Research-Thesis Impact of the EU taxonomy on the share of green bonds held by euro area banks (2021-2025)

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IMPACT OF THE EU TAXONOMY ON THE SHARE OF GREEN BONDS HELD BY EURO AREA BANKS (2021–2025)

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List of abbreviations

- ALM = Asset Liability Management
- BIS = Bank for International Settlements
- BTAR = Banking Book Taxonomy Alignment Ratio
- CSEC = Securities Issues Statistics
- CSRD = Corporate Sustainability Reporting Directive
- DiD = difference-in-differences
- DNSH = Do No Significant Harm
- EBA = European Banking Authority
- ECB = European Central Bank
- ESG = Environmental, Social and Governance
- ESMA = European Securities and Markets Authority
- ESRS = European Sustainability Reporting Standards
- EU = European Union
- EuGB = European Union Green Bond
- GAR = Green Asset Ratio
- HLEG = High-Level Expert Group
- ITS = Interrupted Time Series
- KPI = Key Performance Indicator
- LCR = Liquidity Coverage Ratio
- MiFiD II = Markets in Financial Instruments Directive II
- NSFR = Net Stable Funding Ratio
- SFDR = Sustainable Finance Disclosure Regulation
- SHSS = Securities Holdings Statistics by Sector
- SLB = sustainability-linked bond
- SPO = Second-Party Opinion
- SSM = Single Supervisory Mechanism
- TWFE = Two-Way Fixed Effects

Contents

1. Introduction

The rise of sustainable finance has reshaped the way financial institutions steer and measure their portfolios. Within the European Union, the EU Taxonomy for sustainable activities (Regulation 2020/852) (European Parliament & Council of the European Union (2020)) and, more recently, the EU Green Bond Regulation (EuGB)(European Parliament & Council of the European Union (2023)) seek to reduce the ambiguity surrounding the notion of "green investment" by setting out technical screening criteria and transparency obligations. While these frameworks have already transformed corporate and investor non-financial disclosure, we still know relatively little, empirically, about their measurable effect on banks' portfolio composition, particularly on the share of green bonds they hold.

To begin with, there are four main families of "sustainable bonds". Green bonds are use-of-proceeds instruments: the issuer commits to allocating 100% of the funds to green projects (renewable energy, energy efficiency, clean transport, high-performance buildings), on the basis of an issuance framework that is often complemented by an independent external review (Second-Party Opinion, SPO) (Ehlers & Packer, 2017), and subsequently by allocation and impact reporting. Social bonds follow a similar earmarking logic, but in support of social projects (affordable housing, health, education, inclusion). Sustainability bonds also remain use-of-proceeds instruments, but combine green and social projects within the same issuance. By contrast, sustainability-linked bonds (SLBs) do not earmark proceeds: the issuer raises capital for general purposes and undertakes quantified sustainability performance commitments (KPIs and targets), backed by a financial mechanism (often a coupon step-up) in the event of underperformance. This distinction matters for the choice of indicator: this dissertation focuses on use-of-proceeds green bonds, which offer the most direct link between bonds and green projects, while the social, sustainability, and SLB segments primarily provide context for the literature review.

This dissertation asks a simple, directly testable question: has the operational roll-out of the Taxonomy framework and the associated tightening of requirements (including EuGB and enhanced oversight of SPOs) increased the share of green bonds held by euro area banks? Two mechanisms may underpin such an effect. On the supply side, a stricter definition of what counts as "green" and better-governed instruments (Taxonomy, EuGB, strengthened external review) can reduce information asymmetries and improve the "investability" of these securities for bank treasury portfolios (Ehlers & Packer, 2017; Flammer, 2021). On the demand side, regulatory and market pressure, via sustainability-related prudential indicators (notably the Green Asset Ratio and Pillar 3 ESG templates) (Morningstar Sustainalytics (2023)), supervisory expectations, and clients' sustainability preferences, may create an incentive to increase exposure to green bonds, all else equal.

To test these effects, I rely exclusively on public, reproducible data. The primary source is the European Central Bank's Statistical Data Warehouse (European Central Bank (n.d.)), and

more specifically the Securities Holdings Statistics by Sector (SHSS) dataset. At quarterly frequency, these data report securities holdings by holding sector, mainly, euro area banks (S122) in the euro area aggregate (U2), with a sustainability classification that makes it possible to identify green instruments. Concretely, I construct a "green share" indicator as the ratio between (i) banks' holdings of green bonds and (ii) their total bond holdings (instrument debt securities, market value, end-of-period positions), using a homogeneous scope: worldwide issuers (W0), issuer sector S1 (total economy), all currencies (XDC), non-consolidated (N), and all maturities. This indicator is computed from Q1 2021 (the first quarter for which the "green" breakdown is usable) up to the latest available quarter, covering a pre-period (2021–2023) and a post-period (2024–early 2025). A quality variant further restricts the numerator to green bonds with an SPO, to test whether changes are more pronounced in the segment with higher credibility.

