# The Bank-Sovereign Nexus in a Banking Union: Evidence from Significant and Less Significant Institutions

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# Introduction

# Motivation

- During the GFC, large number of bailouts and emergence of bank-sovereign nexus
  $\rightarrow$ In Europe: introduction of the Banking Union (BU) and bail-in regulations with the aim to break the "vicious circle between banks and sovereigns" (European Council, 2012)
- Banking turmoil in March 2023: public intervention may still be necessary (e.g., CS crisis, BCBS, 2023) and systemic risk exception may still limit the market-discipline effectiveness of ordinary resolution tools (e.g., SVB and Signature Bank in US)

Is too-big-to-fail still an issue?
Did post-crisis reforms break the bank-sovereign nexus?

# Related literature

General results:

- Public bailouts and implicit government guarantees (IGG) create moral hazard (Dam and Koetter, 2012; Gropp et al., 2014)
- Expectations of government bailouts generates a link between bank and sovereign sectors' financial conditions (Acharya et al., 2014; Correa et al., 2014)

Recent contributions:

- Bailout expectations may influence both *large* and *small* banks risk taking:
  - Expectation of systemic bailouts may generate strategic complementarities in risk-taking through excessive leverage (Dávila and Walther, 2020)
  - Expectations of targeted bailouts on TBTF institutions can give rise to systemic risk-taking (Altinoglu and Stiglitz, 2023)

# Related literature (ctd)

- Large literature focuses on measuring IGGs and impact of post-GFC worldwide reforms, mostly focusing on large banks:
  - Bank vs. Sovereign CDS spreads (Pancotto et al., 2019; Fiordelisi et al., 2020)
  - Bond yields (Cutura, 2021)
  - Implied bailout probability in stock prices (Berndt et al., 2025)
- Limited evidence on *large vs small* banks:
  - Differences in credit spreads risk-sensitivity (Acharya et al., 2016)

# This paper

I use the introduction of the list of Significant Institution (SI) under the European Banking Union (BU) as an exogenous supervisory classification to study **heterogeneity in market expectations** between Significant Institutions (SI) and Less Significant Institutions (LSI) in the Eurozone

- Event-study: short-term stock market reaction to Banking Union package reforms
- DD and DDD frameworks:
  $\rightarrow$ Evolution of the bank-sovereign nexus arising from bailout expectations: **elasticity** of bank stocks to sovereign CDS

$\rightarrow$ First study to examine SI vs. LSI differences in bank stocks elasticity to sovereign CDS

# Empirical application

# The European Banking Union: relevant events

- Enhanced supervision & new resolution tools with increased private participation (e.g., mandatory bail-in)
- Two Pillars: Supervision (SSM) & Resolution (SRM) with double-layered authorities depending on bank *significance*
  - SSM: SIs (ECB) vs LSIs (NCAs)
  - SRM: SIs + cb institutions (SRB) vs LSIs (NRAs)

| SSM dates | | SRM dates | |
|---|---|---|---|
| **Event** | **Date** | **Event** | **Date** |
| SSM Announcement | September 12, 2012 | Bail-in proposal | June 06, 2012 |
| SI criteria | December 14, 2012 | SRM proposal | July 10, 2013 |
| SSM Regulation Adoption | October 15, 2013 | BRRD Adoption | May 15, 2014 |
| SI list | September 4, 2014 | SRM start | January 1, 2015 |
| SSM start | November 4, 2014 | SRM fully operational | January 1, 2016 |

*Hypothesis 1.* First SI list publication $\rightarrow$ most relevant event for markets

## Hypotheses development: baseline relationships

Previous work (Acharya et al., 2014) finds positive association between bank and sovereign credit risk (CDS spreads)

Limited evidence on sovereign credit risk vs bank equity: Correa et al. (2014) find negative effect of sovereign ratings downgrades (discrete events)

*Hypothesis 2*. There is a negative baseline relationship between bank stock returns and sovereign credit risk (CDS), due to three main channels (Dell'Ariccia et al., 2018; Fratzscher and Rieth, 2018):

1. **Macroeconomic channel**: economy-wide shocks affect both banking and sovereign sectors
2. **Sovereign debt-holding channel** (Farhi and Tirole, 2018): deterioration in sovereign credit risk cause portfolio losses for banks

$\rightarrow$ These channels affect all banks, regardless of size

# Hypoteses development: baseline relationships (ctd)

3. **IGG channel**:
    - IGGs create a funding advantage for beneficiaries (Tsesmelidakis and Merton, 2013), generating indirect benefits for shareholders
    - This channel operates regardless of bondholdings (Leonello, 2018)
    - Issuers' credit risk affects value of the guarantee (Hull and White, 1995) and thus benefits to creditors & shareholders
    - Fiscal capacity (depending on credit risk) also affects the *probability* of bailout (Acharya et al., 2021; Leonello, 2018)

# Hypotheses development: large vs small banks asymmetry

2 main cases:

- Government intervention is **systemic** (more likely during periods of financial distress): financial sector-wide guarantees benefit both large and small banks (e.g., Kelly et al., 2016)
- Government intervention is **targeted at TBTF banks**: only large banks benefit from bailout expectations, small banks do not

*Hypothesis 3.* Absent the BU, controlling for macro and bond-holding channels, SI stock–sovereign CDS spillovers are negative, LSI spillovers are absent.

