices and the irregular LTRO of the ECB at the end of 2011 and beginning of 2012 that indicate periods of cheap *refinancing possibilities* for banks.

These findings have important implications for banking regulation. Although no evidence that banks behave differently towards member states of the EU compared to third countries is found, this does not necessarily mean that the regulatory treatment of sovereign exposures does not distort banks' balance sheets. Indeed, regulatory requirements for exposures to third countries are not much different from EU countries, especially for highly-rated sovereigns. In fact, they are treated identically for ratings from AAA to AA− in terms of credit and liquidity risk as well as risk concentrations. Moreover, third country sovereign exposures are exempt from the PD floor in internal models for credit risk, potentially inducing low risk weights also for ratings of A+ and below. As banks are generally highly exposed to sovereigns and weakly capitalized as well as less liquid banks being particularly prone to purchase sovereign bonds, it is rather the case that current regulatory requirements generally favor investments into sovereign debt over other asset classes. This might have unwanted side effects on the stability of the financial system, the nexus between sovereigns and banks as well as recourse allocation and economic growth. Thus, as a next step risk-adequate minimum capital and liquidity requirements as well as portfolio size limitations would need to be defined. However, European Systemic Risk Board (2015) highlights the limitations of the portfolio models used in banking regulation, which make assumptions that might not apply to sovereign exposures. Moreover,

Basel Committee on Banking Supervision (2017) point out that there is currently no consensus inside the committee regarding the future regulatory treatment of sovereign exposures.

References

Acharya, V. V., L. Borchert, M. Jager, and S. Steffen (2021). Kicking the Can Down the Road: Government Interventions in the European Banking Sector. *The Review of Financial Studies 34*(9), 4090–4131.

Acharya, V. V., T. Eisert, C. Eufinger, and C. Hirsch (2018). Real Effects of the Sovereign Debt Crisis in Europe: Evidence from Syndicated Loans. *The Review of Financial Studies 31*(8), 2855–2896.

Acharya, V. V., D. Pierret, and S. Steffen (2021). Lender of last resort, buyer of last resort, and a fear of fire sales in the sovereign bond market*. *Financial Markets, Institutions & Instruments 30*(4), 87–112.

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

Affinito, M., G. Albareto, and R. Santioni (2019). Purchases of sovereign debt securities by banks during the crisis: The role of balance sheet conditions. *Journal of Banking & Finance*.

Altavilla, C., M. Pagano, and S. Simonelli (2017). Bank Exposures and Sovereign Stress Transmission. *Review of Finance 21*(6), 2103–2139.

Arnold, I. J. and B. Soederhuizen (2018). Sovereign bond holdings and monetary policy operations in the euro area. *Journal of Policy Modeling 40*(6), 1243–1254.

Basel Committee on Banking Supervision (2017). The regulatory treatment of sovereign exposures – Discussion paper.

Battistini, N., M. Pagano, and S. Simonelli (2014). Systemic risk, sovereign yields and bank exposures in the euro crisis. *Economic Policy*, 203–251.

Becker, B. and V. Ivashina (2018). Financial Repression in the European Sovereign Debt Crisis*. *Review of Finance 22*(1), 83–115.

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

Carpinelli, L. and M. Crosignani (2021). The design and transmission of central bank liquidity provisions. *Journal of Financial Economics*, 27–47.

Chronopoulos, D. K., G. Dotsis, and N. T. Milonas (2020). International Evidence on the Determinants of Domestic Sovereign Debt Bank Holdings. *Journal of Financial Services Research 58*(2-3), 143–160.

Committee on the Global Financial System (2011). The impact of sovereign credit risk on bank funding conditions. *CGFS Papers, Bank for International Settlements* (43).

Crosignani, M., M. Faria-e Castro, and L. Fonseca (2020). The (Unintended?) Consequences of the Largest Liquidity Injection Ever. *Journal of Monetary Economics* (112), 97–112.

De Marco, F., M. Macchiavelli, and R. Valchev (2021). Beyond Home Bias: International Portfolio Holdings and Information Heterogeneity. *The Review of Financial Studies*.

Drechsler, I., T. Drechsel, D. Marques-Ibanez, and P. Schnabl (2016). Who Borrows from the Lender of Last Resort? *The Journal of Finance 71*(5), 1933–1974.

European Banking Authority (2019). 2020 EU-Wide Stress Test – Methodological Note.

European Banking Authority (2020). Risk analysis and data. *Internet reference, www.eba.europa.eu/risk-analysis-and-data, access on 2021-11-26*.

European Commission (2014). COMMISSION DELEGATED REGULATION (EU) 2015/61 of 10 October 2014 to supplement Regulation (EU) No 575/2013 of the European Parliament and the Council with regard to liquidity coverage requirement for Credit Institutions. *Official Journal of the European Union*, 1–36.

European Commission (2021). COMMISSION IMPLEMENTING REGULATION (EU) 2021/2005 of 16 November 2021 laying down implementing technical standards amending Implementing Regulation (EU) 2016/1799 as regards the mapping tables specifying

the correspondence between the credit risk assessments of external credit assessment institutions and the credit quality steps set out in Regulation (EU) No 575/2013 of the European Parliament and of the Council (Text with EEA relevance). *Official Journal of the European Union*, 10–17.

European Parliament and Council (2006). DIRECTIVE 2006/48/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 14 June 2006 relating to the taking up and pursuit of the business of credit institutions (recast) (Text with EEA relevance). *Official Journal of the European Union*, 1–200.

European Parliament and Council (2013). REGULATION (EU) No 575/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012 (Text with EEA relevance). *Official Journal of the European Union*, 1–337.

European Parliament and Council (2019). REGULATION (EU) 2019/876 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 20 May 2019 amending Regulation (EU) No 575/2013 as regards the leverage ratio, the net stable funding ratio, requirements for own funds and eligible liabilities, counterparty credit risk, market risk, exposures to central counterparties, exposures to collective investment undertakings, large exposures, reporting and disclosure requirements, and Regulation (EU) No 648/2012 (Text with EEA relevance). *Official Journal of the European Union*, 1–225.

European Systemic Risk Board (2015). ESRB report on the regulatory treatment of sovereign exposures.

Governing Council of the European Central Bank (2014). GUIDELINE (EU) 2015/510 OF THE EUROPEAN CENTRAL BANK of 19 December 2014 on the implementation of the Eurosystem monetary policy framework (ECB/2014/60) (recast). *Official Journal of the European Union*, 3–135.

Jaccard, J. and R. Turrisi (2003). *Interaction Effects in Multiple Regression* (2 ed.). Sage University Papers Series on Quantitative Applications in the Social Sciences.

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

Lamers, M., T. Present, and R. Vander Vennet (2022). Sovereign Exposures of European Banks: It Is Not All Doom. *Journal of Risk and Financial Management*, 1–24.

Ongena, S., A. Popov, and N. van Horen (2019). The Invisible Hand of the Government: Moral Suasion during the European Sovereign Debt Crisis. *American Economic Journal: Macroeconomics 11*(4), 346–379.

Peydro, J.-L., A. Polo, and E. Sette (2021). Monetary policy at work: Security and credit application registers evidence. *Journal of Financial Economics*, 789–814.

Podstawski, M. and A. Velinov (2018). The state dependent impact of bank exposure on sovereign risk. *Journal of Banking & Finance 88*(63-75).

Popov, A. and N. van Horen (2015). Exporting Sovereign Stress: Evidence from Syndicated Bank Lending during the Euro Area Sovereign Debt Crisis*. *Review of Finance 19*(5), 1825–1866.

Refinitiv (2022). Refinitiv Indices – Government Bond Indices – Index Methodology. *Internet reference, www.refinitiv.com/content/dam/marketing/en_us/documents/methodology/government-bond-indices-user-guide.pdf, access on 2022-01-07*.

Saka, O. (2020). Domestic Banks as Lightning Rods? Home Bias and Information During Eurozone Crisis. *Journal of Money, Credit and Banking 52*(51), 273–305.

Figures

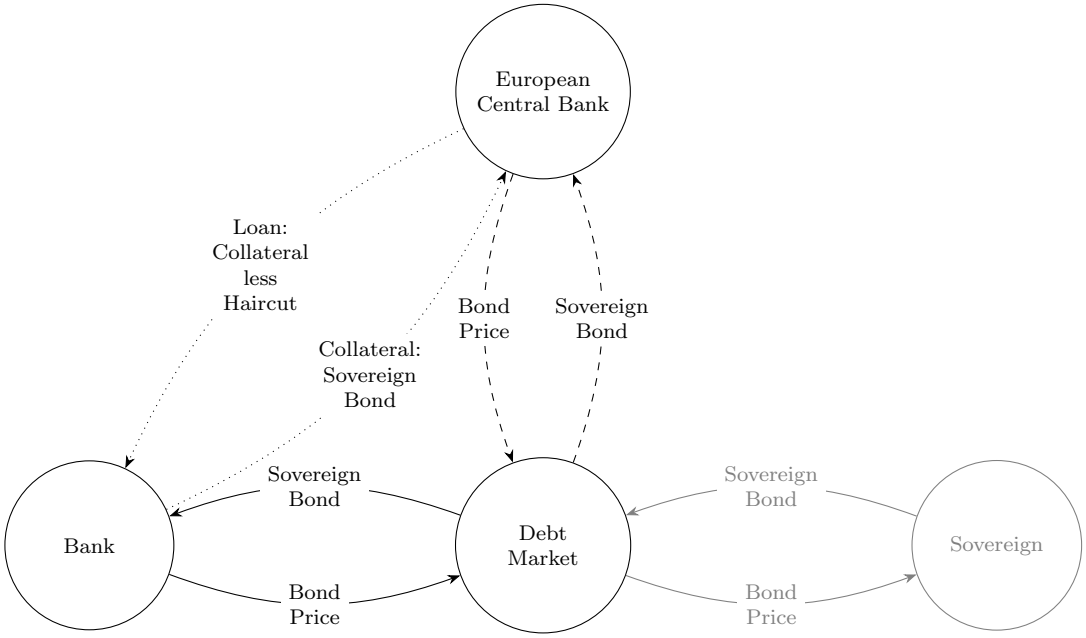


Figure 1. *Open Market Operations of the ECB. Dotted lines depict liquidity provisioning for banks and dashed lines depict liquidity provisioning for sovereigns through the European Central Bank. Figure derived from Governing Council of the European Central Bank (2014).*

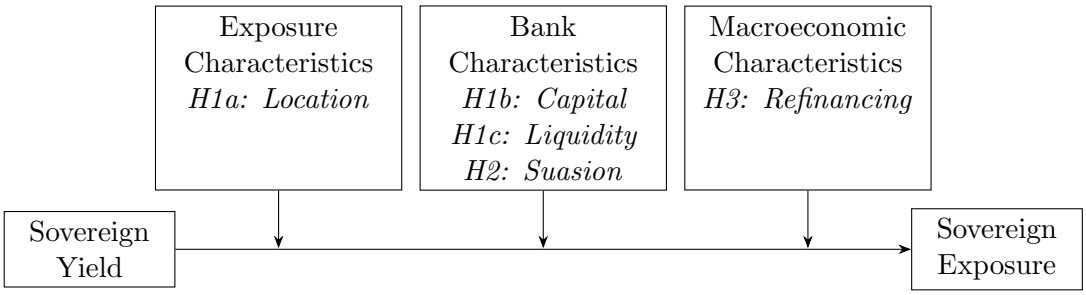


Figure 2. *Interaction approach to estimate banks' reaction to sovereign bond yield changes. The expected change in a bank's sovereign exposure is explained by the change in the bond yield of the counterparty. The magnitude of this relation is expected to be moderated by exposure, bank and macroeconomic characteristics. Figure adjusted from Jaccard and Turrisi (2003).*

