Effectiveness of supervisory activities in mitigating banks' commercial real estate risk[1]

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We assess the effectiveness of supervisory activities in mitigating credit risk stemming from banks' commercial real estate portfolios. We analyse two activity types deployed by European banking supervisors: (a) on-site inspections, which assess in depth banks' risk-taking and internal controls, but can only be selectively applied, and (b) off-site targeted reviews, which survey risk management practices across institutions, are less intrusive but are applied more widely. Using quarterly confidential supervisory data for large euro area banks between 2020 and 2024, we employ a Difference-in-Differences framework with an event-study design to capture the effects of these activities on the coverage ratio of banks' commercial real estate portfolios. We find that on-site inspections are followed by persistent increases in coverage ratios, while targeted reviews are associated with immediate improvements which are significant but short-lived. The results highlight the complementary nature of the two activity types, which have different outreach possibilities and effects.

Key words: supervisory effectiveness, supervisory activities, commercial real estate, bank provisioning

JEL classifications: G21, G28, R30, C23.

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1. Introduction

The financial turbulence of March 2023 originated from banking stress episodes in the United States and Switzerland, and brought renewed attention to the central role of supervision in safeguarding financial stability. International bodies have since reiterated that even in a post-Basel III world of stronger capital and liquidity requirements, supervisory judgement, intrusiveness and timely intervention remain essential to prevent the build-up of vulnerabilities within institutions (IMF, 2023; BCBS, 2025). The renewed emphasis on supervisory effectiveness[2] reflects the recognition that regulation alone cannot address all failures in risk recognition or risk management within banks; supervisory oversight must complement the regulatory framework by identifying deficiencies and ensuring their timely and effective remediation before they crystallise into material losses.[3]

We contribute to this debate by assessing the impact of supervisory activities on the credit risk of banks' commercial real estate (CRE) loan portfolios, which have been an important area of concern in Europe. As highlighted in recent assessments, the combination of interest-rate increases, structural shifts in demand driven by remote work and e-commerce, and regulatory changes related to the green transition (which reduce the value of buildings that no longer meet energy efficiency requirements) re-established CRE as a recurrent systemic vulnerability (OECD, 2024; BIS, 2024; ECB, 2024). The sharp CRE price correction observed between 2022 Q2 and 2024 Q1[4] has, together with rising credit-risk indicators, intensified concerns that mispricing of CRE exposures could transmit stress across banks, insurers and real-estate funds, amplifying macro-financial risks (ESRB, 2023).

Responding to these developments, the Single Supervisory Mechanism (SSM) strengthened its focus on exposures to Covid-19-vulnerable sectors as part of the 2022–2024 supervisory priorities, placing CRE as a key supervisory vulnerability (ECB, SSM Supervisory Priorities 2022–2024). As a

2 The BCBS (2025) defines supervisory effectiveness as the ability to promote the safety and soundness of banks and the banking system by promptly assessing prudential risks, identifying material shortcomings within banks, and leveraging supervisory tools to ensure timely remediation.

3 IMF (2023) argues that the will and the ability to act remain central to effective supervision.

4 According to ECB data, the EU commercial real estate price index declined by approximately 16.2% between 2022 Q2 and 2024 Q1.

complement to regular bank-specific supervisory oversight, the SSM deployed two types of supervisory activities:

(i) on-site inspections (OSIs) in 2021-2022 that provide an independent, in-depth assessment of banks' risk profiles, governance and internal controls, but can only be conducted for a narrow set of banks; and

(ii) targeted reviews (TRs) in 2021-2022 that are thematic off-site analyses that benchmark banks' practices and highlight systemic or institution-specific weaknesses. TRs are less intrusive but can be applied to a wider set of banks.

We use confidential supervisory data to assess the relationship between the activities above and banks' subsequent prudential behaviour in the CRE segment of their loan portfolio, as measured by the segment's coverage ratio, i.e. the ratio of provisions to non-performing exposures. Alessi et al. (2021) argue that coverage ratio is an informative and forward-looking metric which captures the prudential dimension of risk-management behaviour more directly than other, widely used indicators such as the non-performing loan ratio. Coverage ratio embeds information on both asset quality and provisioning practices and is particularly suitable in the CRE context, where supervisory interventions frequently target loan-loss provisioning, forbearance/NPL processes and collateral management. Using the coverage ratio therefore provides a metric that is directly aligned with supervisory priorities and reflects the prudential relevance of these interventions.

Our findings suggest that the assessed supervisory activities are associated with banks becoming more prudent in the CRE segment of their portfolio. Both OSIs and TRs are followed by higher coverage ratios after intervention, indicating stronger risk recognition and enhanced loss-absorption capacity. In comparison to a control group where no OSIs or TRs have taken place, OSIs are related to persistent and economically significant increases in coverage ratios, reflecting their intrusive nature, detailed follow-up, and stronger enforcement profile. TRs, by contrast, are followed by temporary rises in coverage ratio that fade over subsequent quarters—consistent with their more high-level, diagnostic, and benchmarking orientation. Beyond the difference in persistence, the two types of activities differ in the speed at which banks adjust their practices. TRs tend to elicit an earlier reaction, consistent with their signalling and benchmarking role, whereas OSIs generate a more gradual adjustments as banks

incorporate findings into remedial actions and internal processes. Taken together, the results confirm the complementary roles of on-site and off-site tools: targeted reviews broaden supervisory reach and support early vulnerability detection, while on-site inspections anchor behavioural adjustments and deliver more durable prudential improvements.

Our TR estimations rely on a standard Difference-in-Differences (DiD) model with two-way fixed effects, while for OSIs, we employ the staggered Difference-in-Differences approach proposed by Sun and Abraham (2021). The latter is suitable for OSIs, where the timing of the intervention varied across institutions. The analysis is complemented by dynamic specifications to examine the timing and persistence of the effects around the intervention date, capturing whether improvements materialise gradually or immediately following supervisory action. A central identification challenge in our set-up is that supervisory interventions are not randomly assigned: banks are selected based on supervisory risk assessments and operational constraints. We therefore interpret our estimates as conditional effects under the parallel-trends assumption, after controlling for fixed bank characteristics, common shocks, and time-varying risk indicators. Results should be read with caution and are most informative for banks with similar ex-ante risk profiles to those included in the campaigns.

Academic and policy literature provide evidence that supervision can discipline banks' risk-taking, improve asset quality and strengthen internal governance (Hirtle, Kovner and Plosser, 2016; Altavilla et al., 2020; Kok et al., 2023; van Breemen et al., 2025), and a growing body of work shows that OSIs in particular promote more conservative bank behaviour. Delis and Staikouras (2011) document that OSIs reduce risk-taking, Bonfim et al. (2023) find similar effects using granular Portuguese data, and Passalacqua et al. (2024) shows that OSIs improve asset quality and reinforce provisioning practices in euro-area banks. Our paper contributes to the literature by analysing the impact of TRs and by showing the complementary role they play to the OSIs.

Recent research similarly emphasises that weaknesses in capital and risk-management practices can fuel CRE-driven instability: Duca and Ling (2020) show that the weakening of capital requirements contributed to a CRE price boom, while IMF (2023) analysis highlights the central role of CRE in past episodes of financial stress. We add to the debate by providing evidence on the role of supervisory activities in reducing CRE-related risks.

By linking supervisory priorities, sector-specific vulnerabilities and empirical evidence, this paper contributes to the emerging literature on supervisory effectiveness. It provides new evidence on the role of supervisory activities in strengthening resilience in a strategically important sector and highlights the value of integrating outcome-based metrics into evaluations of supervisory performance. In doing so, it advances our understanding of how supervisory tools can be deployed in a complementary and effective manner to mitigate risks in the financial system.