$\rightarrow$ Asymmetry in market-implied bank-sovereign nexus

# Hypotheses development: effect of the EBU

*Has the BU reduced expectations asymmetries between large and small banks?*

- Previous evidence (Pancotto et al., 2019; Fiordelisi et al., 2020) only focuses on large banks (CDS available)
- BU (SRM) is a **double-layered treatment**: Resolution tools apply to all banks, centralized authorities for large banks

*Hypothesis 4*. If the BU is effective at removing IGGs on large banks, then, controlling for the macroeconomic and the bondholdings channels:

1. Negative SI short term reaction vs no reaction for LSI
2. Long-term effect: reduction in sovereign-bank spillovers for SI, no change for LSI

# Data

Bank-level data:

- Bank stock prices: Refinitiv
- Bank financials: BankFocus
- Bank classification: ECB lists 2014-2023

Country-level data:

- Sov. CDS (5y senior unsecured) + Market indices: Refinitiv
- Macro variables: IMF
- Monetary policy and systemic risk: ECB

# Data: sample selection

Bank specialisation (BvD): Commercial bank, Cooperative bank, Savings bank, Bank Holding company, Investment bank

Sample period: Jan. 2010 - Dec. 2019

Stock liquidity: only stocks with at least 1 year of observations & penny stocks (price $<$ 1USD) excluded (extreme returns)

**Treated sample**: banks from 12 EZ countries with quoted CDS

Bank classification based on ECB list of supervised banks:

- SI are banking group parent banks
- Alternatively, SI are the main banks of a group if parent is nonbank
- All subsidiaries are excluded

$$\rightarrow 46\ SI + 32\ LSI$$

# Data: sample selection (ctd)

**Control sample**: banks from non-EZ countries with quoted CDS and similar institutional frameworks for bank resolution

- FSB countries: JP, UK, US
- Nordic countries adopting BRRD-like resolution regimes: DK, NO, SE

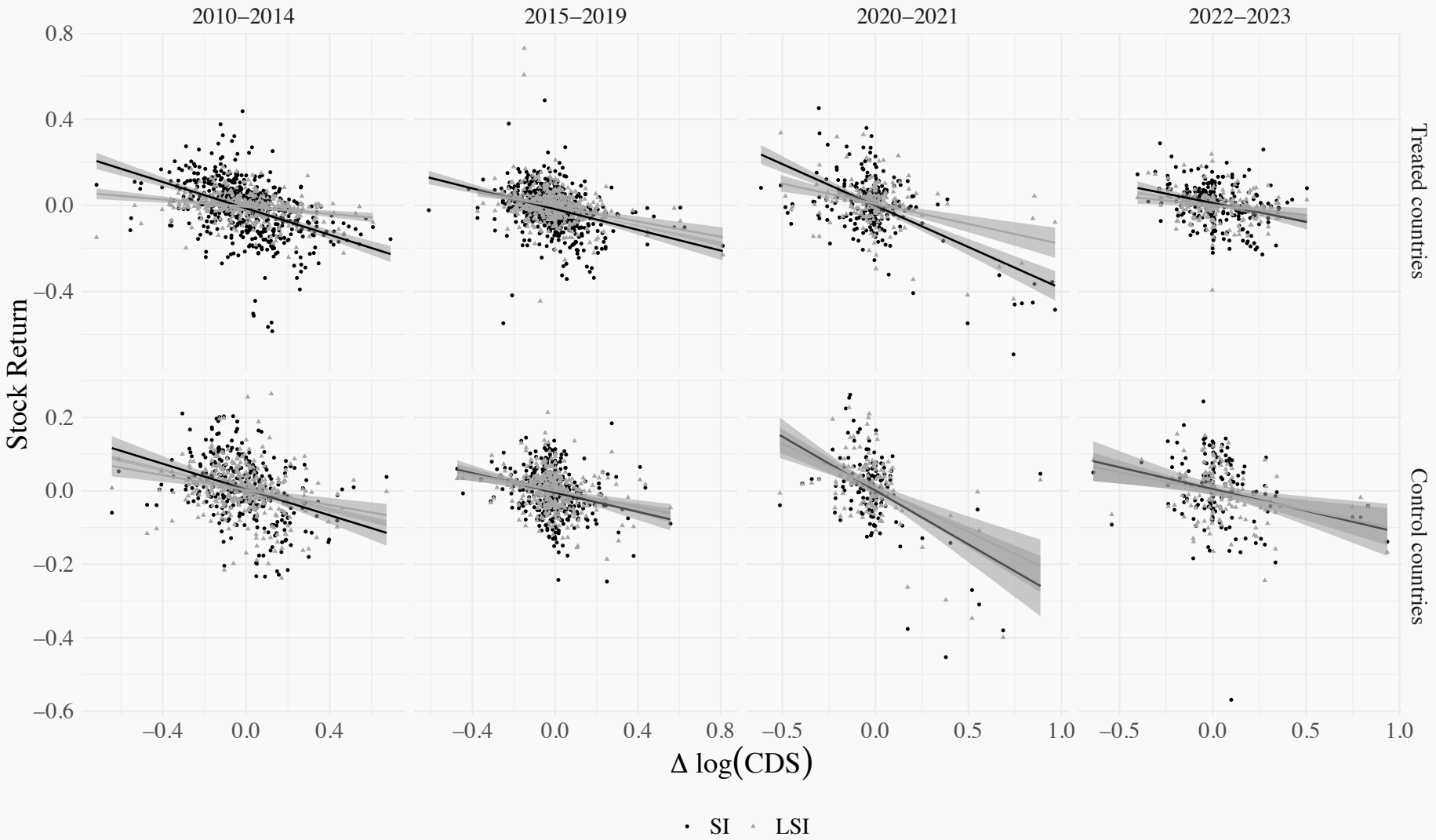
Bank classification in SI-/LSI-equivalents based on Reg. 1024/2013 Art. 6(4):

1. total assets $>$ EUR 30 bn
2. total assets/GDP $>$ 20%
3. Three largest institutions in the country

$$\rightarrow \textit{73 SI} + \textit{353 LSI}$$

+ Matching by size & capitalization

# Bank stock returns vs Sovereign CDS



# Event-study results

# Short run: event study setting

Market model based on Campbell et al. (2010) (daily stock returns):

$$R_{its} = \alpha_i + \beta_i R_{ts} + \epsilon_{its} \tag{1}$$

where $R_{ts}$ is domestic stock market index return.