The empirical strategy comprises two complementary blocks. The first is an interrupted time series (ITS) break model estimated on the aggregate euro area banks' green share series. It allows one to detect a level and/or slope change from 2024 onwards, while correcting for autocorrelation, controlling for potential seasonality, and incorporating contextual variables, notably overall green bond issuance dynamics and developments in total bond outstandings. The second block is an inter-sector comparison that contrasts banks' behaviour with that of other, closely related institutional holders, especially investment funds (S124) and insurers (S128). This comparison relies primarily on a Difference-of-ITS design, applying the same type of model to the difference in green shares between banks and the funds/insurers average, and, as a complement, on two-way difference-in-differences (DiD) specifications (sector $\times$ time fixed effects). The latter are used mainly as diagnostic tools, to document pre-trends and to illustrate the limits of the parallel-trends assumption, rather than as the main causal estimators.

In addition, to document geographic heterogeneity and ensure that any greening observed at the aggregate level is not driven by a single country, I use SHSS data at the country level for the financial corporations sector (S12). In the absence of banks time series by country with the same granularity, the financial corporations sector cut serves as a proxy: it mixes banks with other financial intermediaries, but it allows the share of green bonds to be measured by country and supports the estimation of a simple panel model. This analysis is presented as an additional lens rather than an identification pillar, and it is used to verify that portfolio greening is broadly shared across the euro area.

To assess the specificity of the effect, the empirical design is also applied to the non-green share of banks' bond portfolios, used as an internal placebo. If the post-2024 break observed for the green share were mirrored identically in the non-green share, this would point to a common shock (interest-rate cycle, bond market conditions) rather than a green-specific effect, and the causal interpretation would be tempered accordingly. Conversely, a "flat" placebo on the

non-green side would strengthen the case for a reallocation specifically towards green bonds. In addition, green purchase flows are represented by a ratio of net green transactions to lagged total outstandings (green purchase rate), which complements the stock-based perspective with a more volatile, but informative, measure of the intensity of net purchases.

This study makes three contributions. First, on the data side, it provides a reproducible indicator of the share of green bonds in euro area banks' bond portfolios, built from public ECB/SHSS aggregates and documented precisely in terms of filters, codes, and scope. Second, on the methodological side, it combines a break model (ITS) with an inter-sector comparison (Difference-of-ITS), supplemented by targeted robustness checks: an "with SPO" variant, specifications with supply controls, and analyses based on green purchase flows. Third, on the analytical side, it discusses the magnitude of the identified effect, its economic significance for banks' asset management (orders of magnitude in percentage points of green share), and its implications for the operational implementation of the Taxonomy and associated standards.

2. Literature review

2.1. European regulatory framework, the role of banks, and transparency

The emergence of sustainable finance in Europe is inseparable from the work of the High-Level Expert Group on Sustainable Finance (HLEG), mandated by the European Commission in 2016 and author of a final report in 2018 (High-Level Expert Group on Sustainable Finance (2018)). The HLEG argued for the creation of a common language for sustainable activities, a "taxonomy", to reduce information asymmetries, curb greenwashing, and redirect capital towards the energy transition. The Commission took up these recommendations in its 2018 Action Plan on Financing Sustainable Growth, which structures the EU strategy around ten key actions, with the Taxonomy as the cornerstone.

This work culminated in Regulation (EU) 2020/852, the so-called "Taxonomy Regulation", which sets out environmental objectives, Technical Screening Criteria, and a "Do No Significant Harm" (DNSH) principle, complemented by minimum safeguards (European Commission (2025)). Implementation has proceeded through successive delegated acts: a first act covering the climate objectives entered into force on 1 January 2022, and has since been extended or adjusted (gas, nuclear, new activities, clarifications), with a phased application from 2024 onwards. In parallel, the Commission established the Platform on Sustainable Finance (European Commission (2021b)), tasked with advising on the expansion of the taxonomy, the inclusion of transitional activities, and the simplification of the framework to improve usability without weakening environmental integrity (*Indicators on sustainable finance*).

The Taxonomy does not operate in isolation; it permeates several sectoral texts. The SFDR Regulation (2019/2088) (European Parliament & Council of the European Union (2019)) governs transparency for financial products (Articles 6/8/9) and explicitly refers to the

Taxonomy objectives, notably through the disclosure of the alignment share for relevant funds. The CSRD directive (2022/2464) and the ESRS standards (European Parliament & Council of the European Union (2022)) overhaul corporate sustainability reporting and require the publication of Taxonomy eligibility and alignment ratios. Amendments to MiFID II (2021/1253) (European Commission (2021a)) introduce clients' "sustainability preferences", partly defined by reference to the Taxonomy and SFDR indicators, thereby reinforcing the use of the framework in advisory activities and portfolio management. On the banking side, the EBA has issued technical standards for Pillar 3 ESG disclosures, including in particular the Green Asset Ratio (GAR) and the Banking Book Taxonomy Alignment Ratio (BTAR), which measure the alignment of the banking book with the Taxonomy. (European Banking Authority (2022))