The remainder of the paper is structured as follows. Section 2 introduces institutional background focusing the on-site inspections and targeted reviews undertaken to mitigate CRE-related risks. Section 3 and 4 explain our data and methodology for assessing supervisory effectiveness using the DiD model. Section 5 presents the empirical results and their interpretation. Finally, Section 6 offers concluding remarks and lessons derived from our analysis.

2. Institutional Background

2.1 CRE as an SSM supervisory priority

Within the European banking union, the Single Supervisory Mechanism (SSM) is responsible for the prudential supervision of significant institutions, applying a risk-based approach that aligns supervisory intensity with each bank's risk profile and the ECB's strategic priorities. The SSM's supervisory priorities are implemented through the annual Supervisory Examination Programme (SEP), which translates them into concrete activities at the level of individual institutions.

In 2021, and while defining its supervisory priorities for the 2022–2024 cycle, the ECB explicitly identified exposures to COVID-19-vulnerable sectors—most notably commercial real estate (CRE)—as a key supervisory concern, alongside other structural and emerging risks. The strategic objective was to strengthen supervisory scrutiny of banks' management of these exposures, particularly in the context of post-pandemic adjustments in office and retail property markets. Accordingly, the key planned supervisory activities comprised:

a. regular monitoring of banks' exposures to vulnerable sectors, and

b. targeted reviews and on-site inspections of banks' CRE portfolios, aimed at challenging collateral valuation practices and credit-risk management (ECB, SSM Supervisory Priorities 2022–2024).

This paper focuses on the latter set of interventions—targeted reviews and on-site inspections—as they represent the most intensive supervisory tools deployed by the SSM to address vulnerabilities in the commercial real estate sector. Specifically, the analysis seeks to measure how supervisory interventions influenced banks' provisioning behaviour and risk management practices in CRE exposures. The next two sub-sections discuss in detail the specific targeted review and on-site inspections examined in this study.

2.2 On-Site Inspections

On-Site Inspections (OSIs) represent the most intrusive and a resource-demanding supervisory instrument within the Single Supervisory Mechanism (SSM). Conducted by dedicated inspection teams—operationally independent from the regular, line supervisors—OSIs enable supervisors to perform an in-depth, first-hand assessment of a bank's risk profile, internal controls, and governance structures.[5]

Within the commercial real estate (CRE) domain, the ECB conducted a broad wave of targeted on-site inspections during 2021 and 2022, covering 22 significant institutions across the euro area[6]. Each mission typically lasts up to three months and unfolds through four main phases:

(1) the preparation phase, comprising the formal notification, information request, and kick-off meeting;

(2) the on-site fieldwork phase, during which inspectors conduct detailed reviews and interviews;

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5 Further details can be found in the ECB Guide to On-Site Inspections and Internal Model Investigations (ECB, 2018)

6 A limited number of CRE-related inspections were launch before 2021, but we exclude them from our analysis as they pertain to a different supervisory cycle and are not comparable in timing with the period covered by our empirical framework.

(3) the reporting phase, concluding with the final report and the closing meeting; and

(4) the follow-up phase, when the ECB sends a letter to the CEO of the inspected entity, outlining required or recommended actions, and, where applicable, the related deadlines.

This last phase is particularly relevant for our empirical analysis, as it is when supervisory expectations are formally crystallised and banks are required to take remedial action. Nevertheless, supervisory influence often begins earlier. Some institutions start addressing identified weaknesses immediately after the kick-off meeting, when the Head of Mission presents the inspection's objectives and scope. This moment often raises internal awareness of potential vulnerabilities and triggers early corrective measures—well before the issuance of the final report.

For this reason, and as explained in the methodology section, we identify the treatment quarter as the quarter in which the on-site inspection starts. This is the first period from which one might reasonably expect observable adjustments in the bank's behaviour, or, in empirical terms, a first detectable variation in the dependent variable. However, the dynamic specification adopted in our analysis allows us to trace the evolution of these effects over subsequent quarters, thereby capturing both immediate and delayed reactions that may occur only after the completion of the OSI.

While the timing of the OSI is crucial for identifying when banks begin to adjust, the content and comparability of the supervisory intervention are equally important for empirical identification. During the on-site fieldwork phase, all CRE inspections followed a harmonised methodological framework and work programme, ensuring that supervisory activities were comparable across institutions. As highlighted in the ECB's Supervision Newsletter (ECB, 2022), each mission covered the same core dimensions of CRE risk management—from loan origination and monitoring to collateral valuation and provisioning.

This harmonised design is a critical precondition for the difference-in-differences approach employed in this paper. It ensures that all banks were exposed to both a common supervisory "treatment" and to interventions along the same dimensions of CRE risk management. Such uniformity also supports the use of a consistent dependent variable capable of capturing the overall

effects of the inspections. Specifically, a detailed review of the most affected risk areas—discussed in the next section—will guide the choice of this variable.

In broad terms, the CRE campaign revealed pervasive shortcomings in collateral valuation, lending standards, and monitoring frameworks. Inspection teams frequently identified misalignments between collateral values and prevailing market conditions, insufficient rotation and oversight of appraisers, and inadequate updates of valuation reports. These deficiencies directly undermine key prudential metrics, particularly those assessing the adequacy of provisions relative to the underlying credit risk exposure.

Beyond collateral valuation, inspections also uncovered material weaknesses in loan origination and monitoring practices. Several banks lacked consistent underwriting standards or failed to integrate borrower cash-flow resilience and project-specific risks into credit decisions. Monitoring processes were often underdeveloped, with limited use of early-warning indicators such as loan-to-value (LTV) or debt service coverage ratios (ECB, 2022). Collectively, these weaknesses resulted in delayed risk recognition and insufficient provisioning, reinforcing supervisory concerns around provisioning adequacy as a central element of risk management.

Taken together, these findings provide the empirical and conceptual foundation for the subsequent analysis, which evaluates how banks remediate the deficiencies identified by supervisors, and complement the insights of the targeted review discussed below.

2.3 Targeted Reviews

Targeted Reviews (TRs) are off-site, in-depth supervisory exercises focusing on specific risk areas or portfolios identified as supervisory priorities. They are conducted in parallel to a sample of banks allowing for benchmarking across banks. TRs are designed to provide a granular assessment of banks' internal processes, governance arrangements, and risk-management practices in critical domains.

In particular, our work focuses on the CRE Targeted Review, launched in September 2021. The exercise aimed to assess how prepared banks were to deal with a potential deterioration in CRE conditions, with a particular emphasis on the office and retail segments most affected by post-pandemic structural shifts.

The review was conducted horizontally across the banking union and involved line supervisors. Although the exercise was structured in two phases, our analysis focuses exclusively on the second one, which was the one that had a remediation aspect. In Phase 2, supervisors carried out an in-depth assessment of 15 banks selected from the initial sample based on their significant exposures to the office or retail CRE segments, elevated risk parameters, or concerns regarding data quality.[7] The bank selection was coordinated with the CRE On-Site Inspection (OSI) campaigns to avoid overlap: banks already inspected on CRE in 2021 were excluded, while those in the 2022 OSI campaign were included only in the quantitative benchmarking. This ensures the absence of overlap with the 2021–2022 OSIs, which further simplifies our empirical design. Moreover, Phase 2 generated direct supervisory outputs—notably follow-up measures and recommendations—that are most relevant to assess adjustments in provisioning and valuation behaviour. For the purposes of our empirical framework, we take the intervention point of the TRs to be 2022 Q3, which corresponds to the moment when supervisory feedback and follow-up expectations were formally communicated to the banks.