Abnormal returns around each event:

$$AR_{it} = R_{it} - \hat{R}_{it} \tag{2}$$

Cumulative average abnormal returns (CAAR) for each group of banks $k$:

$$CAAR[l_1, l_2]_k = \sum_{t=l_1}^{l_2} AAR_t^k \tag{3}$$

where $AAR_t^k = \frac{1}{N_k} \sum_{i \in k} AR_{i,t}$ is the average abnormal return for group $k$ (e.g., SI in treated countries)

# Event study sample

- Estimation window selected: 180 trading days
- Only stocks with at least 100 obs in estimation window are kept
- Different event windows: largest length [-5, +5]
- Kept only stocks with at least 3 obs in the event window

+ Different estimation windows for robustness: 120, 220 td

# Event study results

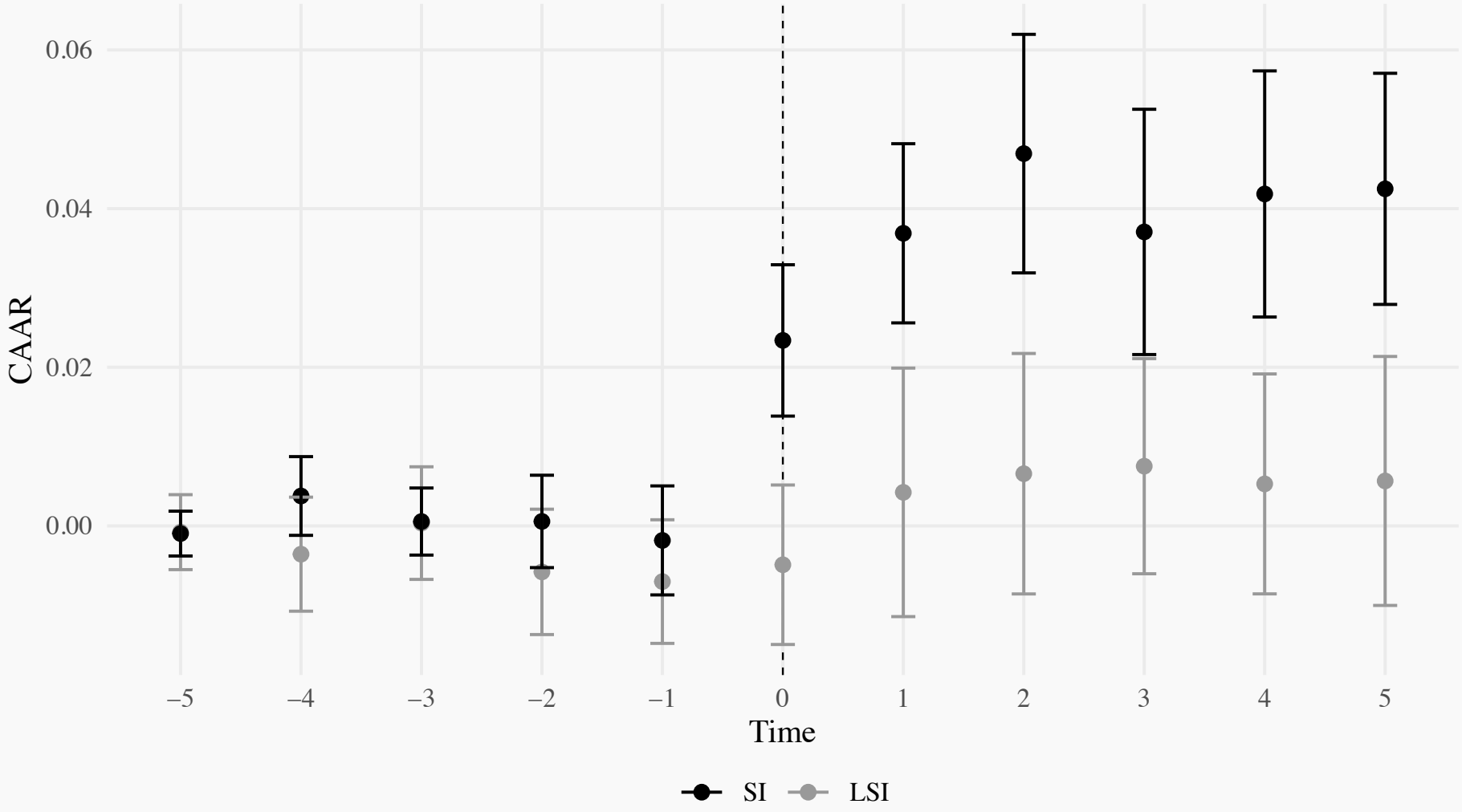



**Figure 1:** CAARs for Euro Area banks around the SI list publication (2014-09-04)

# Event study results (ctd)

CAARs tests based on Kolari and Pynnönen (2010) cross-correlation robust tests

| Countries | Type | N | | | t-test | ADJ-Patell | ADJ-BMP |
|---|---|---|---|---|---|---|---|
| Treated | SI | 40 | CAAR[0,0] | 0.026 | *** | *** | * |
| | | 41 | CAAR[-1,1] | 0.037 | *** | ** | ** |
| | | 41 | CAAR[-2,2] | 0.047 | *** | ** | * |
| | LSI | 23 | CAAR[0,0] | 0.002 | | | |
| | | 23 | CAAR[-1,1] | 0.01 | | | |
| | | 24 | CAAR[-2,2] | 0.006 | | | |
| Control | SI | 41 | CAAR[0,0] | 0.003 | *** | | |
| | | 41 | CAAR[-1,1] | 0 | | | |
| | | 41 | CAAR[-2,2] | 0.005 | * | | |
| | LSI | 184 | CAAR[0,0] | -0.001 | | | |
| | | 187 | CAAR[-1,1] | -0.007 | *** | | |
| | | 189 | CAAR[-2,2] | 0.003 | ** | | |