Early supervisory assessments based on the first ESG Pillar-3 templates show that banks' Taxonomy-aligned exposures in the banking book remain low, even for year-end 2023 data, with sizeable differences across countries and business models. At the same time, market studies using the same disclosures report average Green Asset Ratios in the low single digits around 2–3% for EU banks on 2023 data (e.g. PwC, 2024). (Malta Financial Services Authority (2025); Seidel et al. (2024)) This "pre-2024" snapshot points to a ramp-up phase rather than a fully stabilised system. From a supervisory perspective, the ECB, via the Single Supervisory Mechanism (SSM) (European Central Bank (2022)), has published a guide on climate and environmental risks, conducted a thematic review of practices, and repeatedly stressed that banks do not yet fully meet their expectations. These milestones strengthen both regulatory and market pressure to integrate climate factors into governance, risk appetite, and internal processes.

At the same time, European authorities have made greenwashing a priority. ESMA developed a typology of greenwashing practices and published a synthesis report in 2024 (European Securities and Markets Authority (2024)), which underpins the common supervisory priorities on ESG transparency. Guidelines on the use of terms such as "ESG", "sustainable", "transition" or "impact" in fund names now impose minimum requirements to ensure consistency between marketing claims and the effective composition of portfolios (European Securities and Markets Authority (2024)). In bond markets, Regulation (EU) 2023/2631 on EuGB establishes a voluntary issuance standard aligned with the Taxonomy, coupled with external verification by reviewers registered with, and supervised by, ESMA. The standard is expected to become fully applicable from late 2024, in line with the broader ramp-up of the other building blocks (Taxonomy, SFDR, CSRD, Pillar 3).

In this landscape, banks occupy a distinctive position. They are both issuers and holders of securities; they are subject to prudential sustainability KPIs (GAR/BTAR); and they depend on the quality of corporate reporting (CSRD/ESRS) to compute these indicators. They also act as intermediaries in bond markets, notably through their liquidity portfolios. Recent work

by the EBA and the ECB emphasises that banks' greening trajectory depends simultaneously on regulatory constraints, the availability of "credible" green assets, and the integration of climate risks into the business model. It is precisely this link between the regulatory framework and the composition of banks' bond portfolios that this dissertation seeks to document for the euro area (Elderson (2024)).

2.2. The green bond market, ECB data, and the "quality" question

The market for sustainable bonds has expanded rapidly since 2020, particularly in Europe. BIS (Bank for International Settlements) research documents that the outstanding volume of green bonds has multiplied several-fold over the past decade, with European public-sector issuers playing a major role in this expansion (Ehlers & Packer (2017); Demski et al. (2025)). Within the European Union, the NextGenerationEU (NGEU) programme has turned the European Commission into one of the largest sovereign/supranational issuers of green bonds, with a significant share of the funds raised earmarked for projects aligned with climate objectives (Insight EU Monitoring (2025)). This "sovereign pillar" helps to create market depth, curve benchmarks, and reporting standards that raise the bar for the wider ecosystem, especially for more conservative investors such as banks and insurers.

Since 2023, the ECB has published a structured set of climate indicators that includes a "sustainable finance" pillar dedicated to sustainable bonds (European Central Bank (2025)). On the issuance side, the CSEC (European Central Bank (n.d.)) module provides series on sustainable bond issuance and outstandings (stocks and flows), broken down by label type (green, social, sustainability, sustainability-linked), issuer country and sector, and level of assurance (all sustainable bonds versus the sub-set accompanied by an external review). On the holdings side, the indicators draw on the SHSS and make it possible to track, on a quarterly basis, the stocks and transactions of debt securities held by each major sector, with breakdowns by sustainability classification, issuer area/sector, currency, maturity, and consolidation status.

For green bonds, the ECB applies a use-of-proceeds classification and systematically distinguishes bonds accompanied by a SPO from the rest of the market. This "with SPO" cut provides a proxy for "quality", or the level of assurance, insofar as an external reviewer assesses the issuance framework and its consistency with recognised principles or existing taxonomies. The data indicate that the share of bonds with an SPO is high on the issuance side and remains material in euro area investors' holdings, although it varies across sectors and countries.

The academic literature also highlights the importance of this credibility dimension. Ehlers & Packer (2017) show that certified green bonds, or those accompanied by an external review, tend to be better accepted by investors and are associated with more standardised reporting practices. Studies of the "greenium", i.e., the yield differential between green bonds and otherwise comparable conventional bonds, find, on average, a discount of a few basis points for green bonds, but with substantial heterogeneity depending on issuer type, liquidity, the time

period, and the perceived quality of the label (Zerbib, 2019; Flammer, 2021).