The findings in TRs revealed heterogeneous and often fragmented risk-management practices across participating banks (ECB, 2022). Several institutions displayed weak or insufficiently granular risk-appetite frameworks, limited early-warning systems, and inadequate borrower-capacity assessments, particularly in an environment of rising financing costs. In a number of cases, banks struggled to demonstrate a well-calibrated credit risk management cycle, often lacking the integrated processes necessary to manage market deterioration consistently.

The CRE OSI and Targeted Review exercises were designed to be complementary and mutually reinforcing, jointly offering a comprehensive assessment of banks' CRE risk-management frameworks.

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7 Phase 2 followed an initial benchmarking exercise (Phase 1) covering 32 banks, which aimed to identify outliers, data gaps and inconsistencies in CRE risk metrics.

This alignment provides the empirical foundation for analysing their distinct yet interconnected effects on banks' behaviour in the following sections.

3. Data and Descriptive Statistics

Our empirical analysis combines confidential supervisory data on supervisory interventions with quarterly financial information from the FINREP (Financial Reporting) framework — the harmonised accounting-based reporting system that provides granular balance sheet and profit-and-loss information for all supervised institutions in the euro area. The sample comprises 81 significant institutions (SIs) directly supervised under the SSM and observed quarterly between 2020 Q1 and 2024 Q4. We exclude banks with less than €1 billion in CRE loans in 2024 Q4 to ensure that the analysis focuses on institutions with material exposures to the sector. Within this sample, 22 banks were subject to on-site inspections (OSIs) and 15 underwent targeted reviews (TRs) focusing on CRE portfolios, with no overlap between the two groups. The remaining 44 banks form the comparison group of SIs not directly affected by these campaigns. While this targeted sample is necessary to obtain economically meaningful estimates of CRE-focused supervisory interventions, the relatively limited number of treated institutions implies that statistical precision may vary across specifications.

Data on supervisory activities were sourced from confidential ECB internal databases (IMAS: Integrated Monitoring and Assessment System), which provide detailed information on the timing, scope, and thematic focus of on-site inspections and targeted reviews, as well as the corresponding follow-up measures. These data allow for precise identification of treatment timing across institutions, enabling an empirical assessment under Difference-in-Differences assumptions. Information on banks' balance sheets and asset quality indicators was obtained from FINREP templates reported quarterly to the ECB. From these data, we construct CRE-specific coverage ratio, defined as CRE loan-loss reserves over non-performing CRE loans, which serves as the our outcome variable of interest. By construction, the dependent variable focuses exclusively on CRE exposures, ensuring that the analysis targets risk mitigation within the commercial real estate segment rather than overall provisioning behaviour. It captures both the deterioration in asset quality and the adequacy of provisioning against potential losses, thereby reflecting the combined effect of risk materialisation and

supervisory-induced provisioning adjustments. This metric has also been recognised as a robust prudential indicator linking credit risk exposure with banks' loss-absorption capacity (see Alessi et al., 2021).

To provide a preliminary overview of the sample, Table 1 reports descriptive statistics for the main bank-level variables over the period 2020–2024. Panel A presents summary statistics for the full sample of banks, while Panels B and C focus on CRE-related variables for institutions that underwent on-site inspections (OSIs) and targeted reviews (TRs), respectively.

TR banks tend to be larger and hold, on average, a substantially higher volume of CRE exposures (€29.1 billion versus €14.6 billion for the full sample). Conversely, OSI banks exhibit markedly higher average coverage ratios (107%). The higher coverage ratio may already incorporate the effect of supervisory interventions, which—as illustrated later in Figure 1—suggest a mild upward adjustment in CRE-related provisioning following OSIs. The average levels of NPL ratios, Stage 2 ratios, and share of high loan-to-value (LTV) loans are broadly comparable across the groups. This suggests that differences in coverage ratios are not driven by markedly divergent asset quality profiles, but rather by variations in provisioning practices and supervisory focus that will be examined in detail in the next sections.

The choice of the coverage ratio as the main dependent variable is further supported by the nature of the supervisory measures adopted following the CRE OSI and TR campaigns. Table 2 reports the classification of these measures by thematic categories, distinguishing between those with direct financial consequences and those addressing broader risk attitude and governance frameworks. We categorize measures impacting the credit risk management cycle—ranging from loan origination and monitoring to rating models, risk classification, provisioning, and collateral valuation—as having a direct impact on financial outcomes.[8]

8 Those measures influence credit risk cycle and expected credit loss (ECL) estimations: specifically rating models and risk classification (affecting PD and stage), collateral valuation (affecting LGD), and loan loss provisioning levels.

Table 1: Descriptive Statistics

Panel A : Bank Summary Statistics (full sample)

Variable	Mean	Median	Std	P25	P75
Total loan & advances(mil. €)	172,117	51,028	262,559	27,729	193,837
CET1 ratio	16.39%	15.43%	3.87%	13.63%	18.14%
ROA	0.17%	0.14%	0.32%	0.06%	0.26%
Deposit over total funding	81.66%	85.27%	13.78%	74.25%	91.62%
CRE loan & advances(mil. €)	14,634	7,265	18,058	2,424	21,396
CRE Coverage ratio	85.91%	62.23%	149.15%	44.66%	90.37%
CRE NPL ratio	6.42%	4.32%	6.81%	2.40%	8.37%
CRE Stage 2 ratio	19.20%	16.85%	12.00%	11.24%	24.98%
Share of LTV>80% in CRE loan & advances	22.96%	18.63%	18.67%	10.64%	30.68%
Panel B : CRE related variables for OSI Banks					
CRE loan & advances(mil. €)	11,670	8,157	10,776	2,142	21,800
CRE Coverage ratio	107.14%	62.60%	251.82%	49.77%	102.31%
CRE NPL ratio	6.48%	4.43%	6.33%	1.94%	8.49%
CRE Stage 2 ratio	17.43%	14.92%	12.92%	10.00%	22.85%
Share of LTV>80% in CRE loan & advances	23.78%	21.93%	15.20%	14.35%	33.37%
Panel C : CRE related variables for TR Banks					
CRE loan & advances(mil. €)	29,129	24,155	23,649	8,294	45,383
CRE Coverage ratio	74.91%	70.90%	45.33%	48.35%	92.65%
CRE NPL ratio	4.93%	4.05%	3.41%	2.35%	7.26%
CRE Stage 2 ratio	20.56%	15.72%	14.61%	10.97%	24.96%
Share of LTV>80% in CRE loan & advances	21.97%	17.84%	21.65%	9.84%	24.94%

Note: Statistics are calculated from quarterly ECB supervisory data (FINREP) for 2020 Q1–2024 Q4. Variable definitions and data sources appear in Appendix Table A1.

Collectively, these categories account for 74 percent of the total measures (276 out of 373). Broken down by supervisory activity, OSIs exhibit a higher concentration of measures related to financial consequence (76.8%) compared to TRs (63.2%). Overall, the predominance of measures with direct financial consequences highlights the relevance of the coverage ratio as a key performance metric for assessing supervisory effectiveness.

Table 2: **Classification of Measures by categories**

Category	Total		OSI		TR	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Credit granting / Origination	33	8.8%	24	8.1%	9	11.8%
Early warning / Monitoring	48	12.9%	35	11.8%	13	17.1%
Rating models	15	4.0%	15	5.1%	0	0.0%
Forbearance / UTP / SICR / NPL	75	20.1%	69	23.2%	6	7.9%
Loan loss provisioning	31	8.3%	29	9.8%	2	2.6%
Collateral management / Valuation	74	19.8%	56	18.9%	18	23.7%
Governance / Strategy / Policy	71	19.0%	45	15.2%	26	34.2%
Reporting / Data quality	17	4.6%	15	5.1%	2	2.6%
Other (IT, audit, compliance)	9	2.4%	9	3.0%	0	0.0%
Total	373	100.0%	297	100.0%	76	100.0%

Note: Category assignments were made by the authors. Categories in bold indicate supervisory measures with direct financial consequences, as they influence the origination of loans, the identification of problem loans, and components of Expected Credit Loss estimations. UTP and SICR stand for Unlikely to Pay and Significant Increase in Credit Risk, respectively.
Source: ECB confidential supervisory data (IMAS).