$\rightarrow$ Positive reaction of EZ SI (in line with Moenninghoff et al., 2015 for G-SIB designation)

$\rightarrow$ **Other dates**: no significant reaction

# Event study results (ctd)

| Event date | Countries | Type | N | CAAR[0,0] | t-test | ADJ-PatelI | ADJ-BMP |
|---|---|---|---|---|---|---|---|
| 2012-06-06 | Treated | SI | 44 | -0.002 | | | |
| | | LSI | 35 | 0.005 | | | |
| | Control | SI | 37 | -0.004 | | | |
| | | LSI | 143 | -0.008 | *** | | |
| 2012-09-12 | Treated | SI | 44 | 0.012 | ** | | |
| | | LSI | 31 | 0.003 | | | |
| | Control | SI | 40 | 0.004 | * | | |
| | | LSI | 137 | -0.005 | | | |
| 2012-12-14 | Treated | SI | 43 | -0.006 | *** | | |
| | | LSI | 34 | 0.002 | | | |
| | Control | SI | 40 | 0.002 | * | | |
| | | LSI | 145 | -0.001 | | | |
| 2013-07-10 | Treated | SI | 44 | -0.005 | | | |
| | | LSI | 31 | -0.004 | | | |
| | Control | SI | 43 | -0.004 | *** | | |
| | | LSI | 175 | 0 | | | |
| 2013-10-15 | Treated | SI | 44 | 0.018 | *** | | |
| | | LSI | 32 | -0.005 | | | |
| | Control | SI | 43 | -0.001 | | | |
| | | LSI | 180 | -0.003 | *** | | |
| 2014-05-15 | Treated | SI | 44 | -0.008 | ** | | |
| | | LSI | 35 | -0.005 | * | | |
| | Control | SI | 42 | -0.002 | | | |
| | | LSI | 182 | -0.003 | *** | | |
| 2014-11-04 | Treated | SI | 41 | -0.007 | | | |
| | | LSI | 24 | 0 | | | |
| | Control | SI | 41 | 0.002 | | | |
| | | LSI | 174 | -0.001 | | | |

# Determinants of CARs

| | *Dependent variable: CAR*[0, 0] | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| SI | 0.024*** | 0.016*** | 0.021** | 0.016* |
| | (0.006) | (0.004) | (0.008) | (0.008) |
| *EqRatio* | | -0.169** | -0.172** | -0.089 |
| | | (0.063) | (0.075) | (0.071) |
| *SovRisk* | | 0.000 | 0.008 | 0.009 |
| | | (0.004) | (0.006) | (0.007) |
| SI × *EqRatio* | | | 0.039 | -0.030 |
| | | | (0.119) | (0.125) |
| SI × *SovRisk* | | | -0.012 | -0.009 |
| | | | (0.008) | (0.008) |
| Size | | | | 0.003* |
| | | | | (0.001) |
| *GovSec* | | | | -0.012 |
| | | | | (0.015) |
| Observations | 50 | 50 | 50 | 48 |
| R2 | 0.307 | 0.455 | 0.475 | 0.503 |
| R2 Adj. | 0.293 | 0.419 | 0.415 | 0.416 |

# Regression results

# Model identification

DD formulation (inspired by Fiordelisi et al., 2020) for Eurozone banks:

$$
\begin{aligned}
Y_{its} = \quad & \alpha_i + \phi_t + \beta' X_{its} + \\
& + \gamma_1 \, \Delta Log(SovCDS_{ts}) + \gamma_2 \, SI + \gamma_3 \, post + \\
& \gamma_4 \, \Delta Log(SovCDS_{ts}) \times SI + \gamma_5 \, \Delta Log(SovCDS_{ts}) \times post + \gamma_6 \, SI \times \\
& + \gamma_7 \, SI \times post \times \Delta Log(SovCDS_{ts}) + \varepsilon_{its}
\end{aligned} \tag{4}
$$

where $Y_{its}$ monthly log-return and $\Delta CDS_s$ monthly log-difference in country $s$ CDS spread.

Holding fixed other channels:
$\rightarrow$ If IGG & funding advantage: $\gamma_4 < 0$
$\rightarrow$ If BU is effective: $\gamma_7 > 0$

# Model identification (ctd)

*Problem with DD on EZ:* treatment depends on size, other factors related to size might influence outcome $Y_{its}$

DDD formulation (Gruber, 1994; Olden and Møen, 2022) for EZ and non-EZ banks:

$$
\begin{aligned}
Y_{its} = \quad & \alpha_i + \phi_t + \beta' X_{its} + \ \ldots && (5)\\
& + \gamma_{11}\ SI \times T \times \Delta Log(SovCDS_{ts}) && (6)\\
& + \gamma_{14}\ T \times post \times \Delta Log(SovCDS_{ts})\\
& + \gamma_{15}^{DDD}\ SI \times T \times post \times \Delta Log(SovCDS_{ts}) + \varepsilon_{its}
\end{aligned}
$$

# Some notes on sign expectations

- **Pre-BU:** if IGG on SI: $\gamma_{11} < 0$
  - **IGG give funding advantage to SI** (Tsesmelidakis and Merton, 2013)
  - **The value of the IGG depends on sovereign credit risk** (Leonello, 2018; Acharya et al., 2021; Correa et al., 2014)
- **Post-BU:** if IGG on SI are reduced $\gamma_{15}^{DDD} > 0$
  - **Uniform provisions** on bail-in for all institutions reduce amount and probability of public support
  - **More credible central authority**: stricter supervision (Carletti et al., 2021)
- **Potential spillover** (Olden and Møen, 2022): $\gamma_{14}$