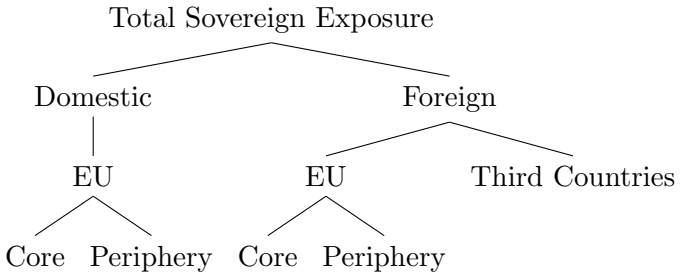


Figure 3. *Categorization of banks' sovereign exposures.*

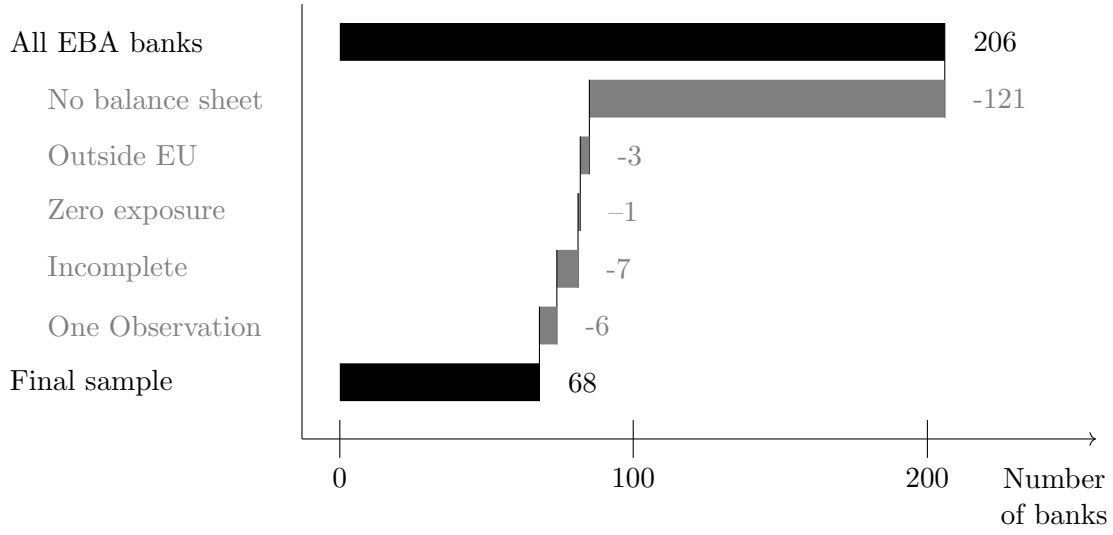
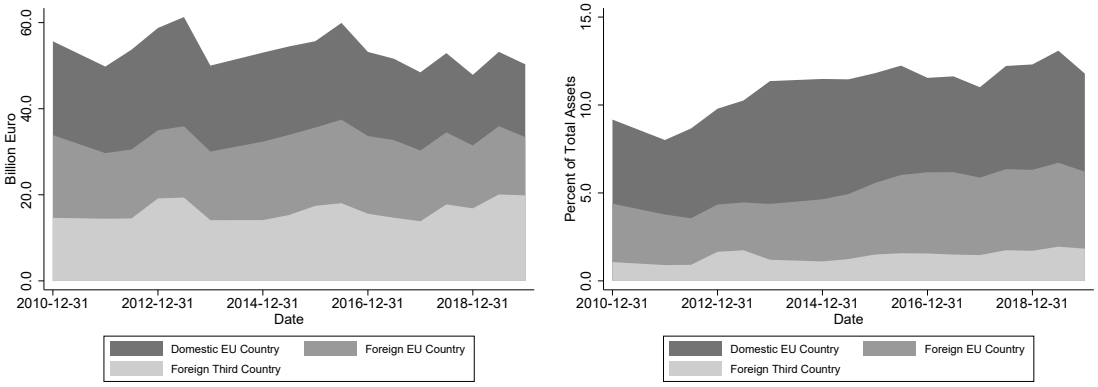


Figure 4. *Waterfall plot exposure data set. The raw data covers all 206 banks included in the EBA investigations. 85 of these banks have balance sheet and regulatory data available in Datastream Worldscope. 82 of these banks are located in the EU. 81 of these banks have at least one sovereign exposure observation greater than zero throughout the observation period. 74 of these banks have complete and consistent balance sheet and regulatory data. 68 of these banks have more than one exposure observation throughout the observation period.*



(a) *Billion Euro* **(b)** *Percent of total asset*

Figure 5. *Evolution of banks' sovereign exposures. The full area represents the average total sovereign exposure per bank, the dark gray area depicts the average exposure to the domestic sovereign, the gray area depicts the average exposure to foreign EU countries and the light gray area the average exposure to foreign third countries from 31 Dec. 2010 to 31 Dec. 2019 in (a) billion Euro and (b) percent of total asset.*

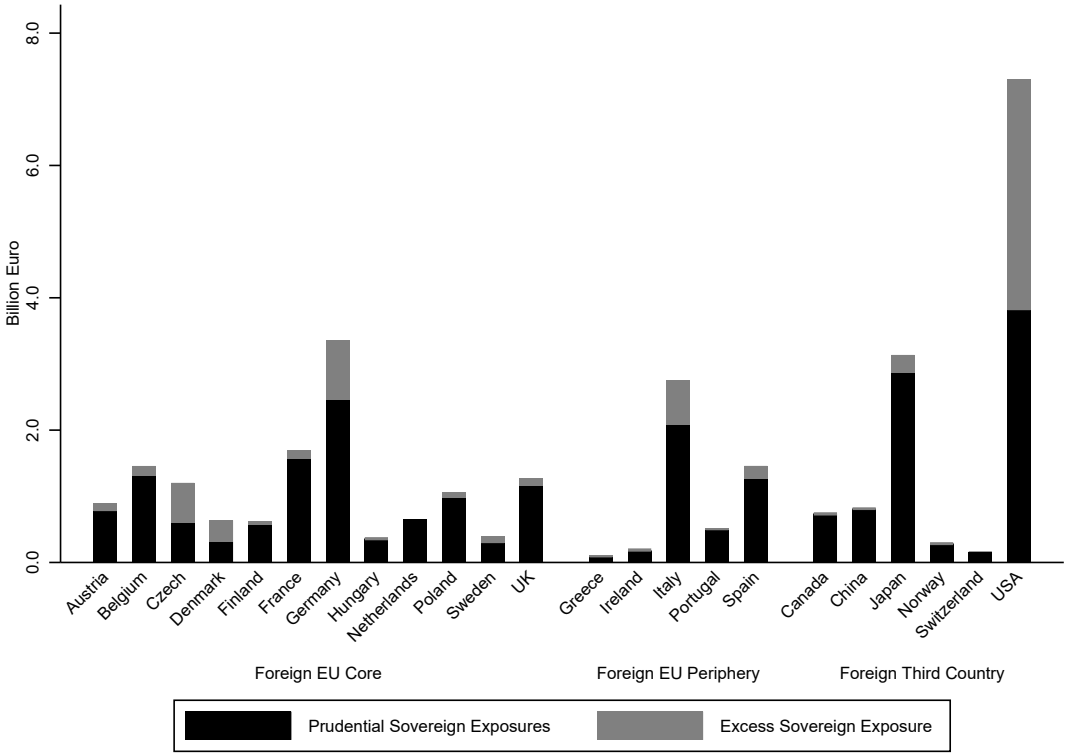


Figure 6. *Excess sovereign exposures by foreign sovereign counterparty. The full bars equal a bank's average sovereign exposure grouped by sovereign counterparty in billion Euro. The black part shows the prudential exposure share that complies with the regulatory large exposures limit of 25% of a bank's eligible capital. The gray part shows the excess sovereign exposures exceeding 25% of a bank's eligible capital.*

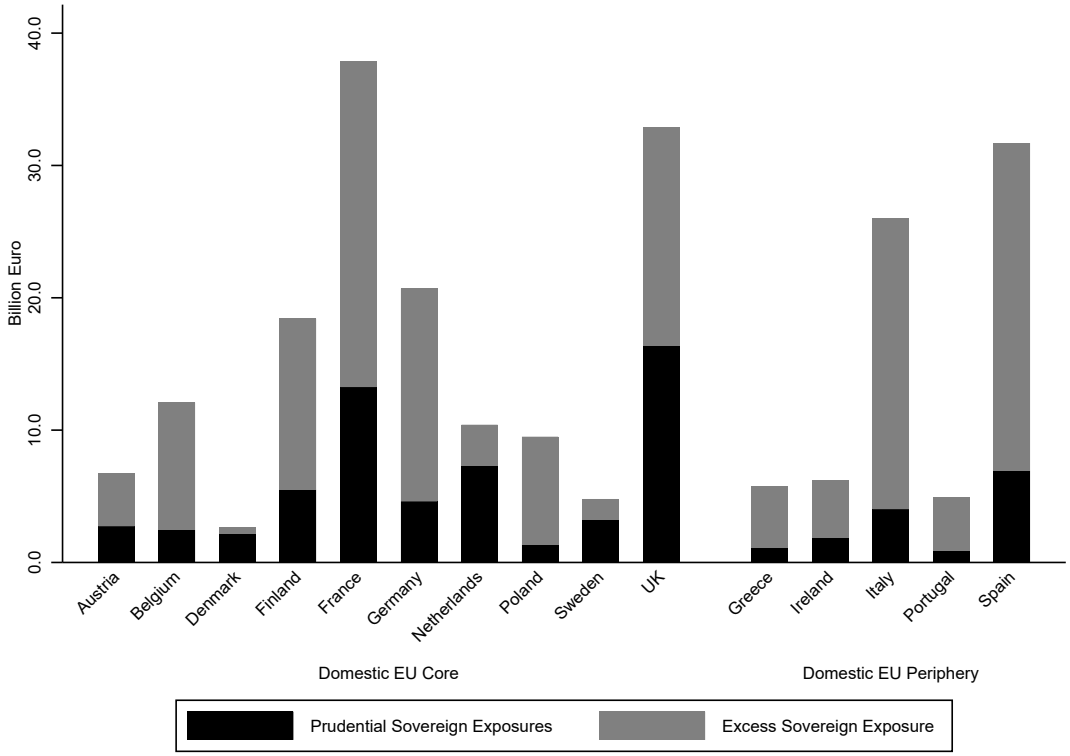


Figure 7. *Excess sovereign exposures by domestic sovereign counterparty. The full bars equal a bank's average sovereign exposures grouped by sovereign counterparty in billion Euro. The black part shows the prudential exposure share that complies with the regulatory large exposures limit of 25% of a bank's eligible capital. The gray part shows the excess sovereign exposures exceeding 25% of a bank's eligible capital.*