To provide a preliminary overview of the outcome variable, Figure 1 plots the evolution of the average CRE coverage ratio across the three groups of banks—those subject to on-site inspections (OSIs), those subject to targeted reviews (TRs), and other significant institutions—over the period 2020–2024. The trajectories move broadly in parallel up to the end of 2022, suggesting comparable

pre-treatment dynamics. From 2022 onwards, however, a clear divergence emerges: banks subject to OSIs maintain higher and more stable coverage ratios, while TR banks display a moderate decline and other banks experience a more pronounced drop. In the context of the CRE sector's downturn during this period (see Footnote 5), the decline in the coverage ratio observed of the control group can be interpreted as a market-consistent trend reflecting heightened credit risks. In contrast, the relative stability among OSI and TR banks suggests that supervisory interventions may have mitigated the decline in their loss coverage. This divergent pattern provides a first visual indication of a more conservative provisioning response among treated banks. Furthermore, the comparable trajectories observed between 2020 and 2022 support the parallel-trends assumption, providing a robust foundation for the formal Difference-in-Differences analysis presented in the next section.

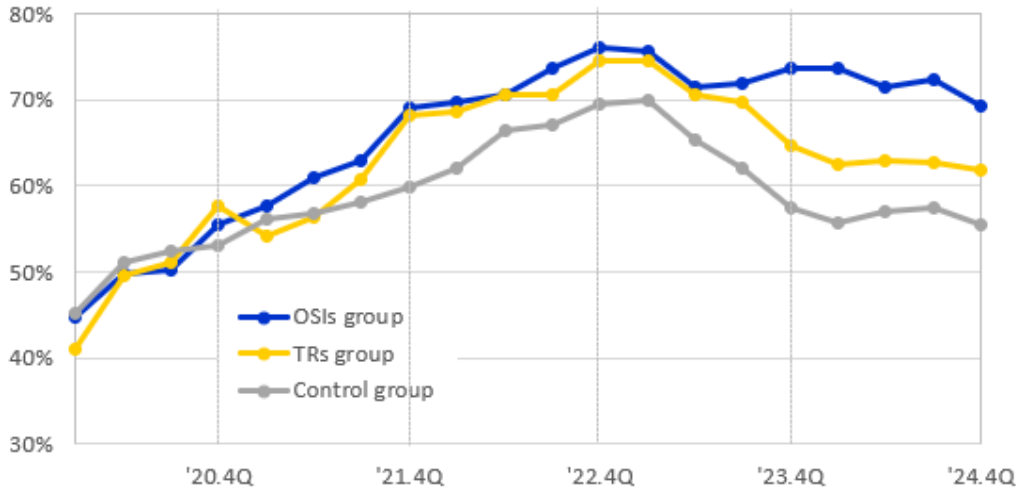

Figure 1: Trend of Coverage ratio by group of banks

4. Empirical strategy

The analysis focuses on the CRE coverage ratio as the main outcome variable[9]. We estimate the effects of supervisory activities on this measure using a Difference-in-Differences (DiD) approach, implemented in both static and dynamic specifications. The OSI and TR campaigns are analysed separately. In each case, the control group consists of banks that were not subjected to any of the two supervisory activities to avoid contamination across treatments.

4.1 Targeted Review – baseline Difference-in-Difference model

For the targeted review (TR) campaign, which was implemented simultaneously across banks, we estimate a standard Two-Way Fixed Effects (TWFE) Difference-in-Differences model in which the treatment effect is captured by the interaction between a post-intervention indicator and a treatment dummy. To estimate the average effect of supervisory interventions on the CRE coverage ratio, we estimate a static Difference-in-Differences specification with bank and time fixed effects. The static DiD model is given by:

$$Coverage\ Ratio_{j,c,t} = \alpha_j + \delta_t + \beta\left(Post_t \times TR_j\right) + \gamma X_{j,t-1} + \zeta Z_{c,t} + \varepsilon_{j,t}$$

where j indexes banks, c countries, and t quarters. α_j and δ_t denote bank and time fixed effects, respectively, capturing time-invariant heterogeneity across banks and common macro-financial shocks. $Post_t$ is a dummy equal to one in the quarters following the supervisory intervention (2022 Q3). The interaction term $\left(Post_t \times Treat_j\right)$ identifies the treatment effect of the supervisory intervention, where TR_j identifies banks subject to Targeted Review campaign for CRE. The coefficient β is the parameter of interest, as it represents the average change in the CRE coverage ratio among treated banks relative to the control group after the intervention, conditional on fixed effects and controls. A

9 To reduce the influence of extreme outliers in the dependent variable while retaining the full sample, the coverage ratio is capped at 200%. This approach aligns with common data-cleaning practices in the literature; for example, Alessi et al. (2021) winsorise coverage-ratio observations at 2.5% and 97.5% to limit the effect of extreme values.

positive and statistically significant coefficient indicates that supervisory activities are associated to more conservative provisioning behaviour or, more specifically, to a relative increase in the CRE coverage ratio.

The vector $X_{j,t-1}$ comprises bank-specific financial indicators (CRE NPL ratio, CRE Stage 2 ratio, CRE loan growth rate, deposit ratio, CET1 ratio, ROA) lagged by one quarter relative to the dependent variable in order to address endogeneity concerns and $Z_{c,t}$ includes country-level macroeconomic controls (GDP growth, corporate lending rates, CRE price index). Robust standard errors are clustered at the bank level. The definitions of $\alpha_j, \delta_t, X_{j,t-1}$ and $Z_{c,t}$ remain consistent across the following models.

While this static specification provides a first insight into the average post-treatment effect, it does not show how the effect evolves quarter by quarter following the intervention. To address this limitation, we implement a dynamic Difference-in-Difference specification that provides a more granular view of the temporal evolution of supervisory impacts. Specifically, this approach estimates a sequence of time-relative treatment effects β_k for each quarter k before and after the intervention, allowing us to trace the evolution of the coverage ratio around the treatment event and assess the validity of the parallel-trends assumption. The dynamic DiD model is given by:

$$Coverage\ Ratio_{j,c,t} = \alpha_j + \delta_t + \sum_{k \neq -1} \beta_k \left(TR_{j,t}^k\right) + \gamma X_{j,t-1} + \zeta Z_{c,t} + \epsilon_{jt}$$

where $TR_{j,t}^k$ is a dummy equal to one if, for bank j, quarter t corresponds to exactly k periods before or after the start of the intervention. The omitted category is typically one quarter before treatment (k $= -1$), so that all coefficients are interpreted relative to the pre-treatment baseline. ($\beta_{-1} = 0$) In addition, including all time-relative dummies would otherwise lead to perfect multicollinearity, a well-known issue in event-study specifications often referred to as the dummy variable trap.