# Parallel trends?

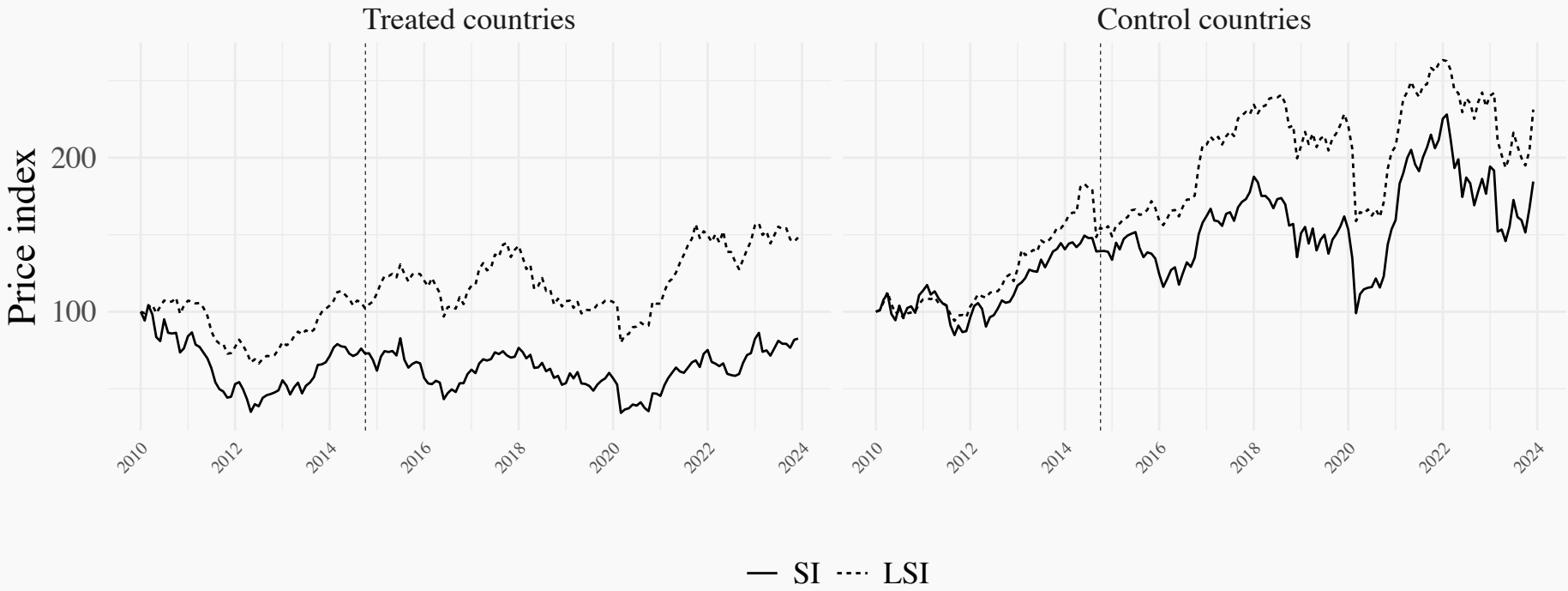


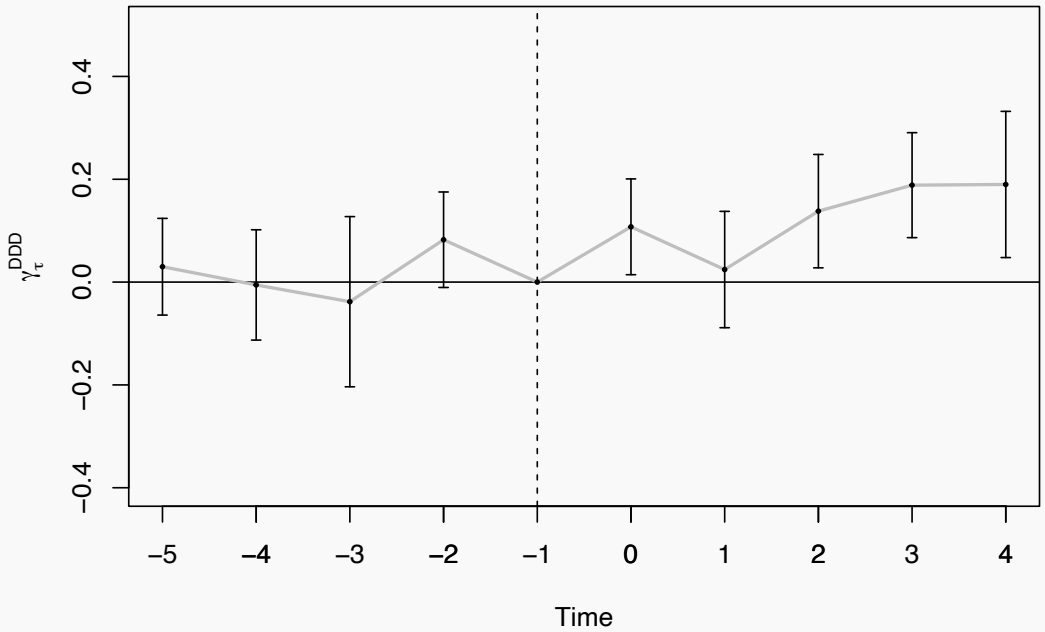

**Figure 2:** Equally-weighted price indices for SI-LSI banks in treated and control countries (2010 = 100)

# TWFE DynDD design

To more formally test for pre-trends, I estimate the following binned Dynamic-DiD TWFE regression to test for *differences in pre-trends* (Olden and Møen, 2022):

$$R_{its} = \delta_i + \delta_t + \sum_{\tau \neq -1} \gamma_\tau^{DDD} \, SI \times treated \times \Delta Log(SovCDS_s) \times \mathbf{1}_\tau + \varepsilon_{its} \quad (7)$$

where $\tau$ is a year bin and $\tau = 0$ is year of intervention



## Control variables

To isolate the IGG channel of the bank-sovereign nexus, I control for potential confounders:

1. Macro controls: GDP growth, Inflation rate
2. Domestic market (Correa et al., 2014)
3. Periods of systemic stress for markets: CISS index in treated countries (not available for GR and CY)
4. Standard bank-level controls: total assets, equity ratio, ROE
5. BU introduction vs ECB unconventional MP interventions:
   - SMP, LTROs, and OMT: robustness tests for restricted period 2013-2016, excluding last intervention ("whatever it takes" and Sep. 2012 OMT program)
   - QE: I control for net ECB purchases by country under APP program
6. BS nexus can arise through bank sovereign portfolio losses: I control for government securities holdings and their interaction with CDS

# DD results: treated sample (monthly data, 2010-2019)

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| $\Delta log(CDS) \times$ SI $\times$ post | 0.141*** | 0.115*** | 0.117** | 0.122*** | 0.106** |
| | (0.045) | (0.043) | (0.045) | (0.045) | (0.046) |
| $\Delta log(CDS) \times$ SI | -0.180*** | -0.171*** | -0.179*** | -0.184*** | -0.168*** |
| | (0.032) | (0.035) | (0.041) | (0.041) | (0.040) |
| $\Delta log(CDS) \times$ post | -0.050 | -0.076* | -0.046 | -0.046 | -0.031 |
| | (0.044) | (0.044) | (0.053) | (0.053) | (0.056) |
| $\Delta log(CDS)$ | -0.010 | 0.111** | 0.024 | 0.024 | 0.037 |
| | (0.037) | (0.043) | (0.052) | (0.052) | (0.048) |
| SI | -0.002 | -0.001 | -0.004 | -0.003 | -0.000 |
| | (0.005) | (0.005) | (0.007) | (0.005) | (0.007) |
| Dom. mkt. ret. | | 1.506*** | 0.964*** | 0.965*** | 0.986*** |
| | | (0.217) | (0.094) | (0.093) | (0.090) |
| $\Delta CISS$ | | | 0.090 | 0.090 | 0.050 |
| | | | (0.063) | (0.063) | (0.071) |
| Net QE pch. | | | -0.001* | -0.001 | -0.001* |
| | | | (0.001) | (0.001) | (0.001) |
| $\Delta log(CDS) \times GovSec$ | | | | | -0.090 |
| | | | | | (0.080) |
| Bank controls | | | | X | X |
| Macro controls | | X | X | X | X |
| Bank + Time FE | X | X | X | X | X |
| Observations | 6,657 | 6,657 | 5,537 | 5,537 | 4,816 |
| R2 | 0.278 | 0.357 | 0.365 | 0.366 | 0.402 |
| R2 Adj. | 0.256 | 0.338 | 0.342 | 0.343 | 0.377 |

SE clustered by bank in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

# DDD results: full sample (monthly data, 2010-2019)

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| $\Delta log(CDS) \times$ treated $\times$ SI $\times$ post | 0.123** | 0.105** | 0.106** | 0.107** | 0.109** |
| | (0.050) | (0.044) | (0.044) | (0.045) | (0.050) |
| $\Delta log(CDS) \times$ treated $\times$ SI | -0.100** | -0.109*** | -0.109*** | -0.109*** | -0.108** |
| | (0.045) | (0.040) | (0.040) | (0.040) | (0.042) |
| $\Delta log(CDS) \times$ treated $\times$ post | -0.110*** | -0.158*** | -0.158*** | -0.159*** | -0.154*** |
| | (0.039) | (0.033) | (0.033) | (0.034) | (0.037) |
| $R_{market}$ | | 1.121*** | 1.123*** | 1.120*** | 1.216*** |
| | | (0.090) | (0.090) | (0.090) | (0.100) |
| $\Delta log(CDS) \times$ GovSec | | | | | -0.010 |
| | | | | | (0.032) |
| Bank controls | | | | X | X |
| Macro controls | | | X | X | X |
| Pairwise interactions | X | X | X | X | X |
| Bank + Time FE | X | X | X | X | X |
| Observations | 36,614 | 36,614 | 36,614 | 36,614 | 33,674 |
| R2 | 0.200 | 0.264 | 0.264 | 0.265 | 0.274 |
| R2 Adj. | 0.187 | 0.253 | 0.253 | 0.254 | 0.262 |

SE clustered by bank in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

# Regression results: extended period (2010-2023)

| | (1) | (2) | (3) |
|---|---|---|---|
| $\Delta log(CDS) \times$ treated $\times$ SI $\times$ post | 0.016 | 0.065 | 0.103** |
| | (0.042) | (0.044) | (0.048) |
| $\Delta log(CDS) \times$ treated $\times$ SI $\times$ covid | | -0.151*** | -0.189*** |
| | | (0.047) | (0.047) |
| $\Delta log(CDS) \times$ treated $\times$ SI $\times$ infl. | | | -0.075 |
| | | | (0.049) |
| Bank controls | X | X | X |
| Macro & mkt controls | X | X | X |
| Pairwise interactions | X | X | X |
| Bank FE | X | X | X |
| Time FE | X | X | X |
| Observations | 47,157 | 47,157 | 47,157 |
| R2 | 0.330 | 0.330 | 0.331 |
| R2 Adj. | 0.321 | 0.321 | 0.322 |