Empirically, these findings have two main implications for this dissertation. First, the increasing depth of the green market, particularly through European sovereign and supranational issuance, means that euro area banks have, at least in principle, a sufficiently large pool of green assets to adjust the composition of their portfolios. Second, distinguishing between "plain" green bonds and those accompanied by an SPO or aligned with the EuGB standard allows one to test whether any post-2024 rise in the green share is concentrated in the most credible segment, which would be consistent with ESMA's and the Commission's objective of reducing greenwashing.

Finally, the coexistence of an on-average modest greenium (Zerbib (2019)) and increasingly binding regulatory constraints suggests that banks' decisions to hold more green bonds are at least as closely linked to compliance, risk-management, and reputational considerations as they are to a pure search for yield. This motivates an empirical focus on both stocks (the share of green outstandings) and flows (net transactions), in order to distinguish structural portfolio reallocation from simple price effects.

2.3. Empirical evidence on green bonds, portfolios, and sustainable regulation

The empirical literature on green bonds initially focused on issuance and valuation. Flammer (2021) shows that firms issuing a green bond experience, on average, improved stock-market performance around the announcement and reduce their CO_2 emissions in subsequent years, suggesting that green bonds can support a genuine reorientation of investment projects. Zerbib (2019) identifies a statistically significant, but economically small, greenium and interprets this as reflecting environmental preferences among a subset of investors. Other contributions, such as Pastor et al. (2021), develop equilibrium models in which the rise of sustainable investing affects relative asset prices without necessarily triggering large short-run reallocations.

More recently, attention has shifted towards the extent to which regulatory constraints and ESG commitments do, or do not, translate into portfolio composition. Early evidence on SFDR and on sustainable fund labels more generally suggests that funds classified under Article 8 or 9 do hold portfolios that are, on average, somewhat more tilted towards issuers and sectors with better ESG profiles and lower carbon intensity than conventional funds. However, the magnitude of these portfolio adjustments remains modest and highly heterogeneous: it depends both on the availability and quality of ESG and Taxonomy-related data, and on end-investor demand for genuinely sustainable products. (Martinez Meyers et al. (2024)). Portfolio analyses by the ECB (de Guindos (2021)), conducted in the context of climate stress tests and risk reports, suggest that European banks' overall exposure to high-emitting assets remains substantial, yet some institutions have begun to embed explicit decarbonisation and portfolio-greening targets into their strategies.

Against this backdrop, research focusing specifically on institutional investors' holdings of green bonds remains relatively scarce. A small but growing empirical literature uses portfolio holdings to show that ESG-labelled or socially responsible funds hold a larger share of 'green' or low-carbon assets than conventional funds, and that this gap tends to widen after the introduction of stricter sustainability disclosure or labelling rules. Although these studies mostly focus on equities rather than green bonds, they support the idea that transparency regulation can reinforce portfolio differentiation between 'green' and conventional funds (Alda & Vicente (2020); Ceccarelli et al. (2023)). The results are, however, sensitive to geographical coverage, the definition of "green" adopted, and the availability of security-level sustainability data.

As regards banks, the analyses published by public authorities mostly concentrate on credit exposures (loans to climate-sensitive counterparties) rather than on market bond portfolios. Green bonds held in treasury books or liquidity portfolios tend to appear as illustrative elements rather than as an object of study in their own right. This leaves an empirical blind spot: we still know relatively little about how the Taxonomy, the EuGB standard, KPIs such as GAR/BTAR, and the broader anti-greenwashing agenda translate into the share of green bonds held by euro area banks.

A particularly close empirical "twin" to this dissertation is Schreiner and Beyer's ECB Working Paper Impacts of ESG banking regulation on financing new sustainable technologies (Working Paper No 3089) (Schreiner & Beyer (2025)). While my analysis focuses on banks' bond portfolios, specifically the evolution of euro area banks' green bond holdings, around the operational ramp-up of the EU sustainable finance framework—Schreiner and Beyer study how EU ESG disclosure regulation (notably SFDR and the EU Taxonomy) affects banks' public holdings in firms that supply critical inputs to the transition, namely mining companies producing battery raw materials.

The methodological logic is somewhat comparable: they exploit the regulatory roll-out as a quasi-natural experiment and implement a DiD-type strategy to quantify whether banks adjust their portfolios when ESG-related constraints tighten. Substantively, the paper is valuable for my dissertation because it documents a portfolio reallocation channel: after the introduction of these regulations, banks reduce their holdings in affected companies—especially those with weaker ESG performance—while the firms' cost of capital appears broadly unchanged, consistent with an "ownership substitution" mechanism whereby other investors step in.