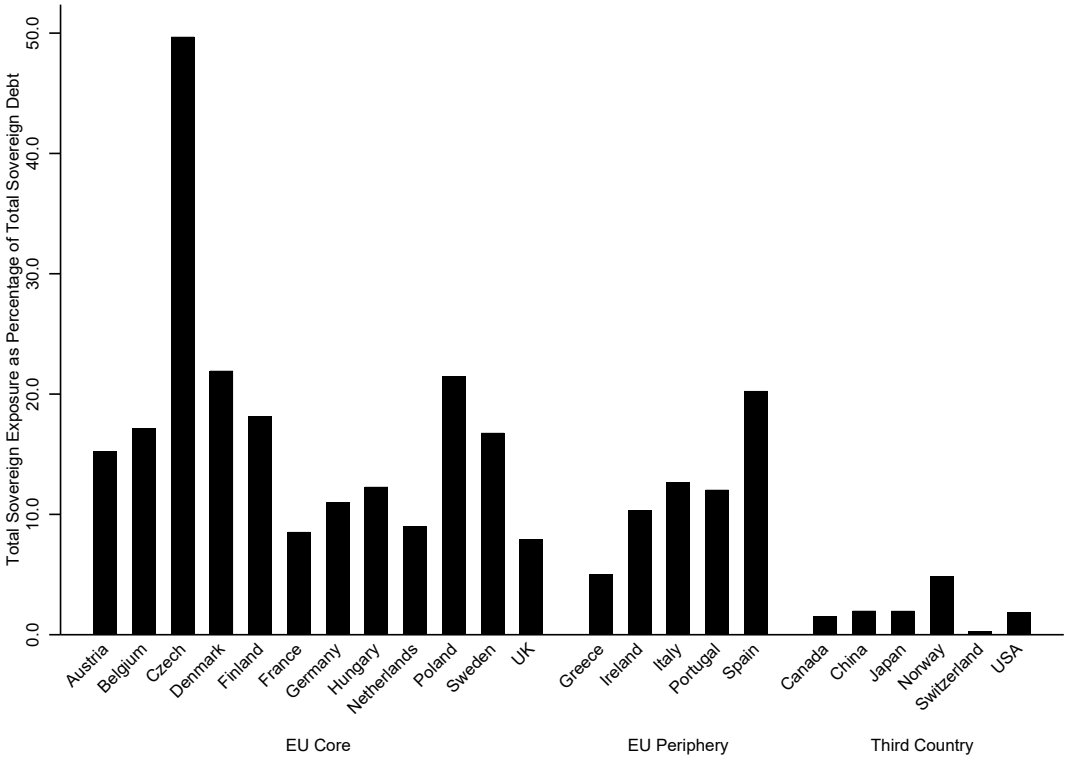


Figure 8. *Share of total sovereign debt held by sample banks.*

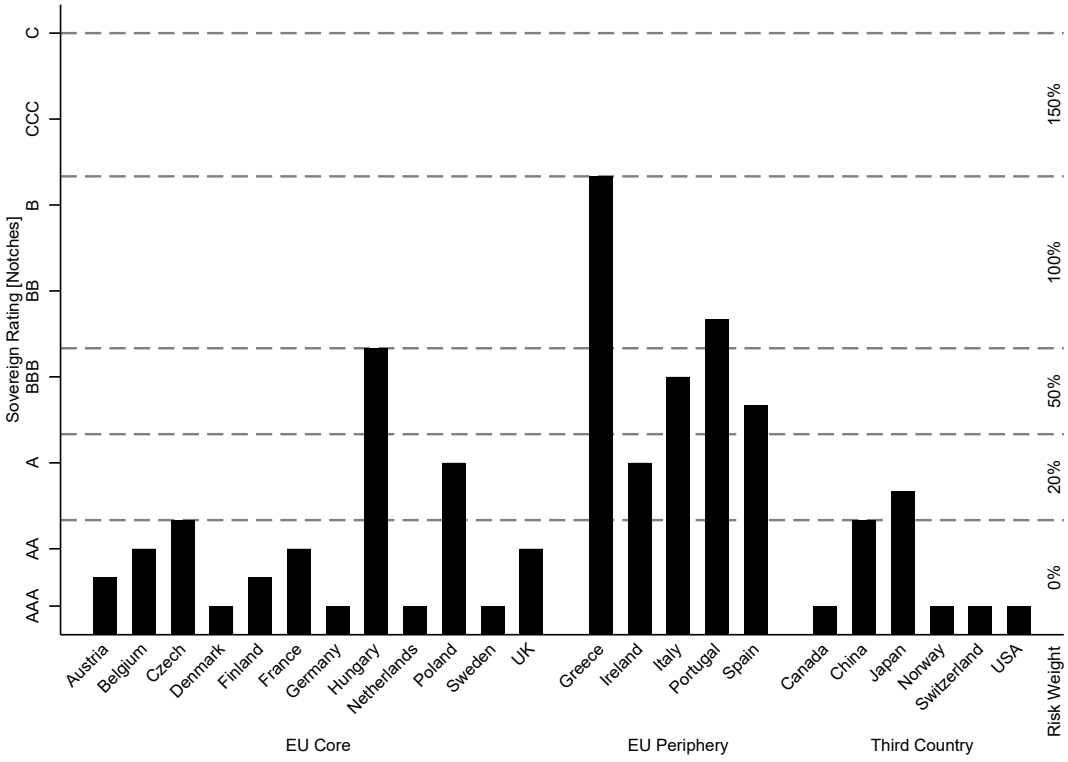


Figure 9. *Sovereign ratings grouped by sovereign counterparty. The black bars depict the median second-best issuer credit rating from Standard & Poor's Ratings Services, Fitch Ratings and Moody's Investors Service. The horizontal dashed gray lines mark the corresponding risk weight according to the Standardized Approach for Credit Risk.*

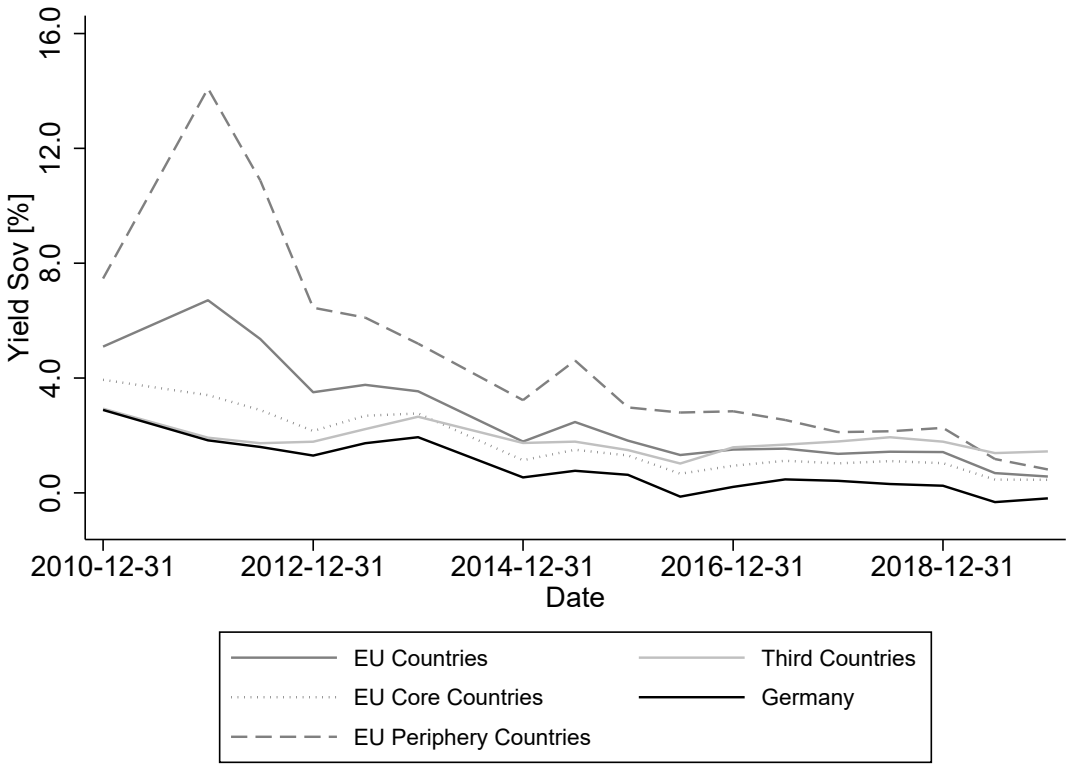


Figure 10. *Evolution of sovereign bond yields. The solid dark gray line represents EU countries, further split into core and peripheral countries by the dotted and dashed dark gray lines, the solid light gray represents third countries and the solid black line Germany. The observation period covers 31 Dec. 2010 to 31 Dec. 2019.*

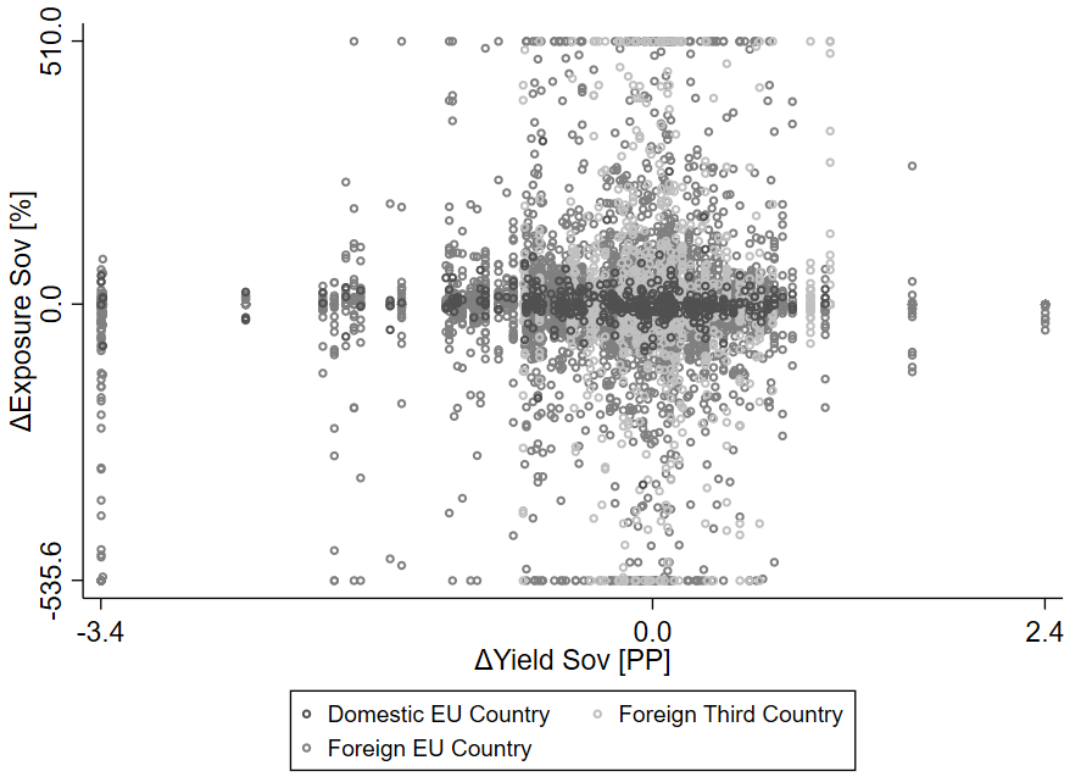


Figure 11. *Scatter plot of average changes in sovereign bond yields and sovereign exposures. The dark gray points depict exposures to the domestic sovereign, the gray points exposures to foreign EU sovereigns and the light gray points exposures to foreign third country counterparties.*