SE clustered by bank in parenthesis. * p $<$ 0.1, ** p $<$ 0.05, *** p $<$ 0.01

$\rightarrow$ COVID-19 period associated with resurgence of the nexus

# Robustness tests

- Different estimation windows (2011-2018, 2013-2016, excluding EBA Capital Exercise on SI & ECB's OMT)
- Different frequencies (weekly, quarterly)
- Different subsamples (vulnerable vs nonvulnerable countries)
- Matching by lagged size and capital ratio

# Robustness tests: different subperiods & frequencies

| | Different subperiods | | Different frequencies | |
|---|---|---|---|---|
| | 2011-2018 | 2013-2016 | Weekly | Quarterly |
| | (1) | (2) | (3) | (4) |
| $\Delta log(CDS) \times$ treated $\times$ SI $\times$ post | 0.119** | 0.281** | 0.082** | 0.073 |
| | (0.053) | (0.113) | (0.033) | (0.058) |
| Bank controls | X | X | X | X |
| Macro & mkt controls | X | X | X | X |
| Pairwise interactions | X | X | X | X |
| Bank FE | X | X | X | X |
| Time FE | X | X | X | X |
| Observations | 27,338 | 14,437 | 122,405 | 10,796 |
| R2 | 0.278 | 0.298 | 0.249 | 0.324 |
| R2 Adj. | 0.264 | 0.277 | 0.243 | 0.295 |

SE clustered by bank in parenthesis. * p $<$ 0.1, ** p $<$ 0.05, *** p $<$ 0.01

# Robustness tests: different subsamples

| | Nonvulnerable countries | | Vulnerable countries | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| $\Delta log(CDS) \times$ SI $\times$ post | 0.163*** | | 0.105* | |
| | (0.050) | | (0.058) | |
| $\Delta log(CDS) \times$ treated $\times$ SI $\times$ post | | 0.109** | | 0.114* |
| | | (0.045) | | (0.065) |
| Bank controls | X | X | X | X |
| Macro & mkt controls | X | X | X | X |
| Pairwise interactions | X | X | X | X |
| Bank FE | X | X | X | X |
| Time FE | X | X | X | X |
| Observations | 1,648 | 30,111 | 3,563 | 32,026 |
| R2 | 0.420 | 0.237 | 0.436 | 0.272 |
| R2 Adj. | 0.361 | 0.224 | 0.408 | 0.260 |

SE clustered by bank in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

# Robustness tests: matched samples

| | (1) | (2) |
|---|---|---|
| $\Delta log(CDS) \times$ treated $\times$ SI $\times$ post | 0.096* | 0.091* |
| | (0.050) | (0.050) |
| $\Delta log(CDS) \times$ treated $\times$ SI $\times$ covid | | -0.254*** |
| | | (0.059) |
| $\Delta log(CDS) \times$ treated $\times$ SI $\times$ infl. | | -0.072 |
| | | (0.056) |
| Bank controls | X | X |
| Macro & mkt controls | X | X |
| Pairwise interactions | X | X |
| Bank FE | X | X |
| Time FE | X | X |
| Observations | 11,175 | 15,089 |
| R2 | 0.371 | 0.400 |
| R2 Adj. | 0.357 | 0.388 |

SE clustered by bank in parenthesis.

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

# Robustness tests: spillovers

*Most importantly: Spillovers?*

- Spillovers cause SUTVA violation (Rubin, 1980)
- Berg et al. (2021) address spillovers in empirical corporate finance papers:
  - Using country FE should reduce concerns if spillovers treated-treated treated-untreated are symmetric
  - Document estimating DD regression only for control units (i.e., Eurozone LSIs)

$$R_{its} = \delta_i + \delta_t + \gamma^{spill} \times \bar{d}_s \times post \times \Delta CDS_s + \varepsilon_{its} \quad (8)$$

where $\bar{d}_s$ is treatment intensity (% of SI in treated countries)

# Robustness tests: spillovers

| | Aggregate (1) | SI + LSI (2) | LSI (3) |
|---|---|---|---|
| $\Delta log(CDS) \times \text{post} \times \bar{d}_c$ | 0.342* | 0.388*** | 0.255 |
| | (0.157) | (0.090) | (0.200) |
| Bank controls | X | X | X |
| Macro & mkt controls | X | X | X |
| Pairwise interactions | X | X | X |
| Bank FE | | X | X |
| Time FE | X | X | X |
| Country FE | X | | |
| Observations | 1,349 | 5,211 | 1,627 |
| R2 | 0.328 | 0.408 | 0.339 |
| R2 Adj. | 0.253 | 0.385 | 0.269 |

SE in parenthesis. * p $<$ 0.1, ** p $<$ 0.05, *** p $<$ 0.01

$\rightarrow$ Aggregate effect likely due to SI: col. (3) does not support presence of spillovers on LSI

# Conclusion

# Conclusion

**Key Findings**:

- ES shows positive short-run effect of SI classification: IGG?
- Both DD and DDD frameworks show:
  - Reduced market-perceived bank-sovereign nexus
  - Reduced differences before 2020 (credibility of central authority)
  - During COVID-19: negative elasticity for Eurozone SI banks, in line with results for G-SIBs (Berndt et al., 2025) and corporate sector (Jappelli et al., 2025)

**Potential implications and next steps**:

- Comparative improvement in funding conditions for LSI: recent evidence suggests mixed effects on SI-LSI banks competitiveness (Raunig and Sigmund, 2023)
- Influence on interbank network structure (Altinoglu and Stiglitz, 2023) and aggregate risk-taking (Dávila and Walther, 2020)
- What about large LSI (HI)?

Thank you!