This dissertation sits at the intersection of these three strands of literature. From the first, it draws the idea that EU regulation creates a common language and strengthens incentives to green portfolios; from the second, it takes the view that the green bond market has become sufficiently deep and segmented (with/without SPO; EuGB) to enable differentiated allocation choices; and from the third, it inherits the need to document empirically whether these incentives and this market depth in fact result in a measurable increase in the share of green

bonds in banks' portfolios, and whether any such increase is specific to banks relative to other institutional investors. In this sense, the study complements existing analyses by leveraging the ECB's new climate statistics and by applying break-based methods (ITS, Difference-of-ITS, DiD) to time series and sector/country panels that, to date, have been only lightly exploited in the academic literature.

2.4. Implications for the empirical design

In light of this framework, the parameter of interest is the share of green bonds held by euro area banks, computed quarterly as

$$\text{share green holdings}_t = \frac{\text{hold green}_t}{\text{hold total}_t}, \tag{1}$$

As the SHSS "sustainability" breakdown is only usable from 2021Q1 onwards, and as the ramp-up of Taxonomy/CSRD/Pillar 3 requirements and the EuGB standard is concentrated around 2024, the chosen window distinguishes a "pre" period (2021–2023) and a "post" period (2024–early 2025). This choice maximises the length of the pre-trend while capturing the first short-run effects of the reform.

The mechanisms identified in the literature, an expansion in the supply of "credible" green securities, the tightening of regulatory KPIs, compliance pressures, and the role of SPOs and the EuGB standard, suggest testing for two empirical signatures. First, whether there is a level shift and/or a change in slope in the green-share trajectory around 2024; and second, whether any post-2024 effect is differential for banks relative to other institutional holders (investment funds and insurers). These questions directly shape the dissertation's empirical design.

An ITS model estimated on the aggregate series for banks is the core of the analysis. The baseline specification is:

$$y_t = \alpha + \beta t + \gamma\,\text{Post}_t + \delta\,(t \times \text{Post}_t) + X_t'\theta + \varepsilon_t, \tag{2}$$

where y_t is the green share (share green holdings or its SPO variant) and $\text{Post}_t = 1$ from 2024Q1 onwards. The parameter γ captures a potential level shift, while δ measures a change in slope. Specifications with HAC/Newey–West standard errors, seasonal dummies, and supply-side controls (quarterly aggregates of green and total issuance) are used to assess robustness.

A Difference-of-ITS approach then compares banks' trajectory to that of a control group (funds and insurers) using a difference series:

$$D_t = \text{share green holdings}_t^{S122} - \frac{1}{2}\Big(\text{share green holdings}_t^{S124} + \text{share green holdings}_t^{S128}\Big), \tag{3}$$

on which an ITS model of the same form is estimated. This approach tests whether, after accounting for sector-wide trends, banks exhibit differential post-2024 behaviour.

Conventional two-way fixed effects (TWFE) DiD models (sector × time panels) are used as a complement, primarily to document pre-trends and to illustrate the limits of the parallel-trends assumption. The canonical specification is:

$$y_{i,t} = \alpha_i + \lambda_t + \vartheta \left(\text{treated}_i \times \text{Post}_t\right) + \varepsilon_{i,t}, \tag{4}$$

with sector fixed effects (α_i) and time fixed effects (λ_t). These estimates are interpreted cautiously, given the divergence in pre-2024 slopes between banks and other sectors that is visible in the data.

Finally, green purchase flows (green purchase rate, defined as the ratio of green transactions to lagged total outstandings) are analysed using analogous specifications (ITS, seasonal variants, SPO cut, issuance controls, and DiD). The aim is not to base identification primarily on flows, which are highly volatile, but to shed light on adjustment mechanisms: the intensity of net purchases, potential temporary spikes in the SPO segment, and the distinction between genuine reallocation and valuation effects.

All coefficients are interpreted in percentage points of green share (or purchase rates), with systematic reporting of robust standard errors and p-values. The analysis pays as much attention to the economic significance of the magnitudes, given portfolio size, liquidity constraints, and the depth of the green market, as to statistical significance.

3. Empirical context and operational definitions

This section sets out how the framework described in Section (2.4) is translated into measurable indicators using the ECB's public statistics. The aim is to define clearly the empirical scope and the definitions used throughout the remainder of the dissertation, without revisiting the regulatory texts in detail.

3.1. Empirical scope and sectors covered

The main analysis focuses on holdings of debt securities by holding sector in the euro area, as reported in the ECB's SHSS. The sector of primary interest is banks as defined in the sector accounts. Two additional sectors are used as comparators: investment funds and insurance corporations. These sectors are studied using filters that are strictly aligned with those used for banks.

Within debt securities, the SHSS provide a breakdown by sustainable bond type (green, social, sustainability, sustainability-linked). In this dissertation, the focus is on use-of-proceeds green bonds (the "Green" category), which form the basis of the main indicator of portfolio "greening".