4.2 On Site Inspection – Staggered Difference-in-Difference model

For the On-Site inspections (OSIs) campaign, where the timing of the intervention varies across institutions, we employ the staggered Difference-in-Differences approach proposed by Sun and Abraham (2021). This estimation methodology is specifically designed to address the potential biases[10] that can arise when applying a standard two way fixed-effect (TWFE) estimator in a staggered DiD setting. The static specification reports the average treatment effect on the treated (ATT) obtained by aggregating the cohort-specific treatment effects estimated within this framework. The static staggered DiD model is given by:

$$Coverage\ Ratio_{j,c,t} = \alpha_j + \delta_t + \beta\left(Post_{j,t} \times OSI_j\right) + \gamma X_{j,t-1} + \zeta Z_{c,t} + \varepsilon_{j,t}$$

where the variable $Post_{j,t}$ is a dummy equal to one in the quarters following the bank j's specific intervention. The interaction term $\left(Post_{j,t} \times OSI_j\right)$ identifies the treatment effect of the supervisory intervention, where OSI_j identifies banks subject to On-Site inspection campaign for CRE. The coefficient β is also the parameter of interest, as it represents the average effect in the CRE coverage ratio among OSI treated banks relative to the untreated group after their on-site inspection, conditional on fixed effects and controls. The dynamic staggered DiD model is given by:

$$Coverage\ Ratio_{j,c,t} = \alpha_j + \delta_t + \sum_{k \neq -1} \beta_k\left(OSI_{j,t}^{k}\right) + \gamma X_{j,t-1} + \zeta Z_{c,t} + \epsilon_{jt}$$

where $OSI_{j,t}^{k}$ is a dummy equal to one if, for bank j, quarter t corresponds to exactly k periods before or after the start of on-site work. The omitted category is typically one quarter before treatment (k = -1) as well as in the case of TR.

10 As noted by Sun and Abraham (2021), standard TWFE estimators can yield inconsistent results in staggered DiD settings because they may use previously treated units as controls for later-treated units. In the presence of time-varying treatment effects, this contamination of a control group can lead to biased estimates of the average treatment effect.

Crucially, the specification is defined in event time, meaning that each bank has its own "time zero" corresponding to the quarter in which the on-site work begins. This alignment allows us to account for heterogeneous treatment timings and to estimate dynamic responses relative to each institution's event, rather than to a fixed calendar quarter. Moreover, the estimated coefficients are presented as a sequence of quarterly treatment effects, showing how the dependent variable evolves around the intervention. Significantly positive coefficients in post-treatment quarters indicate sustained increases in coverage ratios attributable to the intervention.

4.3 Identification considerations

The identification strategy relies on the parallel-trends assumption, implying that prior to the supervisory intervention, treated and untreated banks are expected to exhibit no materially different trends in coverage ratios. This assumption can be supported empirically by (i) comparable pre-intervention trajectories in descriptive plots, and (ii) statistically insignificant pre-treatment coefficients in the dynamic DiD results.

Given that supervisory interventions are risk-based rather than randomly assigned, our empirical framework accounts for observed and time-invariant bank characteristics. Nevertheless, the results should be interpreted as robust conditional associations rather than definitive causal effects. Furthermore, the observed changes in coverage ratios may reflect two distinct channels: mechanical supervisory adjustments—such as supervisory-induced increase in loan-loss provisioning—and shifts in banks' risk attitudes. Our empirical approach captures the combined impact of these two channels. Specifically, although the selection of banks followed the SSM's risk-based planning process, relevant structural differences were adequately controlled. Potential confounding factors are mitigated through:

- inclusion of bank fixed effects, capturing unobserved differences in risk appetite, business models, or internal governance structures.
- time fixed effects, controlling for macro-financial shocks common to all banks;

- and bank-level risk and country-level macroeconomic controls, accounting for contemporaneous changes in asset quality, and the broader economic environment.

5. Results

5.1 Average Supervisory Effects: Static DiD Estimates

Table 3 reports the static Difference-in-Differences (DiD) estimates assessing the impact of the OSI campaign on banks' CRE coverage ratios. The model is applied to a dataset comprising OSI and untreated groups. Four specifications are presented, progressively adding bank-specific and macroeconomic controls variables. All regressions include bank and quarter fixed effects, and standard errors are clustered at the bank level.

Across all specifications, the interaction coefficients (Post × OSI) remain remarkably stable, ranging between 0.121 and 0.145. In the simplest specification (Column 1), this coefficient is positive (0.139) but lacks statistical significance. However, the precision of estimates improves after controlling for bank-specific characteristics (Columns 2 and 3). While the magnitude of the effect remains consistent at approximately 14 percentage points, the inclusion of these controls decreases standard error, inducing the interaction coefficients statistically significant at the 1 percent level. Additionally, with controlling for macro-financial variables (Column 4), the estimated coefficient remains highly significant at 0.121. The model's explanatory power rises substantially across specifications, with the adjusted R^2 rising from 0.686 in the baseline model to 0.768 in the fully specified model.

The consistently positive and statistically significant coefficients support the effectiveness of OSIs as an intervention tool. This effect is economically meaningful, as OSIs appear to encourage banks to strengthen credit risk management in CRE exposures through more conservative provisioning practices. The effect becomes statistically significant at the 1 percent level only once bank heterogeneity is accounted for. This indicates that the impact of OSIs is not uniform across banks. Rather, it reflects heterogeneous behavioural adjustments that depend on bank-specific features such as portfolio composition, funding structure, and risk profile.

In line with this interpretation, the estimated coefficients in Column 4 further support a pattern of risk-sensitive provisioning:

- A higher CRE share in total lending is negatively related to the coverage ratio, which may indicate that banks with greater CRE exposure either hold relatively higher-quality loans or have stronger incentives to under-provision.
- CRE loan growth enters positively, indicating prudential provisioning in periods of rapid portfolio expansion.
- The deposit ratio is also positive and significant, implying that banks with stable funding exhibit greater loss-absorption capacity.

Table 4 presents the DiD estimates for the TR campaign. Similar to the OSI DiD model, we estimate four specifications, excluding OSI-treated banks to focus exclusively on comparison between TR-treated banks and untreated banks. Across all specifications, the interaction term (Post × TR) is positive, but the estimated effects are economically small — ranging from 0.004 to 0.036— and not statistically significant. Although the signs of the coefficients are consistent with those in the OSI models, their magnitudes are smaller. This weaker impact may stem from the nature of the TR measures. As shown in Table 2, TR interventions are more concentrated in areas such as governance, strategy, and credit granting, which are more indirectly related to provisioning practices and thus less likely to translate into immediate changes in CRE-specific coverage ratios.

Table 3: OSI effects: Static Difference-in-Differences Estimates

	(1)	(2)	(3)	(4)
post × OSI	0.139	0.143***	0.145***	0.121***
	(0.092)	(0.045)	(0.045)	(0.045)
Share of CRE in total loan		-3.948***	-4.143***	-3.969***
		(1.365)	(1.408)	(1.399)
CRE NPL ratio		-0.262	-0.223	-0.313
		(0.449)	(0.424)	(0.405)
CRE Stage 2 ratio		0.233	0.242	0.286
		(0.209)	(0.212)	(0.207)
CRE LTV >80% ratio		0.033	0.028	0.057
		(0.236)	(0.227)	(0.232)
CRE loan growth rate		0.202**	0.203*	0.209**
		(0.094)	(0.103)	(0.103)
Deposit ratio			1.373**	1.200**
			(0.566)	(0.534)
CET1 ratio			0.493	-0.025
			(1.130)	(1.198)
ROA			1.751	1.137
			(3.182)	(3.136)
Corporate interest rate				0.025
				(0.046)
GDP growth rate				-0.005
				(0.005)
CRE price index (YoY)				0.008
				(0.005)
Number of Obs.	1148	1033	1024	1024
Adjust R^2	0.686	0.762	0.764	0.768
FE: bank	YES	YES	YES	YES
FE: time	YES	YES	YES	YES

Note: Asterisks indicate significance at *** p < 0.01, ** p < 0.05, * p < 0.1. Standard errors are shown in parentheses.