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# Appendix: Descriptives

**Table 1:** Descriptive statistics: bank-level

| | | Treated countries | | | | Control countries | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | SI (46) | | LSI (32) | | SI (73) | | LSI (353) | |
| | | Mean | St.Dev. | Mean | St.Dev. | Mean | St.Dev. | Mean | St.Dev. |
| 2010–2014 | Stock return (%) | -2.7 | 4.1 | -0.7 | 3.1 | 0.3 | 1.1 | 0.6 | 1.8 |
| | Total assets (EUR mn) | 574,957.2 | 754,083.9 | 14,587.4 | 11,854.2 | 694,529.4 | 848,388.7 | 5,329.9 | 7,911.1 |
| | Total Equity ratio (%) | 6.0 | 3.2 | 8.7 | 4.4 | 7.4 | 3.1 | 12.1 | 15.0 |
| | ROE (%) | 3.8 | 15.7 | 7.2 | 13.9 | 6.5 | 9.1 | 6.2 | 11.1 |
| | Gov. Sec. ratio (%) | 9.3 | 5.2 | 14.7 | 16.6 | 10.5 | 6.2 | 18.2 | 12.3 |
| 2014–2019 | Stock return (%) | -1.9 | 2.9 | -0.7 | 2.3 | -0.1 | 0.8 | 0.6 | 1.0 |
| | Total assets (EUR mn) | 428,523.5 | 592,343.1 | 11,425.2 | 11,807.1 | 615,884.4 | 808,905.1 | 6,514.4 | 8,215.3 |
| | Total Equity ratio (%) | 7.6 | 2.4 | 9.4 | 4.3 | 8.3 | 3.7 | 17.0 | 20.5 |
| | ROE (%) | 4.8 | 10.9 | 6.7 | 14.4 | 8.5 | 5.0 | 8.9 | 5.3 |
| | Gov. Sec. ratio (%) | 10.0 | 5.7 | 16.2 | 16.1 | 10.8 | 8.8 | 14.2 | 11.4 |
| 2020–2021 | Stock return (%) | -0.4 | 3.2 | 0.4 | 4.3 | 0.2 | 1.2 | 0.4 | 1.2 |
| | Total assets (EUR mn) | 490,180.5 | 697,002.1 | 13,542.8 | 13,245.1 | 627,602.9 | 902,785.5 | 7,769.8 | 8,986.6 |
| | Total Equity ratio (%) | 6.9 | 2.3 | 9.6 | 4.0 | 7.6 | 2.7 | 17.8 | 22.0 |
| | ROE (%) | 2.6 | 13.1 | 9.3 | 9.6 | 8.2 | 5.2 | 9.9 | 6.3 |
| | Gov. Sec. ratio (%) | 8.8 | 5.3 | 7.0 | 5.8 | 11.8 | 9.6 | 12.9 | 11.2 |
| 2022–2023 | Stock return (%) | 0.9 | 1.9 | -0.3 | 2.8 | -0.8 | 5.7 | -0.8 | 3.6 |
| | Total assets (EUR mn) | 480,402.4 | 678,104.7 | 11,370.8 | 8,683.3 | 522,731.0 | 845,893.0 | 7,032.5 | 7,935.9 |
| | Total Equity ratio (%) | 7.1 | 2.1 | 9.9 | 4.4 | 7.9 | 5.0 | 17.4 | 22.2 |
| | ROE (%) | 11.5 | 5.8 | 10.6 | 6.2 | 9.3 | 6.1 | 9.9 | 7.9 |
| | Gov. Sec. ratio (%) | 8.8 | 6.2 | 9.5 | 8.7 | 11.8 | 8.7 | 12.7 | 10.5 |

# Appendix: Descriptives

**Table 2:** Descriptive statistics: country-level

| | | Treated Countries | | Control Countries | |
|---|---|---|---|---|---|
| | | Mean | St.Dev. | Mean | St.Dev. |
| 2010–2014 | $\Delta Log(SovCDS)(\%)$ | 0.3 | 19.8 | -1.1 | 16.0 |
| | SovCDS (bp) | 326.4 | 805.3 | 44.3 | 29.0 |
| | Market ret (%) | -0.3 | 9.4 | 0.7 | 5.6 |
| | GDP growth (%) | 0.0 | 1.2 | 0.4 | 0.9 |
| | Infl. rate (%) | 0.1 | 0.6 | 0.1 | 0.4 |
| | CISS Index | 17.2 | 14.8 | | |
| 2014–2019 | $\Delta Log(SovCDS)(\%)$ | -2.1 | 12.7 | -1.1 | 11.7 |
| | SovCDS (bp) | 106.8 | 220.0 | 18.6 | 9.3 |
| | Market ret (%) | 0.0 | 5.0 | 0.2 | 4.0 |
| | GDP growth (%) | 0.7 | 1.7 | 0.5 | 0.5 |
| | Infl. rate (%) | 0.1 | 0.6 | 0.1 | 0.3 |
| | CISS Index | 4.9 | 6.2 | | |
| 2020–2021 | $\Delta Log(SovCDS)(\%)$ | -0.7 | 19.2 | -1.1 | 17.3 |
| | SovCDS (bp) | 32.9 | 37.3 | 11.4 | 6.0 |
| | Market ret (%) | 0.6 | 7.5 | 1.0 | 6.5 |
| | GDP growth (%) | 0.6 | 6.2 | 0.6 | 5.2 |
| | Infl. rate (%) | 0.2 | 0.6 | 0.2 | 0.4 |
| | CISS Index | 7.2 | 11.2 | | |
| 2022–2023 | $\Delta Log(SovCDS)(\%)$ | 1.3 | 15.8 | 3.4 | 19.7 |
| | SovCDS (bp) | 29.5 | 27.1 | 16.1 | 8.2 |
| | Market ret (%) | 0.2 | 6.6 | -0.1 | 6.3 |
| | GDP growth (%) | 0.4 | 1.0 | 0.2 | 1.3 |
| | Infl. rate (%) | 0.5 | 0.8 | 0.4 | 0.6 |
| | CISS Index | 16.9 | 14.1 | | |

# Appendix: Bank stock returns vs Sovereign CDS