An exploratory extension, reported in the results section, additionally uses country-level holdings of debt securities for financial corporations excluding the central bank, in order to document geographic heterogeneity. This extension is treated as a robustness exercise: in the absence of homogeneous country-level banking statistics, financial corporations is used as an aggregated proxy and interpreted with caution.

3.2. Indicators of portfolio greening

The dissertation's central indicator is the share of green bonds held. For a given holding sector i and quarter t, it is defined as

$$\text{share green holdings}_{i,t} = \frac{\text{hold green}_{i,t}}{\text{hold total}_{i,t}}, \tag{5}$$

where:

- $\text{hold green}_{i,t}$ denotes holdings of use-of-proceeds green bonds (the "Green" category in the ECB's climate indicators);
- $\text{hold total}_{i,t}$ denotes total holdings of debt securities for the same perimeter.

A "quality" variant is constructed by replacing, in the numerator, the full set of green bonds with the sub-set accompanied by an external review (with SPO). This yields:

$$\text{share green SPO holdings}_{i,t} = \frac{\text{hold green SPO}_{i,t}}{\text{hold total}_{i,t}}, \tag{6}$$

where *hold green SPO*$_{i,t}$ includes only green bonds with an SPO. This cut makes it possible to test whether the results are stronger in a segment where the environmental credibility of the securities is more clearly documented.

To document within-portfolio reallocation, I also use an internal placebo defined as the non-green share:

$$\text{share non-green holdings}_{i,t} = 1 - \text{share green holdings}_{i,t}. \tag{7}$$

If the green share increases after 2024 while the non-green share declines, this points to an active rebalancing within the bond portfolio rather than a purely mechanical expansion in overall outstandings.

Finally, in some specifications the analysis focuses on green purchase flows, proxied by a green purchase rate:

$$\text{green purchase rate}_{i,t} = \frac{\text{transactions green}_{i,t}}{\text{hold total}_{i,t-1}}, \tag{8}$$

where *transactions green*$_{i,t}$ denotes net transactions in green bonds (quarterly flows) and *hold total*$_{i,t-1}$ the total debt stock in the previous quarter. This ratio, also expressed in

percentage points, links stock dynamics to the intensity of net purchases, while acknowledging that flows are inherently more volatile.

3.3. Time window

The "sustainability" breakdown of holdings is available in the SHSS from 2021Q1 onwards. Moreover, as recalled in Section (2), the ramp-up of the Taxonomy, CSRD/ESRS disclosures, the first banking KPIs (GAR/BTAR), and the EuGB standard is concentrated around 2024.

The empirical window retained is therefore:

- pre-intervention period: 2021Q1–2023Q4;
- post-intervention period: 2024Q1–2025Q2 (the latest quarter available at the time of data extraction).

This split provides a pre-trend of roughly a dozen quarters, sufficient to estimate the underlying trend prior to 2024, while capturing the first short-run effects associated with the operational implementation of the Taxonomy/CSRD/Pillar 3 framework and with the increased standardisation of the green bond market.

The following sections detail the concrete construction of the datasets (Section (4)) and then the Interrupted Time Series models and inter-sector comparison designs used to identify potential breaks in these indicators (Section (5)).

4. Data

4.1. Main source: ECB – SHSS (securities holdings)

The main data come from the ECB's SHSS dataset (European Central Bank (n.d.)). I use quarterly aggregates of securities holdings at market value, measured at end-of-period, for the euro area, with breakdowns by:

- **holding sector:**
  - banks = S122,
  - investment funds = S124,
  - insurance corporations = S128;
- **sustainability classification:**
  - use-of-proceeds green bonds ("Green"),
  - a "with SPO" variant where available.

The other dimensions are fixed as follows:

- Counterpart area = W0 (world),
- Counterpart sector = S1 (total economy),

- Instrument = F.3 (debt securities),
- Currency = XDC (all currencies),
- Consolidation = N (non-consolidated),
- Maturity = T (all maturities),
- Valuation = M (market value).

The series were extracted in CSV format from the ECB's statistical portal.

4.1.1. Key variables by sector (illustrated with banks)

Table 1 summarises the main variables constructed for banks. The same families of variables are constructed for investment funds and insurance corporations in order to enable a consistent comparison of sectoral trajectories.