Table 4: TR Effects: Static Difference-in-Differences Estimates

	(1)	(2)	(3)	(4)
post × TR	0.004	0.031	0.036	0.035
	(0.077)	(0.073)	(0.070)	(0.071)
Share of CRE in total loan		-2.356**	-2.656**	-2.512**
		(1.082)	(1.190)	(1.233)
CRE Non-performing loan ratio		-0.693	-0.679	-0.772
		(0.552)	(0.488)	(0.487)
CRE Stage 2 ratio		0.061	0.045	0.066
		(0.246)	(0.258)	(0.262)
CRE LTV >80% ratio		0.161	0.072	0.095
		(0.207)	(0.145)	(0.144)
CRE loan growth rate		0.134	0.155	0.161*
		(0.095)	(0.097)	(0.094)
Deposit ratio			1.099*	0.994*
			(0.590)	(0.574)
CET1 ratio			2.905**	2.712*
			(1.393)	(1.444)
ROA			-2.334	-3.356
			(3.059)	(2.851)
Corporate interest rate				0.015
				(0.048)
GDP growth rate				-0.004
				(0.004)
CRE price index (YoY)				0.004
				(0.004)
Number of Obs.	1018	936	922	922
Adjust R^2	0.712	0.721	0.730	0.731
FE: bank	YES	YES	YES	YES
FE: time	YES	YES	YES	YES

Note: Asterisks indicate significance at *** p < 0.01, ** p < 0.05, * p < 0.1. Standard errors are shown in parentheses.

5.2 Dynamic Supervisory Effects: Event-Study Estimates

This section presents the dynamic Difference-in-Differences estimates, which trace quarterly treatment effects relative to the last pre-treatment quarter (t = –1), used as the baseline period. For the OSI campaign, quarter 0 corresponds to the actual start of on-site work at each bank. For the TR campaign, the starting point is uniformly set to 2022 Q3, when the second phase of the targeted review was launched across selected institutions. In both cases, the estimated pre-treatment coefficients are small and statistically insignificant, supporting the parallel-trends assumption and lending credibility to the identification strategy. For the OSI specification, however, one isolated statistically significant coefficient emerges at t = –3. Importantly, its magnitude is limited and is not part of a systematic pre-trend pattern across adjacent periods, suggesting that it is likely driven by statistical noise rather than indicating a violation of the parallel-trends assumption.

Overall, the dynamic results are highly consistent with the average effects reported in the static model. In line with our baseline findings, the event-study estimates for OSIs show sustained and statistically significant increase in coverage ratios across most post-intervention quarters. In contrast, the TR campaign exhibits only transient effects, with significant coefficients observed in only a few quarters. Furthermore, the stability of the point estimates after controlling for bank-specific characteristics and macro-finance variables confirms the robustness of our dynamic model. The full set of dynamic coefficients is reported in Appendix Tables A.2 and A.3, while a more granular discussion of the timing and persistence of these effects is provided in the following sub-sections.

5.2.1 Dynamic impact of the OSI campaign

Figure 2 plots the event-time coefficients for the OSI campaign based on the fully specified model (Appendix Table A.2, Column 4). The estimated effects turn positive at the time of the intervention (t = 0), with a statistically significant increase in the coverage ratio ($\beta_0 = 0.09$, $p < 0.01$), suggesting an immediate adjustment in provisioning behaviour. While a temporary moderation is observed at t = 1 and t = 5, the supervisory impact remains remarkably persistent, maintaining statistical significance across most quarters up to nine quarters. Notably, the magnitude of the impact

strengthens from quarter +6 onwards, with coefficients ranging between 0.155 and 0.197. Even beyond the ten- quarter horizon, the estimated effects maintain a substantial level, underscoring the enduring nature of the OSI-induced adjustments.

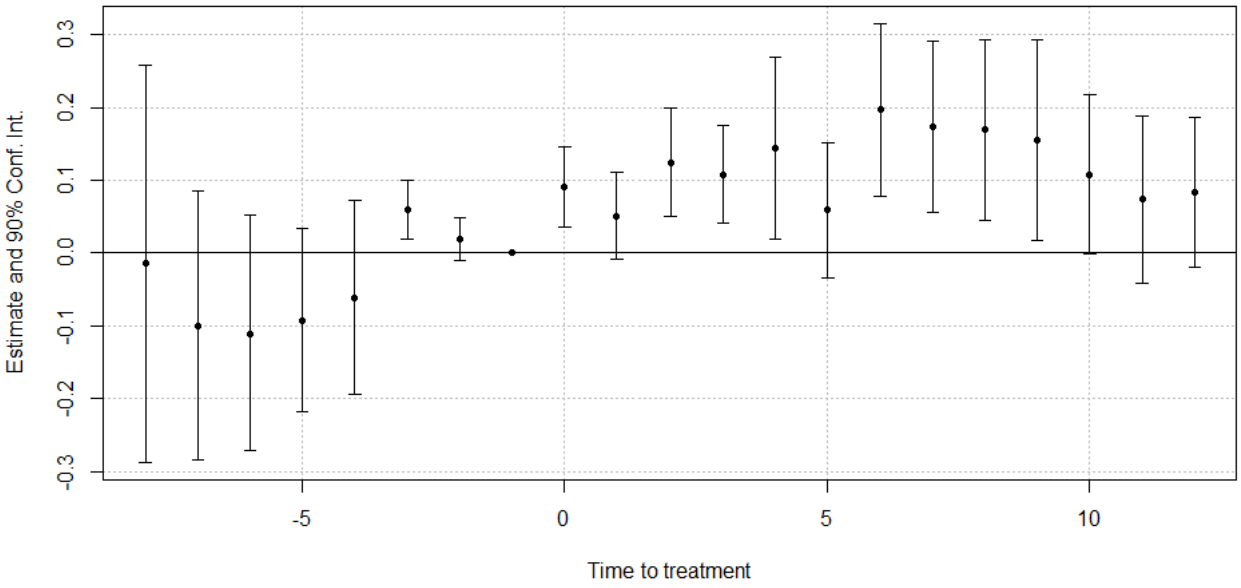

Figure 2: Evolution of OSI campaign impact relative to time to treatment

This gradual and persistent pattern, spanning three years of on-site activity is consistent with the multi-stage and intrusive nature of OSIs. The process—extending from initial evidence collection to the formal issuance of reports and the subsequent implementation of follow-up measures—suggests that banks' behavioural responses strengthen as findings are formalised and corrective actions are enforced.

5.2.2 Dynamic impact of the TR campaign

Figure 3 shows the dynamic effects for the TR campaign based on the fully specified model (Appendix Table A.3, Column 4), showing a markedly different pattern compared to OSI results. The first post-treatment quarters display a positive and statistically significant increase in the coverage ratio, with coefficients of approximately 0.089 at $t = 1$ ($p < 0.1$) and 0.116 at $t = 2$ ($p < 0.05$), indicating an

immediate adjustment in provisioning behaviour following the intervention. However, the effect fades quickly thereafter. From quarter +3 onwards, the estimated coefficients become statistically insignificant and gradually decline in magnitude, with no evidence of a persistent increase in coverage ratios over time.