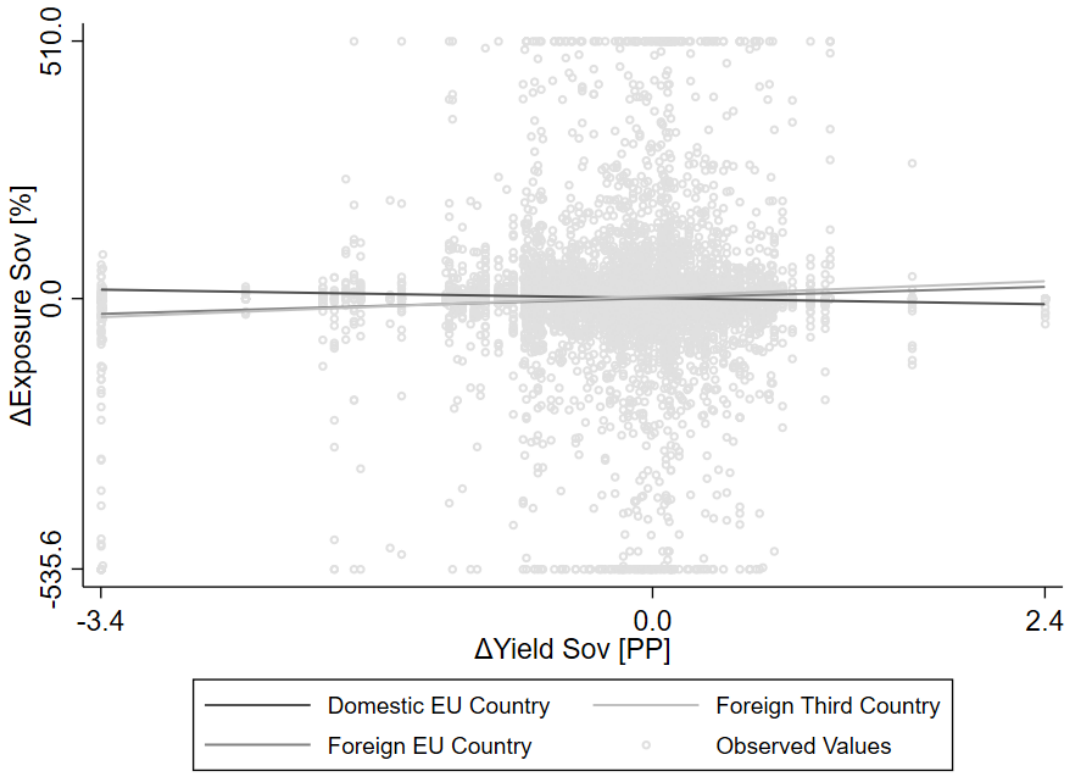
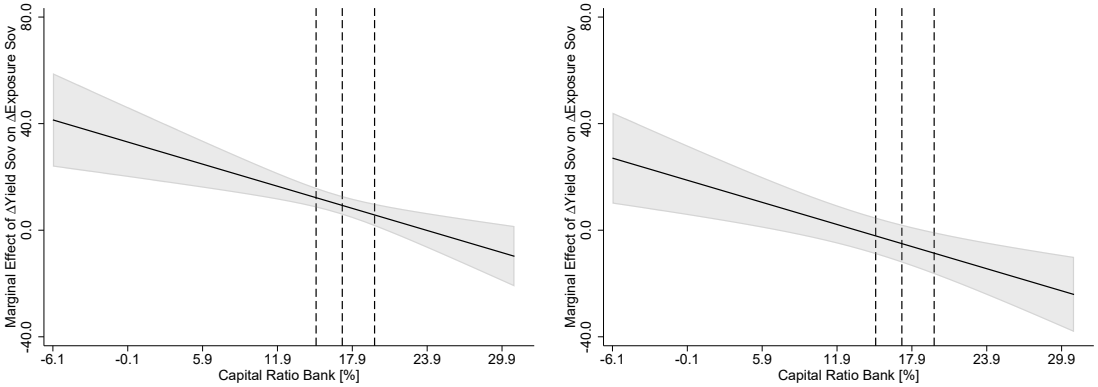


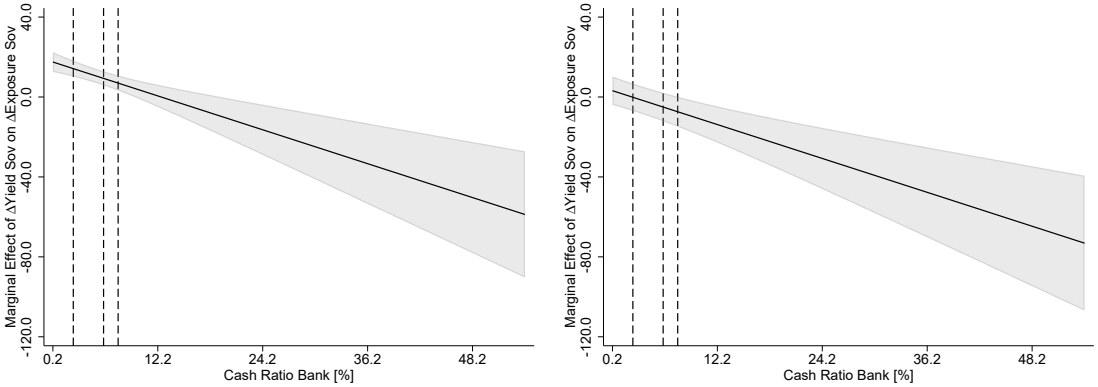
Figure 12. *Slope estimations for sovereign counterparty location. Scatter plot of changes in sovereign bond yields and banks' sovereign exposures including slope estimations for three sub-groups of sovereign counterparties based on table 8 and equation 4. Exposures to (1) the domestic sovereign (solid dark gray line), (2) foreign EU sovereigns (solid gray line) and (3) third country sovereigns (solid light gray line).*



(a) *Foreign sovereign exposure*

(b) *Domestic sovereign exposure*

Figure 13. *Effect of bank capitalization. Marginal effect of sovereign bond yield changes on changes in banks' sovereign exposures at different percentiles of the empirical distribution of banks' total capital ratio for (a) foreign sovereign exposures and (b) domestic sovereign exposures. Estimations are based on table 8 and equation 4 including 90% confidence intervals. The vertical dashed black lines show the mean as well as* 25^{th} *and* 75^{th} *percentiles of the empirical distribution of the interaction variable and estimations range from its minimum to maximum.*



(a) *Foreign sovereign exposure*

(b) *Domestic sovereign exposure*

Figure 14. *Effect of bank liquidity. Marginal effect of sovereign bond yield changes on changes in banks' sovereign exposures at different percentiles of the empirical distribution of banks' cash ratio for (a) foreign sovereign exposures and (b) domestic sovereign exposures. Estimations are based on table 8 and equation 4 including 90% confidence intervals. The vertical dashed black lines show the mean as well as 25^{th} and 75^{th} percentiles of the empirical distribution of the interaction variable and estimations range from its minimum to maximum.*

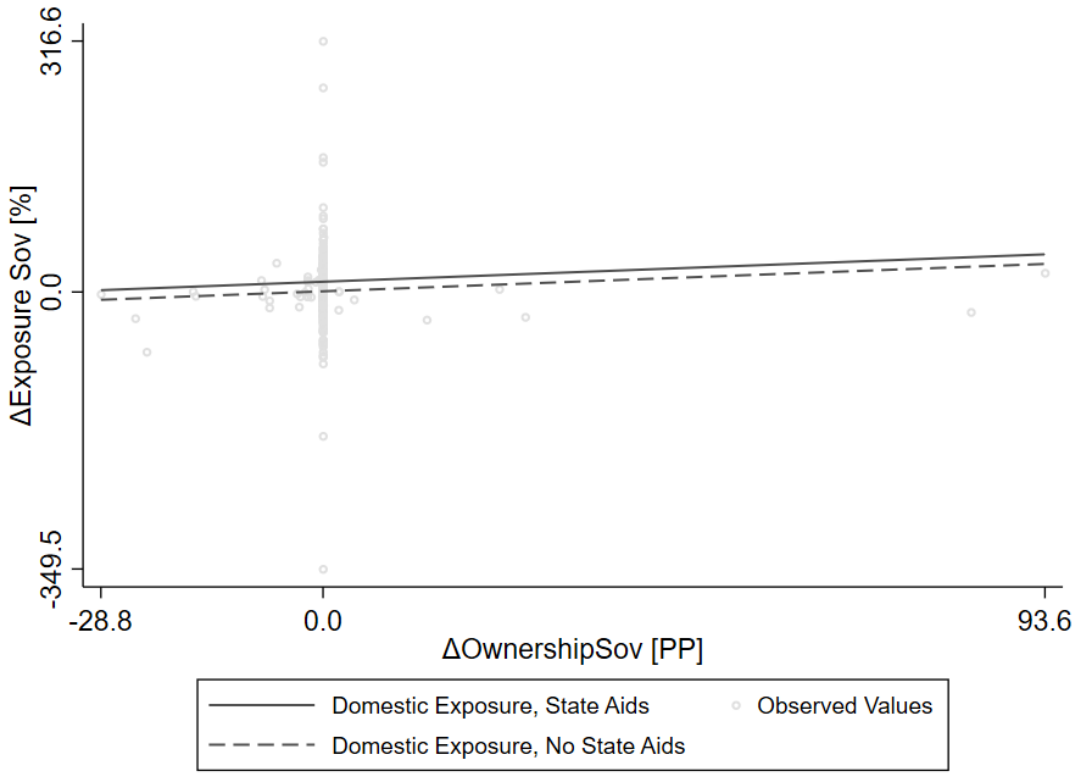


Figure 15. *Slope estimations for government ownership. Scatter plot of changes in government ownership and banks' domestic sovereign exposures including slope estimations for two sub-groups of banks based on table 9 and equation 5. Banks (1) that received state aids from their domestic sovereign in the respective half-year (solid dark gray line) and (2) that did not (dashed dark gray line).*

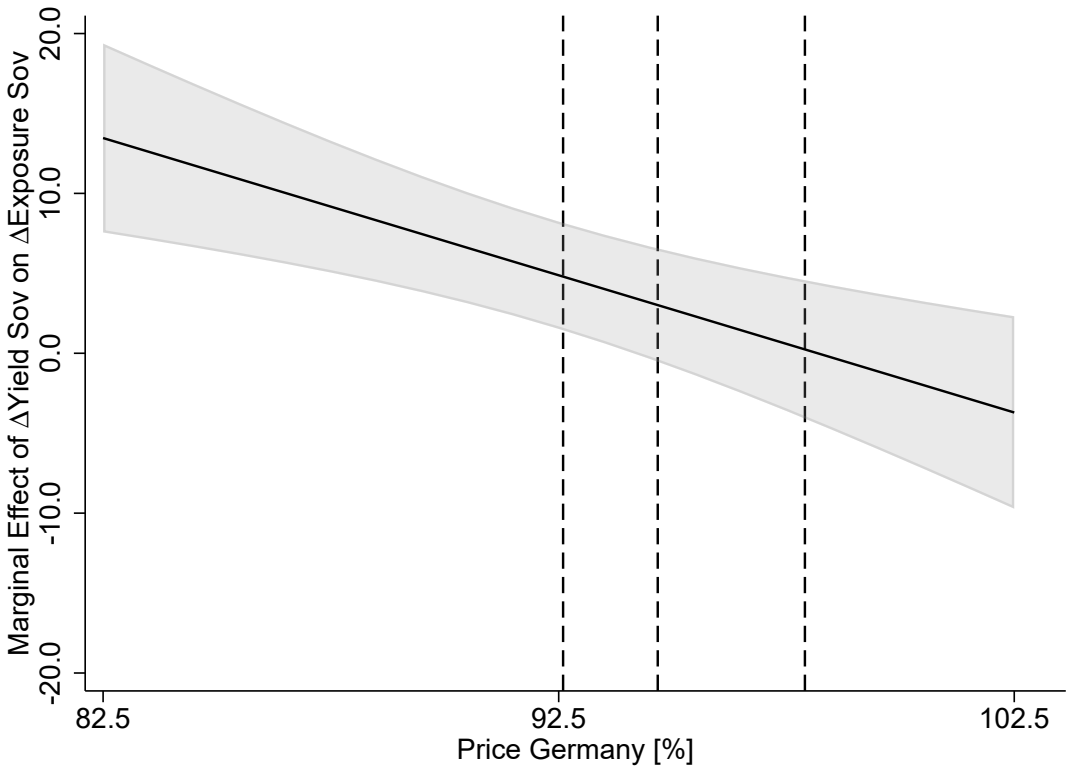


Figure 16. *Effect of the German sovereign bond price. Marginal effect of sovereign bond yield changes on changes in banks' sovereign exposures at different percentiles of the empirical distribution of the German sovereign bond price. Estimations are based on table 10 and equation 7 including 90% confidence intervals. The vertical dashed black lines show the mean as well as* 25^{th} *and* 75^{th} *percentiles of the empirical distribution of the interaction variable and estimations range from its minimum to maximum.*