Table 1: Key variables for banks built from ECB–SHSS aggregates

`Variable`	**Definition**	**Unit**	**Source / filters (summary)**
`hold green`^{S122}	Outstanding amounts of green bonds (Green, use-of-proceeds) held by banks	€ billions	U2 · S122 · W0/S1 · F.3 · LE · M · XDC · N · T · Green
`hold green SPO`^{S122}	Outstanding amounts of green bonds with an SPO held by banks	€ billions	Same series, restricted to the "with SPO" filter
`hold total`^{S122}	Total outstanding amounts of debt securities held by banks	€ billions	U2 · S122 · W0/S1 · F.3 · LE · M · XDC · N · T
`trans green`^{S122}	Net transactions in green bonds	€ billions	Same series, type = Transactions (T)
`trans green SPO`^{S122}	Net transactions in green bonds with an SPO	€ billions	Same series, restricted to the "with SPO" filter
`trans total`^{S122}	Total net transactions in debt securities	€ billions	U2 · S122 · W0/S1 · F.3 · T · M · XDC · N · T

4.2. Complementary source: ECB – CSEC (sustainable bond issuance)

To account for the supply of green paper, I also use the ECB's sustainable bond issuance statistics (CSEC). The "sustainable bonds" block provides, at monthly frequency:

- outstandings and issuance for green/social/sustainability/SLB bonds;
- broken down by issuer area and sector, currency, and level of assurance (with or without an SPO).

In this dissertation, I retain euro area aggregated series for:

- total green outstandings / issuance,
- green outstandings / issuance "with SPO",
- total outstandings / issuance of debt securities.

These series are:

- aggregated to quarterly frequency (summing the months within each quarter),
- optionally smoothed (four-quarter moving average) for ITS specifications with supply controls,
- kept in nominal levels (no deflation), since they are used as explanatory variables and are not incorporated into the numerator or denominator of the holdings ratios.

4.3. Variable construction

4.3.1. Green share in banks' outstandings

The central indicator is the share of green bonds in euro area banks' bond portfolios. For banks, in quarter t:

$$\text{share green holdings}_t^{S122} = \frac{\text{hold green}_t^{S122}}{\text{hold total}_t^{S122}} \times 100. \tag{9}$$

Here:

- $\textit{hold green}_t^{S122}$ is the outstanding amount of use-of-proceeds green bonds held by banks,
- $\textit{hold total}_t^{S122}$ is the total outstanding amount of debt securities held by banks.

The SHSS filters are strictly identical in the numerator and the denominator (same sectors, areas, instrument, currency, consolidation, and maturity), in line with the perimeter defined in Section (3.2).

A quality variant is constructed analogously:

$$\text{share green SPO holdings}_t^{S122} = \frac{\text{hold green SPO}_t^{S122}}{\text{hold total}_t^{S122}} \times 100, \tag{10}$$

restricting the numerator to green bonds accompanied by an SPO. This series is used to test whether results are more pronounced in the most credible segment.

The same ratios are constructed for sectors investment funds and insurance corporations in order to support the inter-sector comparisons (DiD, Difference-of-ITS).

A third series, used as an internal placebo, is defined as:

$$\text{share non green}_t^{S122} = 100 - \text{share green holdings}_t^{S122}. \tag{11}$$

It allows one to verify whether effects attributed to "green" debt are mirrored in the non-green component.

4.3.2. Green purchase flows

Green purchase flows are proxied by a turnover-type rate:

$$\text{green purchase rate}_t^{S122} = \frac{\text{trans green}_t^{S122}}{\text{hold total}_{t-1}^{S122}} \times 100. \tag{12}$$

Here:

- $\textit{trans green}_t^{S122}$ denotes banks' net transactions in green bonds (purchases minus sales) in quarter t;
- $\textit{hold total}_{t-1}^{S122}$ denotes banks' total outstanding bond holdings in the previous quarter.

This ratio measures the share of the previous quarter's outstanding amounts that is renewed, net, in green bonds. It is used to analyse the intensity of net purchases.

An SPO variant is defined in the same way:

$$\text{green purchase rate SPO}_t^{S122} = \frac{\text{trans green SPO}_t^{S122}}{\text{hold total}_{t-1}^{S122}} \times 100. \tag{13}$$

Finally, for certain diagnostic exercises, the green share in total purchases can be constructed as:

$$\text{share green in purchases}_t = \frac{\text{trans green}_t^{S122}}{\max\left(\text{trans total}_t^{S122},\, 0\right)} \times 100, \tag{14}$$

replacing the denominator with total flows only when these are positive, in order to avoid dividing by negative net flows (net sales).

Flow measures (*green purchase rate*) are also computed for investment funds and insurance corporations, notably for comparative descriptives and for DiD specifications on flows (with the usual cautions regarding noise and volatility).

4.4. Control sectors and difference series

To compare banks with other investors, the same variables are constructed for investment funds and insurance corporations.

These two sectors serve as the control group in the inter-sector comparisons. In particular, the

difference series

$$D_t = \text{share green holdings}_t^{S122} - \frac{1}{2}\Big(\text{share green holdings}_t^{S124} + \text{share green holdings}_t^{S128}\Big) \quad (15)$$

measures the gap in the green share between banks and the average of funds and insurers. It lies at the core of the Difference-of-ITS approach used to test for a potential post-2024 differential effect.

4.5. Country extension: green share of financial corporations

To explore geographic heterogeneity, I also extract SHSS country-level series for the financial corporations sector, keeping filters strictly aligned with those used at the aggregate level.