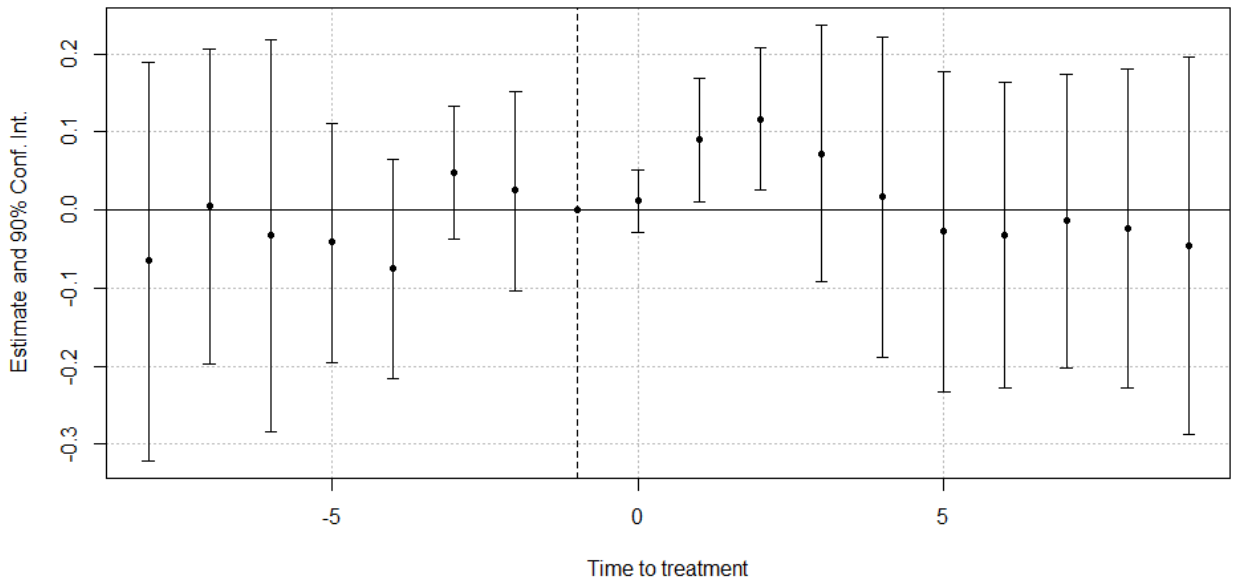

Figure 3: Evolution of TR campaign impact relative to time to treatment

This pattern suggests that targeted reviews trigger a short-lived response in banks' provisioning behaviour, while the OSI campaign showed sustained growth and stability over a two-year horizon. A more detailed interpretation of these contrasting dynamics—focusing on the nature and severity of the measures—is provided in Section 5.3.

5.3 Interpretation of supervisory effects

While both supervisory instruments are associated with an upward shift in coverage ratios, they differ in terms of the duration and intensity of their effects. The OSI campaign exhibits a gradual and persistent supervisory impact extending up to nine quarters, whereas the TR campaign produces a

transient effect that dissipates after the first two quarters. In terms of magnitude, the OSI effect peak at approximately 20 percentage points by quarter +6, while the TR campaign reaches a peak effect of around 12 percentage points. We can attribute these different impacts to three primary factors.

First, the two supervisory instruments differ in their mode of application and degree of enforceability. As discussed in Section 3, OSIs follow a four-stage process involving intrusive on-site assessments that culminate in binding corrective measures. In contrast, TRs are primarily desk-based exercises designed for horizontal benchmarking and identifying emerging vulnerabilities. They typically lack the same degree of on-site validation or the implementation of enforceable follow-up actions as OSIs.

Second, the divergence is driven by the volume and severity of measures imposed. Direct statistical evidence supports this: according to Table 6, the OSI campaign resulted in an average of 13.5 measures per bank, with over 60 percent classified as high or very high severity (M3 and M4). In contrast, the TR campaign generated only 5.1 measures per bank, with over 70 percent falling into the low or moderate severity categories (M1 and M2).

Table 6: Measures severity in CRE OSI and TR campaigns

Campaign	Number of banks	Number of measures	Average of measures	Severity of measures			
				M1 (low)	M2 (moderate)	M3 (high)	M4 (very high)
OSI	22	297	13.5	7 (2.4%)	111 (37.4%)	148 (49.8%)	31 (10.4%)
TR	15	76	5.1	9 (11.8%)	46 (60.5%)	20 (26.3%)	1 (1.3%)

Note: The share in total number of measures are shown in parentheses.
Source: ECB confidential supervisory data (IMAS).

Third, the qualitative nature of the measures further explains the observed differences in outcomes. OSI measures are more directly linked to provisioning and other quantitative outcomes, with a higher proportion of actions targeting rating models, risk classification, and loan-loss provisioning (Section 4). In contrast, TR measures focus mainly on risk monitoring and governance

framework. These types of measures are less likely to produce persistent changes in quantitative metrics like the coverage ratio. At the same time, these results should be interpreted in light of the non-random, risk-based selection of supervisory interventions and the limited number of treated institutions, which may affect both internal validity and the external generalisability of the findings.

6. Conclusions

The global financial crisis of 2008 and the subsequent regulatory reforms profoundly reshaped the prudential landscape of the banking sector. Yet, the market disruptions witnessed in 2023 reaffirmed that regulation alone cannot safeguard financial stability without effective supervision. These events have reignited the debate on how supervisory effectiveness should be measured and strengthened within the post-crisis regulatory architecture.

This paper contributes to that debate by providing empirical evidence on the effectiveness of two key supervisory activities—On-Site Inspections (OSIs) and Targeted Reviews (TRs)—in mitigating commercial real estate (CRE) risks within the Single Supervisory Mechanism. By focusing on the CRE-specific coverage ratio, we evaluate how these activities translate into measurable improvement in banks' loss-absorption capacity and risk-management practices.

Our results provide novel empirical evidence consistent with supervisory activities being followed by material changes in banks' risk-management practices in the CRE segment. OSIs are associated with a persistent and statistically significant increase in coverage ratios, consistent with their intrusive nature, detailed follow-up, and the enforcement of binding remedial measures. TRs, in contrast, are followed by an immediate but transient improvement, reflecting their primarily role in horizontal benchmarking and early risk diagnosis rather than bank-specific enforcements in OSI.

Taken together, our results highlight the complementary nature of the two activity types, which have different outreach possibilities and effects. The strong and persistent effects of OSIs make them well suited for driving behavioural change and securing more durable improvements in provisioning. In contrast, the agile effects of TRs allow for a broader supervisory reach, enabling timely identification of emerging vulnerabilities across an wider set of banks.

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Appendix

Table A.3. Definitions of the variables and data sources

This table describes the variables used in the paper and indicates the sources from which the data were retrieved.

Variable	definition	source
Dependent variable		
CRE Coverage ratio	Ratio of CRE provisions to CRE non-performing loan and advances (truncated by 200% for the regressions)	Supervisory data
Bank level control variables		
Share of CRE in total loan	Ratio of CRE loan and advances to total loan and advances	Supervisory data
CRE NPL ratio	Ratio of CRE non-performing loan and advances to CRE total loan and advances	Supervisory data
CRE Stage 2 ratio	Ratio of CRE Stage 2 loan and advances to CRE total performing loan and advances	Supervisory data
Share of LTV>80% in CRE loan	Ratio of CRE loan and advances with LTV over 80% to CRE total loan and advances	Supervisory data
CET1 ratio	Ratio of common equity tier1 capital to risk-weighted assets	Supervisory data
ROA	Return on Asset	Supervisory data
Deposit ratio	Ratio of deposit to total funding	Supervisory data
Country level macro-financial variables		
GDP growth rate	Annual growth rate in Gross domestic product difference to EU 27 countries	ECB Data Portal
Corporate loan interest rate	Bank interest rates - loans to corporations (new business)	ECB Data Portal
CRE price index	Annual growth rate in CRE price index	Supervisory data