Tables

Table 1. *Regulatory requirements for sovereign exposures. Requirements are differentiated between credit, market and liquidity risks as well as risk concentrations and leverage of third-country sovereign exposures. Privileges for EU sovereign exposures are shown below. ECAI stands for External Credit Assessment Institution. LCR is the Liquidity Coverage Ratio. NSFR is the Net Stable Funding Ratio. HQLA are High Quality Liquid Assets. RSF is the Amount of Required Stable Funding.*

	Credit Risk	Market Risk	Liquidity Risk			Risk Concentrations
	Risk	Specific Risk	LCR		NSFR	Limit to
ECAI Rating	Weight [%]	Capital Charge [%]	HQLA	Haircut [%]	RSF Factor [%]	Large Exposures
AAA to AA−	0.00	0.00	Level 1	0.00	0.00	No limit
A+ to A−	20.00	0.25/1.00/1.60	Level 2A	15.00	15.00	$0.25 \cdot Capital$
BBB+ to BBB−	50.00	0.25/1.00/1.60	Not eligible	100.00	50.00/100.00	$0.25 \cdot Capital$
BB+ to B−	100.00	8.00	Not eligible	100.00	50.00/100.00	$0.25 \cdot Capital$
CCC+ to D	150.00	12.00	Not eligible	100.00	50.00/100.00	$0.25 \cdot Capital$
EU Privilege	0.00	0.00	Level 1	0.00	0.00	No limit

Table 2. *EBA investigations. Overview of the investigations conducted by the European Banking Authority since the first publication of bank-level sovereign exposures. Reporting date refers to the closing date of the balance sheet. Publication date is the date on which the EBA made the data available to the public. The data is available at European Banking Authority (2020).*

Data Point	Reporting Date	Publication Date	EBA Investigation
1	2010-12-31	2011-07-15	Stress Test 2011
2	2011-12-31	2012-10-03	Capital Exercise 2011
3	2012-06-30	2012-10-03	Capital Exercise 2011
4	2012-12-31	2013-12-16	Transparency Exercise 2013
5	2013-06-30	2013-12-16	Transparency Exercise 2013
6	2013-12-31	2014-10-26	Stress Test 2014
7	2014-12-31	2015-11-24	Transparency Exercise 2015
8	2015-06-30	2015-11-24	Transparency Exercise 2015
9	2015-12-31	2016-12-02	Transparency Exercise 2016
10	2016-06-30	2016-12-02	Transparency Exercise 2016
11	2016-12-31	2017-11-24	Transparency Exercise 2017
12	2017-06-30	2017-11-24	Transparency Exercise 2017
13	2017-12-31	2018-12-14	Transparency Exercise 2018
14	2018-06-30	2018-12-14	Transparency Exercise 2018
15	2018-12-31	2019-11-29	Transparency Exercise 2019
16	2019-06-30	2019-11-29	Transparency Exercise 2019
17	2019-12-31	2020-06-08	Transparency Exercise 2020

Table 3. *Sovereigns counterparties covered in the EBA investigations.*

Total Sovereign Counterparties (38)		
EU (28)		
Core (23)	Periphery (5)	Third Countries (10)
Austria	Greece	Iceland
Belgium	Ireland	Liechtenstein
Bulgaria	Italy	Norway
Cyprus	Portugal	USA
Czech	Spain	Japan
Denmark		Australia
Estonia		Canada
Finland		Hong Kong
France		Switzerland
Germany		China
Croatia		
Hungary		
Latvia		
Lithuania		
Luxembourg		
Malta		
Netherlands		
Poland		
Romania		
Slovakia		
Slovenia		
Sweden		
UK		

Table 4. *Sample distribution grouped by banks. The full sample covers exposures of 68 EU banks to 23 sovereigns from 31 Dec. 2010 to 31 Dec. 2019.*

Bank	Obs.	Bank	Obs.	Bank	Obs.
ABN Amro NV	252	Barclays PLC	391	Landesbank Berlin Holding AG	80
AIB Group PLC	340	Caixa Economica Montepio Geral SA	20	Landesbank Hessen-Thueringen	288
Aareal Bank AG	168	CaixaBank SA	25	Liberbank SA	28
Abanka dd	26	Commerzbank AG	391	Lloyds Banking Group PLC	272
BAWAG Group AG	42	Credit Agricole SA	391	Mediobanca SpA	165
BNP Paribas SA	391	Credito Emiliano SpA	120	National Bank of Greece SA	117
BPER Banca SpA	150	Cyprus Popular Bank Ltd	14	Nordea Bank Abp	374
Banca Carige SpA	16	Danske Bank AS	374	Nova Ljubljanska Banka dd	228
Banca Monte dei Paschi di Siena SpA	210	Deutsche Bank AG	391	OTP Bank Nyrt	34
Banca Popolare di Milano Scarl	12	Deutsche Pfandbriefbank AG	119	Permanent TSB Group Holdings PLC	42
Banca Popolare di Sondrio ScpA	168	Dexia SA	228	Piraeus Financial Holdings SA	117
Banco BPI SA	80	Erste Group Bank AG	374	Powszechna Kasa Oszczednosci Bank SA	13
Banco BPM SpA	44	Espirito Santo Financial Group SA	35	Raiffeisen Bank International AG	126
Banco Bilbao Vizcaya Argentaria SA	340	Eurobank Ergasias Services and Holdings SA	117	Skandinaviska Enskilda Banken AB	340
Banco Comercial Portugues SA	221	First Investment Bank AD	27	Societe Generale SA	391
Banco Popular Espanol SA	36	HSBC Holdings PLC	391	Standard Chartered PLC	91
Banco Sabadell SA	156	Hellenic Bank PCL	108	Svenska Handelsbanken AB	255
Banco Santander SA	357	ING Groep NV	264	Swedbank AB	153
Bank Polska Kasa Opieki SA	4	Intesa Sanpaolo SpA	391	Sydbank AS	36
Bank of Cyprus Ltd	272	Jyske Bank AS	323	UniCredit SpA	391
Bank of Ireland PLC	272	KBC Group NV	374	Unicaja Banco SA	12
Bank of Valletta PLC	252	LHV Group AS	21	Unione di Banche Italiane SpA	182
Bankinter SA	45	Landesbank Baden-Wuerttemberg	391		
				68	12,869

Table 5. *Sample distribution grouped by home countries and sovereign counterparties. The full sample covers exposures of 68 EU banks to 23 sovereigns from 31 Dec. 2010 to 31 Dec. 2019. Nordea Bank Abp is double counted due to re-location from Sweden to Finland in 2019.*

		Banks			Sovereign Counterparties		
	Country	Count	Obs.	(%)	Count	Obs.	(%)
EU Core	Austria	3	542	(4.21)	1	616	(4.79)
	Belgium	2	602	(4.68)	1	648	(5.04)
	Bulgaria	1	27	(0.21)	0	0	(0.00)
	Cyprus	3	394	(3.06)	0	0	(0.00)
	Czech	0	0	(0.00)	1	426	(3.31)
	Denmark	3	733	(5.70)	1	478	(3.71)
	Estonia	1	21	(0.16)	0	0	(0.00)
	Finland	1	66	(0.51)	1	527	(4.10)
	France	3	1,173	(9.11)	1	677	(5.26)
	Germany	7	1828	(14.20)	1	742	(5.77)
	Hungary	1	34	(0.26)	1	495	(3.85)
	Malta	1	252	(1.96)	0	0	(0.00)
	Netherlands	2	516	(4.01)	1	617	(4.79)
	Poland	2	17	(0.13)	1	616	(4.79)
	Slovenia	2	254	(1.97)	0	0	(0.00)
	Sweden	4	1,056	(8.21)	1	568	(4.41)
	UK	4	1,145	(8.90)	1	606	(4.71)
		40	8,660	(67.29)	12	7,016	(54.52)
EU Periphery	Greece	3	351	(2.73)	1	580	(4.51)
	Ireland	3	654	(5.08)	1	571	(4.44)
	Italy	11	1,849	(14.37)	1	723	(5.62)
	Portugal	4	356	(2.77)	1	602	(4.68)
	Spain	8	999	(7.76)	1	692	(5.38)
		29	4,209	(32.71)	5	3,168	(24.62)
Third Countries	Canada	0	0	(0.00)	1	506	(3.93)
	China	0	0	(0.00)	1	409	(3.18)
	Japan	0	0	(0.00)	1	348	(2.70)
	Norway	0	0	(0.00)	1	365	(2.84)
	Switzerland	0	0	(0.00)	1	375	(2.91)
	USA	0	0	(0.00)	1	682	(5.30)
		0	0	(0.00)	6	2,685	(20.86)
Full Sample		69	12,869	(100.00)	23	12,869	(100.00)

Table 6. *Descriptive statistics of the data sample. The full sample covers exposures of 68 EU banks to 23 sovereigns from 31 Dec. 2010 to 31 Dec. 2019 with a total of 12,869 observations. 10,541 observations are available in first differences.* $TotalAssets^{Bank}_{i,j,t}$ *are the total assets,* $CapitalRatio^{Bank}_{i,j,t}$ *the total capital ratio,* $CashRatio^{Bank}_{i,j,t}$ *the ratio of cash to total assets and* $LoansAssets^{Bank}_{i,j,t}$ *as well as* $DepLiab^{Bank}_{i,j,t}$ *the ratios of loans to assets and deposits to liabilities of bank* i*.* $StateAid^{Bank}_{i,j=k,t}$ *indicates state aids for bank* i*.* $Ownership^{Sov}_{i,j=k,t}$ *is the share of bank* i*'s equity owned by its home country* j*.* $Exposure^{Sov}_{i,k,t}$*,* $Exposure^{Domestic}_{i,k=j,t}$*,* $Exposure^{ThCountries}_{i,k\neq j,t}$ *and* $Exposure^{EU}_{i,k\neq j,t}$ *are bank* i*'s exposures to country* k*, its home county* j*, foreign third as well as foreign EU countries.* $Yield^{Sov}_{k,t}$*,* $Yield^{Domestic}_{k=j,t}$*,* $Yield^{ThCountries}_{k\neq j,t}$ *and* $Yield^{EU}_{k\neq j,t}$ *are the sovereign bond yields (10 years) of the respective counterparty.* $\Delta FXRate^{Counterparty}_{k\neq j,t}$ *is the foreign exchange rate of country* k*'s local currency to Euro.* $Price^{Germany}_{t}$ *is the price of German sovereign bonds (10 years).* $LTRO_t$ *indicates year-end 2011 and the first half of 2012.* $\Delta EqIndex^{Domestic}_{k=j,t}$ *is the return on the equity index of country* j*.*

Variable	Mean	Std. Dev.	Min.	P^{25}	P^{75}	Max.
Bank Characteristics						
$TotalAssets^{Bank}_{i,j,t}$ [billion Euro]	587.72	624.00	0.94	92.79	846.06	2,411.91
$ln(TotalAssets^{Bank}_{i,j,t})$	12.50	1.47	6.84	11.44	13.65	14.70
$CapitalRatio^{Bank}_{i,j,t}$ [%]	17.09	4.82	−6.1	15.00	19.68	31.76
$CashRatio^{Bank}_{i,j,t}$ [%]	5.98	5.06	0.18	2.52	7.65	54.22
$LoansAssets^{Bank}_{i,j,t}$ [%]	58.17	14.48	22.63	49.83	68.27	100.00
$DepLiab^{Bank}_{i,j,t}$ [%]	50.97	20.14	0.85	35.78	63.38	96.60
$StateAid^{Bank}_{i,j=k,t}$ [1 = yes]	0.0010	0.0323	0.0000	0.0000	0.0000	1.0000
$Ownership^{Sov}_{i,j=k,t}$ [%]	0.34	4.42	0.00	0.00	0.00	99.90
$\Delta Ownership^{Sov}_{i,j=k,t}$ [PP]	0.01	1.38	−28.78	0.00	0.00	93.55
Exposure Characteristics						
$Exposure^{Sov}_{i,k,t}$ [billion Euro]	2.47	7.87	0.00	0.00	1.07	110.01
$\Delta Exposure^{Sov}_{i,k,t}$ [% of average]	0.09	106.06	−535.57	−7.58	6.53	510.00
$Exposure^{Domestic}_{i,k=j,t}$ [billion Euro]	19.04	19.46	0.00	4.76	26.73	85.79
$Exposure^{ThCountries}_{i,k\neq j,t}$ [billion Euro]	2.67	9.07	0.00	0.00	0.88	110.01
$Exposure^{EU}_{i,k\neq j,t}$ [billion Euro]	1.17	3.22	0.00	0.00	0.68	51.06
$Yield^{Sov}_{k,t}$ [%]	1.95	2.35	−0.64	0.55	2.53	26.28
$\Delta Yield^{Sov}_{k,t}$ [PP]	−0.16	0.66	−3.36	−0.45	0.18	2.39
$Yield^{Domestic}_{k=j,t}$ [%]	1.78	1.89	−0.32	0.53	2.28	10.97
$Yield^{ThCountries}_{k\neq j,t}$ [%]	1.71	1.19	−0.64	0.84	2.48	4.64
$Yield^{EU}_{k\neq j,t}$ [%]	2.04	2.61	−0.32	0.55	2.57	26.28
$\Delta FXRate^{Counterparty}_{k\neq j,t}$	0.03	2.43	−29.01	0.00	0.00	18.92
Macroeconomic Characteristics						
$Price^{Germany}_{t}$ [%]	94.69	6.32	82.52	92.62	97.92	103.26
$LTRO_t$ [1 = 2011H2 or 2012H1]	0.06	0.23	0.00	0.00	0.00	1.00
$\Delta EqIndex^{Domestic}_{k=j,t}$ [%]	7.18	65.45	−52.65	−3.84	11.62	1,417.43

Table 7. *Benchmark reaction to sovereign bond yield changes. Regression results for equation 3.* $\Delta Exposure^{Sov}_{i,k,t}$ *denotes the change in bank* i*'s exposure to country* k*.* $\Delta Yield^{Sov}_{k,t}$ *is the change in the bond yield of country* k*. Control variables cover country* k*'s foreign exchange rate, bank* i*'s total assets, its ratios of loans to assets and deposits to liabilities as well as domestic equity indices. Standard errors (in parentheses) are clustered at the bank level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.*

	$\Delta Exposure^{Sov}_{i,k,t}$		
	Benchmark Reaction		
	All Banks (1)	Core (2)	Periphery (3)
$\Delta Yield^{Sov}_{k,t}$	12.7293***	14.0050***	9.3290**
	(2.2205)	(2.9761)	(3.4299)
$\Delta FXRate^{Counterparty}_{k\neq j,t}$	−1.1306**	−1.2746**	−0.8438
	(0.4611)	(0.6058)	(0.4998)
$ln(TotalAssets^{Bank}_{i,j,t})$	−11.5862	2.2254	−56.7034*
	(11.2084)	(9.4410)	(33.2915)
$LoansAssets^{Bank}_{i,j,t}$	0.0483	0.0427	0.0297
	(0.1829)	(0.2190)	(0.7825)
$DepLiab^{Bank}_{i,j,t}$	0.0412	−0.1205	−0.1511
	(0.1560)	(0.1134)	(0.7155)
$\Delta EqIndex^{Domestic}_{k=j,t}$	−0.0650***	−0.0634***	−0.0810
	(0.0051)	(0.0049)	(0.5244)
Entity Fixed Effects	Bank level	Bank level	Bank level
Time Fixed Effects	Half-yearly	Half-yearly	Half-yearly
Constant	Yes	Yes	Yes
Observations	10,541	7,241	3,300
Banks	68	39	29
Adjusted R^2 [%]	1.3	1.2	2.4

Table 8. *Impact of regulatory arbitrage. Regression results for equation 4.* $\Delta Exposure_{i,k,t}^{Sov}$ *denotes the change in bank* i*'s exposure to country* k*.* $\Delta Yield_{k,t}^{Sov}$ *is the change in the bond yield of country* k*.* $Domestic_{i,k=j,t}^{Counterparty}$ *and* $ThCountry_{i,k\neq j,t}^{Counterparty}$ *indicate exposures to bank* i*'s home country* j *and a foreign third country.* $CapitalRatio_{i,j,t}^{Bank}$ *is bank* i*'s total capital ratio.* $CashRatio_{i,j,t}^{Bank}$ *is bank* i*'s ratio of cash to total assets. Control variables cover country* k*'s foreign exchange rate, bank* i*'s total assets, its ratios of loans to assets and deposits to liabilities as well as domestic equity indices. Standard errors (in parentheses) are clustered at the bank level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.*

	$\Delta Exposure_{i,k,t}^{Sov}$		
	Regulatory Arbitrage		
	All Banks (1)	Core (2)	Periphery (3)
$\Delta Yield_{k,t}^{Sov}$	41.4130***	56.3457***	16.4292
	(8.5146)	(9.9724)	(12.1650)
$Domestic_{i,k=j,t}^{Counterparty}$	−0.0628	2.7116	−6.3221*
	(1.9726)	(2.3810)	(3.6820)
$\Delta Yield_{k,t}^{Sov} \cdot Domestic_{i,k=j,t}^{Counterparty}$	−14.3429***	−7.0528	−15.5748***
	(4.4003)	(6.4960)	(5.5524)
$ThCountry_{i,k\neq j,t}^{Counterparty}$	3.8606**	3.3144**	5.5657
	(1.8138)	(1.5409)	(5.3770)
$\Delta Yield_{k,t}^{Sov} \cdot ThCountry_{i,k\neq j,t}^{Counterparty}$	3.0174	7.7175	−4.5998
	(10.2690)	(12.4494)	(17.3407)
$CapitalRatio_{i,j,t}^{Bank}$	−1.5313**	−1.3482**	−1.2769
	(0.6341)	(0.6200)	(1.7597)
$\Delta Yield_{k,t}^{Sov} \cdot CapitalRatio_{i,j,t}^{Bank}$	−1.3834***	−2.1256***	0.1279
	(0.4537)	(0.4510)	(0.9060)
$CashRatio_{i,j,t}^{Bank}$	−0.1664	0.0921	1.4023
	(0.5769)	(0.6280)	(1.6871)
$\Delta Yield_{k,t}^{Sov} \cdot CashRatio_{i,j,t}^{Bank}$	−1.4130***	−1.4336***	−1.8035
	(0.3874)	(0.4303)	(1.4889)
$\Delta FXRate_{k\neq j,t}^{Counterparty}$	−1.1181**	−1.2598**	−0.8731*
	(0.4556)	(0.5949)	(0.4849)
$ln(TotalAssets_{i,j,t}^{Bank})$	−10.6426	4.4305	−58.5037
	(11.0403)	(10.4142)	(35.5179)
$LoansAssets_{i,j,t}^{Bank}$	0.0438	0.0762	0.3447
	(0.1703)	(0.1890)	(0.8094)
$DepLiab_{i,j,t}^{Bank}$	0.0542	−0.0688	−0.4087
	(0.1198)	(0.0986)	(0.7604)
$\Delta EqIndex_{k=j,t}^{Domestic}$	−0.0669***	−0.0651***	−0.1500
	(0.0047)	(0.0044)	(0.5401)
Entity Fixed Effects	Bank level	Bank level	Bank level
Time Fixed Effects	Half-yearly	Half-yearly	Half-yearly
Constant	Yes	Yes	Yes
Observations	10,541	7,241	3,300
Banks	68	39	29
Adjusted R^2 [%]	1.6	1.6	2.4

Table 9. *Impact of moral suasion. Regression results for equation 5.* $\Delta Exposure^{Sov}_{i,k,t}$ *denotes the change in bank* i*'s exposure to country* k*.* $\Delta Yield^{Sov}_{k,t}$ *is the change in the bond yield of country* k*.* $StateAid^{Bank}_{i,j=k,t}$ *indicates state aids for bank* i*.* $Ownership^{Sov}_{i,j=k,t}$ *is the share of bank* i*'s equity owned by its home country* j*. Control variables cover country* k*'s foreign exchange rate, bank* i*'s total assets, its ratios of loans to assets and deposits to liabilities as well as domestic equity indices. Standard errors (in parentheses) are clustered at the bank level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.*

	$\Delta Exposure^{Sov}_{i,k,t}$		
	Moral Suasion		
	All Banks (1)	Core (2)	Periphery (3)
$\Delta Yield^{Sov}_{k,t}$	12.7936***	13.9755***	9.5565***
	(2.2228)	(2.9796)	(3.4471)
$StateAid^{Bank}_{i,j=k,t} \cdot Domestic^{Counterparty}_{i,k=j,t}$	12.9424**	−0.6907	16.9771***
	(5.0211)	(10.2575)	(5.6926)
$\Delta Ownership^{Sov}_{i,j=k,t} \cdot Domestic^{Counterparty}_{i,k=j,t}$	0.3695*	−0.6975	0.6790***
	(0.2159)	(0.9041)	(0.1854)
$\Delta FXRate^{Counterparty}_{k\neq j,t}$	−1.1313**	−1.2729**	−0.8456
	(0.4611)	(0.6060)	(0.4993)
$ln(TotalAssets^{Bank}_{i,j,t})$	−11.7322	2.2358	−58.0023*
	(11.2344)	(9.4549)	(33.3686)
$LoansAssets^{Bank}_{i,j,t}$	0.0485	0.0427	0.0361
	(0.1827)	(0.2191)	(0.7795)
$DepLiab^{Bank}_{i,j,t}$	0.0414	−0.1204	−0.1755
	(0.1561)	(0.1135)	(0.7123)
$\Delta EqIndex^{Domestic}_{k=j,t}$	−0.0651***	−0.0634***	−0.0957
	(0.0051)	(0.0049)	(0.5289)
Entity Fixed Effects	Bank level	Bank level	Bank level
Time Fixed Effects	Half-yearly	Half-yearly	Half-yearly
Constant	Yes	Yes	Yes
Observations	10,541	7,241	3,300
Banks	68	39	29
Adjusted R^2 [%]	1.3	1.1	2.4