Table A.2: OSI Effects: Dynamic Difference-in-Differences Estimates

	(1)	(2)	(3)	(4)
Relative quarter to treat = -9	-0.184	0.028	0.016	0.013
	(0.150)	(0.127)	(0.128)	(0.128)
Relative quarter to treat = -8	-0.069	-0.006	-0.009	-0.014
	(0.122)	(0.165)	(0.168)	(0.163)
Relative quarter to treat = -7	-0.089	-0.072	-0.085	-0.099
	(0.106)	(0.112)	(0.114)	(0.110)
Relative quarter to treat = -6	-0.042	-0.098	-0.098	-0.110
	(0.100)	(0.097)	(0.098)	(0.097)
Relative quarter to treat = -5	-0.048	-0.081	-0.083	-0.093
	(0.082)	(0.075)	(0.075)	(0.075)
Relative quarter to treat = -4	-0.009	-0.058	-0.054	-0.061
	(0.073)	(0.077)	(0.079)	(0.079)
Relative quarter to treat = -3	0.081*	0.062**	0.062**	0.059**
	(0.044)	(0.025)	(0.026)	(0.024)
Relative quarter to treat = -2	0.055	0.025	0.022	0.018
	(0.042)	(0.019)	(0.019)	(0.017)
Relative quarter to treat = 0	0.121***	0.096***	0.096***	0.090***
	(0.039)	(0.032)	(0.033)	(0.033)
Relative quarter to treat = 1	0.050	0.059	0.062*	0.051
	(0.084)	(0.036)	(0.033)	(0.036)
Relative quarter to treat = 2	0.130	0.143***	0.141***	0.124***
	(0.104)	(0.043)	(0.043)	(0.045)
Relative quarter to treat = 3	0.137	0.124***	0.130***	0.108***
	(0.103)	(0.044)	(0.042)	(0.041)
Relative quarter to treat = 4	0.164	0.167**	0.170**	0.143*
	(0.114)	(0.078)	(0.080)	(0.075)
Relative quarter to treat = 5	0.061	0.077	0.091	0.059
	(0.107)	(0.059)	(0.061)	(0.056)
Relative quarter to treat = 6	0.191	0.216***	0.228***	0.197***

	(0.136)	(0.070)	(0.072)	(0.071)
Relative quarter to treat = 7	0.210+	0.204***	0.205***	0.173**
	(0.120)	(0.069)	(0.072)	(0.071)
Relative quarter to treat = 8	0.206+	0.202***	0.198**	0.169**
	(0.121)	(0.075)	(0.076)	(0.075)
Relative quarter to treat = 9	0.163	0.180**	0.181**	0.155*
	(0.141)	(0.084)	(0.083)	(0.083)
Relative quarter to treat = 10	0.145	0.128*	0.136**	0.108
	(0.127)	(0.067)	(0.062)	(0.066)
Relative quarter to treat = 11	0.062	0.094	0.080	0.073
	(0.082)	(0.071)	(0.064)	(0.069)
Relative quarter to treat = 12	0.092	0.119*	0.099	0.083
	(0.074)	(0.060)	(0.061)	(0.062)
Relative quarter to treat = 13	0.092	0.177**	0.141*	0.093
	(0.073)	(0.073)	(0.074)	(0.091)
Relative quarter to treat = 14	0.203*	0.111	0.083	0.034
	(0.080)	(0.081)	(0.090)	(0.103)
Share of CRE in total loan		-3.948***	-4.143***	-3.969***
		(1.365)	(1.408)	(1.399)
CRE NPL ratio		-0.262	-0.223	-0.313
		(0.449)	(0.424)	(0.405)
CRE Stage 2 ratio		0.233	0.242	0.286
		(0.209)	(0.212)	(0.207)
CRE LTV >80% ratio		0.033	0.028	0.057
		(0.236)	(0.227)	(0.232)
CRE growth		0.202**	0.203*	0.209**
		(0.094)	(0.103)	(0.103)
Deposit ratio			1.373**	1.200**
			(0.566)	(0.534)
CET1			0.493	-0.025
			(1.130)	(1.198)

ROA			1.751	1.137
			(3.182)	(3.136)
Corporate interest rate				0.025
				(0.046)
GDP growth rate				-0.005
				(0.005)
CRE price index (YoY)				0.008
				(0.005)
Number of Obs.	1148	1039	1024	1024
Adjust R^2	0.686	0.762	0.764	0.768
FE: bank	YES	YES	YES	YES
FE: time	YES	YES	YES	YES

Note: Asterisks indicate significance at * p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors are shown in parentheses.

Table A.3: TR Effects: Dynamic Difference-in-Differences Estimates

	(1)	(2)	(3)	(4)
Relative quarter to treat = -8	-0.066	-0.077	-0.057	-0.066
	(0.159)	(0.161)	(0.160)	(0.152)
Relative quarter to treat = -7	0.019	-0.001	0.006	0.004
	(0.128)	(0.127)	(0.121)	(0.120)
Relative quarter to treat = -6	-0.037	-0.065	-0.040	-0.034
	(0.156)	(0.153)	(0.152)	(0.150)
Relative quarter to treat = -5	-0.043	-0.060	-0.036	-0.042
	(0.102)	(0.097)	(0.098)	(0.091)
Relative quarter to treat = -4	-0.071	-0.075	-0.073	-0.075
	(0.093)	(0.091)	(0.088)	(0.084)
Relative quarter to treat = -3	0.059	0.066	0.053	0.047
	(0.055)	(0.057)	(0.055)	(0.051)
Relative quarter to treat = -2	0.029	0.039	0.031	0.024
	(0.078)	(0.081)	(0.081)	(0.076)
Relative quarter to treat = 0	0.014	0.020	0.014	0.011
	(0.018)	(0.022)	(0.023)	(0.024)
Relative quarter to treat = 1	0.086	0.104*	0.092*	0.089*
	(0.052)	(0.052)	(0.050)	(0.048)
Relative quarter to treat = 2	0.077	0.120*	0.123*	0.116*
	(0.058)	(0.057)	(0.057)	(0.055)
Relative quarter to treat = 3	0.019	0.063	0.078	0.072
	(0.105)	(0.106)	(0.107)	(0.098)
Relative quarter to treat = 4	-0.018	0.010	0.024	0.017
	(0.128)	(0.128)	(0.130)	(0.122)
Relative quarter to treat = 5	-0.064	-0.038	-0.026	-0.028
	(0.135)	(0.130)	(0.130)	(0.123)
Relative quarter to treat = 6	-0.070	-0.042	-0.026	-0.032

	(0.133)	(0.125)	(0.125)	(0.117)
Relative quarter to treat = 7	-0.067	-0.037	-0.013	-0.015
	(0.124)	(0.116)	(0.118)	(0.112)
Relative quarter to treat = 8	-0.084	-0.048	-0.025	-0.024
	(0.135)	(0.126)	(0.129)	(0.122)
Relative quarter to treat = 9	-0.099	-0.063	-0.041	-0.046
	(0.155)	(0.146)	(0.148)	(0.144)
Share of CRE in total loan		-2.331*	-2.640*	-2.498*
		(1.073)	(1.183)	(1.223)
CRE NPL ratio		-0.711	-0.687	-0.778
		(0.548)	(0.489)	(0.491)
CRE Stage 2 ratio		0.067	0.052	0.070
		(0.241)	(0.255)	(0.259)
CRE LTV >80% ratio		0.139	0.063	0.084
		(0.199)	(0.146)	(0.146)
CRE growth		0.121	0.143	0.148
		(0.102)	(0.104)	(0.101)
Deposit ratio			1.145*	1.041*
			(0.615)	(0.600)
CET1			2.648*	2.462
			(1.449)	(1.491)
ROA			-2.120	-3.135
			(3.122)	(2.907)
Corporate interest rate				0.017
				(0.049)
GDP growth rate				-0.003
				(0.004)
CRE price index (YoY)				0.004
				(0.004)
Number of Obs.	1018	936	922	922
Adjust R^2	0.711	0.720	0.728	0.728

FE: bank	YES	YES	YES	YES
FE: time	YES	YES	YES	YES

Note: Asterisks indicate significance at * p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors are shown in parentheses.