Table 10. *Impact of refinancing possibilities. Regression results for equation 7.* $\Delta Exposure^{Sov}_{i,k,t}$ *denotes the change in bank* i*'s exposure to country* k*.* $\Delta Yield^{Sov}_{k,t}$ *is the change in the bond yield of country* k*.* $Price^{Germany}_{t}$ *is the price of German sovereign bonds.* $LTRO_t$ *indicates year-end 2011 and the first half of 2012. Control variables cover country* k*'s foreign exchange rate, bank* i*'s total assets, its ratios of loans to assets and deposits to liabilities as well as domestic equity indices. Standard errors (in parentheses) are clustered at the bank level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.*

	$\Delta Exposure^{Sov}_{i,k,t}$		
	Refinancing Possibilities		
	All Banks (1)	Core (2)	Periphery (3)
$\Delta Yield^{Sov}_{k,t}$	84.2958***	119.7747***	−3.6629
	(27.3872)	(34.1234)	(45.5244)
$\Delta Yield^{Sov}_{k,t} \cdot Price^{Germany}_{t}$	−0.8584***	−1.2185***	0.0384
	(0.2957)	(0.3703)	(0.4907)
$\Delta Yield^{Sov}_{k,t} \cdot LTRO_t$	29.3716***	23.1704***	41.8428***
	(5.9531)	(6.8354)	(10.6965)
$\Delta FXRate^{Counterparty}_{k\neq j,t}$	−1.3345***	−1.4349**	−1.1251**
	(0.4648)	(0.6130)	(0.4992)
$ln(TotalAssets^{Bank}_{i,j,t})$	−11.3506	1.8593	−57.1719
	(11.0468)	(9.4820)	(33.7607)
$LoansAssets^{Bank}_{i,j,t}$	0.0558	0.0451	0.0554
	(0.1805)	(0.2173)	(0.7807)
$DepLiab^{Bank}_{i,j,t}$	0.0352	−0.1162	−0.1898
	(0.1521)	(0.1142)	(0.7187)
$\Delta EqIndex^{Domestic}_{k=j,t}$	−0.0653***	−0.0634***	−0.0970
	(0.0051)	(0.0049)	(0.5227)
Entity Fixed Effects	Bank level	Bank level	Bank level
Time Fixed Effects	Half-yearly	Half-yearly	Half-yearly
Constant	Yes	Yes	Yes
Observations	10,541	7,241	3,300
Banks	68	39	29
Adjusted R^2 [%]	1.9	1.7	3.1

Table 11. *Joint impact regulatory arbitrage, moral suasion and refinancing possibilities. Regression results for equation 8 combining the impact of regulatory arbitrage, moral suasion and refinancing possibilities. Standard errors (in parentheses) are clustered at the bank level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.*

	$\Delta Exposure^{Sov}_{i,k,t}$		
	Joint Impact		
	All Banks (1)	Core (2)	Periphery (3)
$\Delta Yield^{Sov}_{k,t}$	78.0260***	106.7966***	−11.8503
	(27.8214)	(33.7450)	(47.3612)
$Domestic^{Counterparty}_{i,k=j,t}$	−0.5457	2.3621	−8.4970**
	(2.0404)	(2.4186)	(3.8609)
$\Delta Yield^{Sov}_{k,t} \cdot Domestic^{Counterparty}_{i,k=j,t}$	−13.1759***	−5.3251	−17.6282***
	(4.8224)	(6.3696)	(6.2988)
$ThCountry^{Counterparty}_{i,k\neq j,t}$	3.9541**	3.3354**	5.9212
	(1.8083)	(1.5347)	(5.2866)
$\Delta Yield^{Sov}_{k,t} \cdot ThCountry^{Counterparty}_{i,k\neq j,t}$	7.2110	10.3800	2.8396
	(10.2575)	(12.6480)	(17.2511)
$CapitalRatio^{Bank}_{i,j,t}$	−1.5075**	−1.3221**	−1.4075
	(0.6358)	(0.6253)	(1.7668)
$\Delta Yield^{Sov}_{k,t} \cdot CapitalRatio^{Bank}_{i,j,t}$	−1.0089**	−1.6072***	0.2051
	(0.4893)	(0.5517)	(1.0383)
$CashRatio^{Bank}_{i,j,t}$	−0.1446	0.0904	1.6550
	(0.5780)	(0.6305)	(1.6658)
$\Delta Yield^{Sov}_{k,t} \cdot CashRatio^{Bank}_{i,j,t}$	−0.8961**	−0.9671**	−0.7504
	(0.3922)	(0.4387)	(1.3050)
$StateAid^{Bank}_{i,j=k,t} \cdot Domestic^{Counterparty}_{i,k=j,t}$	4.8966	−3.4167	5.9846
	(6.2688)	(10.7011)	(8.3438)
$\Delta Ownership^{Sov}_{i,j=k,t} \cdot Domestic^{Counterparty}_{i,k=j,t}$	0.2970*	−0.8781	0.0449
	(0.1698)	(1.0408)	(0.2615)
$\Delta Yield^{Sov}_{k,t} \cdot Price^{Germany}_{t}$	−0.5664*	−0.7291*	0.1416
	(0.2987)	(0.3795)	(0.5217)
$\Delta Yield^{Sov}_{k,t} \cdot LTRO_t$	28.5924***	21.3488***	43.2634***
	(6.1272)	(7.0531)	(10.5705)
$\Delta FXRate^{Counterparty}_{k\neq j,t}$	−1.3248***	−1.4107**	−1.1841**
	(0.4619)	(0.6066)	(0.4893)
$ln(TotalAssets^{Bank}_{i,j,t})$	−10.9359	3.7739	−59.5803
	(11.0029)	(10.4238)	(36.5383)
$LoansAssets^{Bank}_{i,j,t}$	0.0388	0.0623	0.3620
	(0.1678)	(0.1899)	(0.8185)
$DepLiab^{Bank}_{i,j,t}$	0.0382	−0.0837	−0.4496
	(0.1156)	(0.1024)	(0.7730)
$\Delta EqIndex^{Domestic}_{k=j,t}$	−0.0670***	−0.0649***	−0.1888
	(0.0047)	(0.0044)	(0.5446)
Entity Fixed Effects	Bank level	Bank level	Bank level
Time Fixed Effects	Half-yearly	Half-yearly	Half-yearly
Constant	Yes	Yes	Yes
Observations	10,541	7,241	3,300
Banks	68	39	29
Adjusted R^2 [%]	2.1	1.9	3.0

Table 12. *Robustness test: Constant sample of banks. Regression results for equations 3 and 8 using a sample of banks with consecutive EBA data available. Standard errors (in parentheses) are clustered at the bank level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.*

	$\Delta Exposure^{Sov}_{i,k,t}$	
	Constant Sample	
	Benchmark Reaction (1)	Joint Impact (2)
$\Delta Yield^{Sov}_{k,t}$	14.0627***	97.6688***
	(2.0048)	(25.7501)
$Domestic^{Counterparty}_{i,k=j,t}$		0.7864
		(1.7716)
$\Delta Yield^{Sov}_{k,t} \cdot Domestic^{Counterparty}_{i,k=j,t}$		−18.0055***
		(3.8830)
$ThCountry^{Counterparty}_{i,k\neq j,t}$		5.8465***
		(1.7283)
$\Delta Yield^{Sov}_{k,t} \cdot ThCountry^{Counterparty}_{i,k\neq j,t}$		4.6226
		(11.5439)
$CapitalRatio^{Bank}_{i,j,t}$		−1.1711*
		(0.6850)
$\Delta Yield^{Sov}_{k,t} \cdot CapitalRatio^{Bank}_{i,j,t}$		−1.6590***
		(0.5305)
$CashRatio^{Bank}_{i,j,t}$		−0.2832
		(0.6198)
$\Delta Yield^{Sov}_{k,t} \cdot CashRatio^{Bank}_{i,j,t}$		−0.9016
		(0.7526)
$StateAid^{Bank}_{i,j=k,t} \cdot Domestic^{Counterparty}_{i,k=j,t}$		−1.9947
		(8.5904)
$\Delta Ownership^{Sov}_{i,j=k,t} \cdot Domestic^{Counterparty}_{i,k=j,t}$		0.4553
		(0.7930)
$\Delta Yield^{Sov}_{k,t} \cdot Price^{Germany}_{t}$		−0.6595**
		(0.3095)
$\Delta Yield^{Sov}_{k,t} \cdot LTRO_t$		31.4163***
		(6.8138)
$\Delta FXRate^{Counterparty}_{k\neq j,t}$	−1.3569**	−1.5842***
	(0.5180)	(0.5171)
$ln(TotalAssets^{Bank}_{i,j,t})$	−8.9971	−7.6856
	(10.9390)	(10.9944)
$LoansAssets^{Bank}_{i,j,t}$	−0.1107	−0.0802
	(0.2275)	(0.2239)
$DepLiab^{Bank}_{i,j,t}$	−0.1672	−0.1091
	(0.1072)	(0.0978)
$\Delta EqIndex^{Domestic}_{k=j,t}$	−0.0612***	−0.0625***
	(0.0055)	(0.0050)
Entity Fixed Effects	Bank level	Bank level
Time Fixed Effects	Half-yearly	Half-yearly
Constant	Yes	Yes
Observations	7,986	7,986
Banks	30	30
Adjusted R^2 [%]	1.3	2.3

Table 13. *Robustness test: No winsorization. Regression results for equations 3 and 8 without winsorizing sovereign exposure and bond yield changes. Standard errors (in parentheses) are clustered at the bank level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.*

	$\Delta Exposure^{Sov}_{i,k,t}$	
	No Winsorization	
	Benchmark Reaction (1)	Joint Impact (2)
$\Delta Yield^{Sov}_{k,t}$	11.6800***	43.0741
	(1.6942)	(29.4959)
$Domestic^{Counterparty}_{i,k=j,t}$		−0.3800
		(2.2080)
$\Delta Yield^{Sov}_{k,t} \cdot Domestic^{Counterparty}_{i,k=j,t}$		−5.7663
		(5.0615)
$ThCountry^{Counterparty}_{i,k\neq j,t}$		6.1330**
		(2.7632)
$\Delta Yield^{Sov}_{k,t} \cdot ThCountry^{Counterparty}_{i,k\neq j,t}$		27.4358
		(16.9878)
$CapitalRatio^{Bank}_{i,j,t}$		−1.8890**
		(0.7890)
$\Delta Yield^{Sov}_{k,t} \cdot CapitalRatio^{Bank}_{i,j,t}$		−0.5564*
		(0.3059)
$CashRatio^{Bank}_{i,j,t}$		−0.3070
		(0.7758)
$\Delta Yield^{Sov}_{k,t} \cdot CashRatio^{Bank}_{i,j,t}$		−0.5482*
		(0.2924)
$StateAid^{Bank}_{i,j=k,t} \cdot Domestic^{Counterparty}_{i,k=j,t}$		5.2518
		(7.5936)
$\Delta Ownership^{Sov}_{i,j=k,t} \cdot Domestic^{Counterparty}_{i,k=j,t}$		0.1842
		(0.1966)
$\Delta Yield^{Sov}_{k,t} \cdot Price^{Germany}_{t}$		−0.3252
		(0.3306)
$\Delta Yield^{Sov}_{k,t} \cdot LTRO_t$		28.4770***
		(6.1656)
$\Delta FXRate^{Counterparty}_{k\neq j,t}$	−1.2851**	−1.2875**
	(0.6243)	(0.6197)
$ln(TotalAssets^{Bank}_{i,j,t})$	−6.2436	−6.0838
	(14.0580)	(14.3363)
$LoansAssets^{Bank}_{i,j,t}$	0.0422	0.0135
	(0.1792)	(0.1607)
$DepLiab^{Bank}_{i,j,t}$	0.1107	0.0995
	(0.1834)	(0.1349)
$\Delta EqIndex^{Domestic}_{k=j,t}$	−0.0472***	−0.0495***
	(0.0092)	(0.0083)
Entity Fixed Effects	Bank level	Bank level
Time Fixed Effects	Yes	Yes
Constant	Yes	Yes
Observations	10,541	10,541
Banks	68	68
Adjusted R^2 [%]	0.7	1.6

Table 14. *Robustness test: Clustering of standard errors. Regression results for equation 8 with standard errors (in parentheses) clustered at (1) the exposure level, (2) the home country level and (3) the counterparty level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.*

	$\Delta Exposure^{Sov}_{i,k,t}$		
	Cluster		
	Exposure (1)	Country (2)	Counterparty (3)
$\Delta Yield^{Sov}_{k,t}$	78.0260**	78.0260**	78.0260*
	(31.4485)	(34.0808)	(39.2010)
$Domestic^{Counterparty}_{i,k=j,t}$	−0.5457	−0.5457	−0.5457
	(1.7995)	(1.8469)	(2.0008)
$\Delta Yield^{Sov}_{k,t} \cdot Domestic^{Counterparty}_{i,k=j,t}$	−13.1759***	−13.1759***	−13.1759***
	(4.6181)	(3.6227)	(3.5734)
$ThCountry^{Counterparty}_{i,k\neq j,t}$	3.9541**	3.9541***	3.9541*
	(1.7424)	(1.2487)	(1.9733)
$\Delta Yield^{Sov}_{k,t} \cdot ThCountry^{Counterparty}_{i,k\neq j,t}$	7.2110	7.2110	7.2110
	(8.6512)	(11.7011)	(13.6432)
$CapitalRatio^{Bank}_{i,j,t}$	−1.5075***	−1.5075**	−1.5075***
	(0.4684)	(0.6163)	(0.4016)
$\Delta Yield^{Sov}_{k,t} \cdot CapitalRatio^{Bank}_{i,j,t}$	−1.0089**	−1.0089**	−1.0089*
	(0.4001)	(0.3888)	(0.4910)
$CashRatio^{Bank}_{i,j,t}$	−0.1446	−0.1446	−0.1446
	(0.4487)	(0.6917)	(0.4052)
$\Delta Yield^{Sov}_{k,t} \cdot CashRatio^{Bank}_{i,j,t}$	−0.8961**	−0.8961**	−0.8961*
	(0.4342)	(0.3303)	(0.4452)
$StateAid^{Bank}_{i,j=k,t} \cdot Domestic^{Counterparty}_{i,k=j,t}$	4.8966	4.8966	4.8966
	(5.6259)	(5.1153)	(5.2262)
$\Delta Ownership^{Sov}_{i,j=k,t} \cdot Domestic^{Counterparty}_{i,k=j,t}$	0.2970	0.2970*	0.2970
	(0.1971)	(0.1512)	(0.3100)
$\Delta Yield^{Sov}_{k,t} \cdot Price^{Germany}_{t}$	−0.5664*	−0.5664	−0.5664
	(0.3421)	(0.3506)	(0.3813)
$\Delta Yield^{Sov}_{k,t} \cdot LTRO_t$	28.5924***	28.5924***	28.5924
	(8.3235)	(7.4870)	(29.0378)
$\Delta FXRate^{Counterparty}_{k\neq j,t}$	−1.3248***	−1.3248**	−1.3248**
	(0.4405)	(0.4806)	(0.6245)
$ln(TotalAssets^{Bank}_{i,j,t})$	−10.9359	−10.9359	−10.9359
	(8.5533)	(13.1613)	(8.3270)
$LoansAssets^{Bank}_{i,j,t}$	0.0388	0.0388	0.0388
	(0.1610)	(0.1460)	(0.1514)
$DepLiab^{Bank}_{i,j,t}$	0.0382	0.0382	0.0382
	(0.1139)	(0.1405)	(0.1262)
$\Delta EqIndex^{Domestic}_{k=j,t}$	−0.0670*	−0.0670***	−0.0670*
	(0.0344)	(0.0049)	(0.0347)
Entity Fixed Effects	Bank level	Bank level	Bank level
Time Fixed Effects	Half-yearly	Half-yearly	Half-yearly
Constant	Yes	Yes	Yes
Observations	10,541	10,541	10,541
Number of Clusters	943	21	23
Adjusted R^2 [%]	2.1	2.1	2.1

Table 15. *Robustness test: Scaling of exposure change. Regression results for equation 8 using (1) the relative change in a bank's sovereign exposure, (2) the exposure change scaled by total sovereign exposure and (3) the exposure change scaled by total assets as alternative dependent variable. Standard errors (in parentheses) are clustered at the bank level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.*

	$\Delta Exposure^{Sov}_{i,k,t}$		
	Scaling		
	Relative (1)	Total Exposure (2)	Total Assets (3)
$\Delta Yield^{Sov}_{k,t}$	43.9960	1.5526**	0.1260**
	(79.8178)	(0.6115)	(0.0611)
$Domestic^{Counterparty}_{i,k=j,t}$	−13.0922***	−0.3582	−0.0671**
	(3.7103)	(0.2641)	(0.0274)
$\Delta Yield^{Sov}_{k,t} \cdot Domestic^{Counterparty}_{i,k=j,t}$	−1.4571	−1.8770***	−0.1757***
	(8.7915)	(0.5088)	(0.0502)
$ThCountry^{Counterparty}_{i,k\neq j,t}$	5.3997	0.0658	0.0059
	(5.8987)	(0.0509)	(0.0044)
$\Delta Yield^{Sov}_{k,t} \cdot ThCountry^{Counterparty}_{i,k\neq j,t}$	16.4585	0.0371	0.0114
	(14.5033)	(0.1340)	(0.0129)
$CapitalRatio^{Bank}_{i,t}$	−2.2298**	−0.0096	−0.0010
	(0.8922)	(0.0179)	(0.0019)
$\Delta Yield^{Sov}_{k,t} \cdot CapitalRatio^{Bank}_{i,t}$	−1.7833*	−0.0349***	−0.0030***
	(0.9041)	(0.0083)	(0.0008)
$CashRatio^{Bank}_{i,t}$	0.3642	0.0117	0.0005
	(0.6266)	(0.0112)	(0.0009)
$\Delta Yield^{Sov}_{k,t} \cdot CashRatio^{Bank}_{i,t}$	−1.3015	−0.0079	−0.0013***
	(0.9939)	(0.0066)	(0.0005)
$StateAid^{Bank}_{i,j=k,t} \cdot Domestic^{Counterparty}_{i,k=j,t}$	8.2260	1.4493	0.2449
	(12.4172)	(1.6375)	(0.1658)
$\Delta Ownership^{Sov}_{i,j=k,t} \cdot Domestic^{Counterparty}_{i,k=j,t}$	0.3538	0.0048	−0.0003
	(0.2535)	(0.0711)	(0.0072)
$\Delta Yield^{Sov}_{k,t} \cdot Price^{Germany}_{t}$	−0.1954	−0.0094	−0.0007
	(0.9347)	(0.0064)	(0.0006)
$\Delta Yield^{Sov}_{k,t} \cdot LTRO_t$	18.3153**	0.0257	0.0038
	(9.0872)	(0.1445)	(0.0129)
$\Delta FXRate^{Counterparty}_{k\neq j,t}$	−1.7863***	−0.0170**	−0.0012**
	(0.4623)	(0.0067)	(0.0006)
$\Delta TotalAssets^{Bank}_{i,t}$	−10.1441	0.0707	0.0112
	(16.5033)	(0.2920)	(0.0328)
$\Delta LoansAssets^{Bank}_{i,t}$	0.4258**	0.0024	0.0003
	(0.2108)	(0.0045)	(0.0005)
$\Delta DepLiabilities^{Bank}_{i,t}$	0.2230	0.0041	0.0005
	(0.2469)	(0.0048)	(0.0005)
$\Delta EqIndex^{Domestic}_{k=j,t}$	−0.0659***	−0.0007***	−0.0001***
	(0.0033)	(0.0001)	(0.0000)
Entity Fixed Effects	Bank level	Bank level	Bank level
Time Fixed Effects	Half-yearly	Half-yearly	Half-yearly
Constant	Yes	Yes	Yes
Observations	7,438	10,477	10,504
Banks	67	67	68
Adjusted R^2 [%]	2.1	3.3	3.5

Table 16. *Robustness test: Sample split foreign sovereign exposures. Regression results for equation 8 using sample splits of banks' foreign sovereign exposures. Model (1) uses the full sub-sample of foreign sovereign exposures, model (2) exposures to foreign EU counterparties and model (3) exposures to foreign third countries. Standard errors (in parentheses) are clustered at the bank level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.*

	$\Delta Exposure^{Sov}_{i,k,t}$		
	Sample Split Foreign Sovereign Counterparties		
	Full Sample (1)	EU Countries (2)	Third Countries (3)
$\Delta Yield^{Sov}_{k,t}$	82.8859***	41.4849	402.3592**
	(28.0748)	(27.4915)	(187.0461)
$CapitalRatio^{Bank}_{i,j,t}$	−1.5986**	−1.5223**	−1.9978
	(0.6553)	(0.5964)	(1.6423)
$\Delta Yield^{Sov}_{k,t} \cdot CapitalRatio^{Bank}_{i,j,t}$	−1.0044*	−1.1860**	1.1640
	(0.5351)	(0.5078)	(2.2038)
$CashRatio^{Bank}_{i,j,t}$	−0.1512	−0.3476	0.6797
	(0.5949)	(0.5638)	(1.2373)
$\Delta Yield^{Sov}_{k,t} \cdot CashRatio^{Bank}_{i,j,t}$	−0.8459**	−0.8185**	−1.7768
	(0.4011)	(0.3949)	(2.8591)
$\Delta Yield^{Sov}_{k,t} \cdot Price^{Germany}_{t}$	−0.6156**	−0.1804	−4.1411**
	(0.3061)	(0.3076)	(1.9917)
$\Delta Yield^{Sov}_{k,t} \cdot LTRO_t$	30.0841***	37.6783***	−204.5462**
	(6.3351)	(6.7665)	(96.7165)
$\Delta FXRate^{Counterparty}_{k \neq j,t}$	−1.3552***	−1.7668**	0.2103
	(0.4623)	(0.6992)	(0.6086)
$ln(TotalAssets^{Bank}_{i,j,t})$	−11.5249	−13.2901	−4.5846
	(11.6132)	(11.4028)	(22.7760)
$LoansAssets^{Bank}_{i,j,t}$	0.0328	0.0394	0.0377
	(0.1779)	(0.1692)	(0.4258)
$DepLiab^{Bank}_{i,j,t}$	0.0450	−0.0565	0.6537
	(0.1183)	(0.0775)	(0.3931)
$\Delta EqIndex^{Domestic}_{k=j,t}$	−0.0691***	−0.0528***	−0.1035***
	(0.0050)	(0.0052)	(0.0082)
Entity Fixed Effects	Bank level	Bank level	Bank level
Time Fixed Effects	Half-yearly	Half-yearly	Half-yearly
Constant	Yes	Yes	Yes
Observations	9,964	7,746	2,218
Banks	66	66	57
Adjusted R^2 [%]	2.2	2.8	0.9