For each euro area country covered by the sustainability breakdown, I construct:

- a green outstanding amount *hold green*^{S12} and, where available, its *hold green SPO*^{S12} ("with SPO") variant;
- a total outstanding amount *hold total*^{S12};
- two green-share ratios:

$$\text{share green}^{S12} = \frac{\text{hold green}^{S12}}{\text{hold total}^{S12}}, \qquad \text{share green SPO}^{S12} = \frac{\text{hold green SPO}^{S12}}{\text{hold total}^{S12}}. \quad (16)$$

On this basis, for each country I compute the average green share before 2024 (2021Q1–2023Q4) and after 2024 (2024Q1–2025Q2), as well as the difference in percentage points between the two sub-periods. I then aggregate these country series to construct a euro area "S12 green share" and estimate a simple panel model. The aim is to assess whether the greening observed for banks is consistent with a dynamic that is broadly shared across national financial systems, while keeping in mind that financial corporations is an imperfect proxy for banks alone.

4.6. Data limitations

Several data limitations should be borne in mind when interpreting the results, even though they do not undermine the overall consistency of the estimates.

1. **The pre-period is adequate but not particularly long.** The "sustainability" breakdown of holdings is only available from 2021Q1 onwards. The pre-2024 trend therefore spans twelve quarters, which is sufficient to estimate an ITS model and to identify a level and/or slope change around 2024, but it does not allow the documentation of very long-run cycles. The conclusions are therefore explicitly framed over a horizon of a few years, rather than as evidence of decade-long structural trends.
2. **The EuGB standard is still recent.** Although it is now embedded in the EU regulatory framework and discussed in detail in the literature review, the EuGB standard represents, over the horizon studied, only a limited share of the green bond universe. It is not isolated

as a stand-alone category in the holdings ratios, but is instead treated as part of the broader context of market standardisation and credibility-building.

3. **Price effects are not fully neutralised.** Outstanding amounts (positions) reflect both quantities held and valuation effects. Combining stock-based indicators (green shares in outstandings) with flow-to-stock ratios (such as *green purchase rate*, based on net transactions scaled by lagged outstandings) helps to characterise allocation behaviour and reduces the ambiguity between quantities and prices. It does not, however, perfectly disentangle the two. As a result, flow-based findings should be read primarily as evidence on mechanisms, complementary to the main stock-based results, rather than as a pure measure of "physical" purchases.
4. **XDC series aggregate multiple currencies.** The SHSS data are used in "all currencies", pooling securities denominated in euros and in other currencies. In the absence of a fully consistent EUR-only cut across all specifications, the core analysis is conducted in XDC, with the caveat that some movements may reflect dynamics in non-euro portfolios, even if euro-denominated holdings remain dominant.
5. **The statistics may be revised.** SHSS and CSEC series are subject to revision by the ECB. To mitigate the impact of such revisions, the raw extracts used in this dissertation are stored as dated files, and the extraction date is documented. The results should therefore be understood as valid for the state of the data at that extraction date.
6. **Sectoral aggregation masks within-sector heterogeneity.** The SHSS provide data at the aggregated sector level, not at the level of individual institutions. The analysis therefore cannot distinguish bank-by-bank behaviour, but documents average sector trajectories, complemented by inter-sector comparisons. Some heterogeneity can be illustrated at the margin, but the core results remain at the euro area–sector aggregate level.
7. **Cross-country heterogeneity is observed only through a sector proxy.** Country-level SHSS data for sustainable holdings are not available for the banking sector, but only for the aggregated financial corporations sector. The country analysis therefore relies on this proxy, which mixes banks with other financial intermediaries. The "by-country" results should be interpreted as indicative orders of magnitude rather than as a precise measure of national banking portfolios.

5. Empirical methodology

This section describes the methods used to measure the effect of the Taxonomy's operational roll-out on the share of green bonds held by euro area banks. Two complementary approaches are employed:

- an ITS design on the aggregate banking series;
- a comparison of banks versus other major holders (investment funds and insurers), first through a TWFE DiD model, and then through a more flexible Difference-of-ITS approach.

Control variables are added as robustness checks to account for supply shocks and the macro-financial environment, and several validity tests are implemented (parallel trends, placebos).

5.1. Interrupted Time Series

The ITS design is the central strategy of the dissertation (Lopez Bernal et al., 2017; Clark, n.d.). It leverages the fact that the shift to the Taxonomy framework's "operational" phase occurs at a common date for all euro area banks (2024), while a relatively long pre-intervention trend is available (2021Q1–2023Q4).

5.1.1. Baseline specification

The reference specification for a quarterly series y_t (the share of green bonds in banks' outstandings, or the green purchase rate) is:

$$y_t = \alpha + \beta t + \gamma \, \text{Post}_t + \delta \, (t \times \text{Post}_t) + X_t' \theta + \varepsilon_t, \tag{17}$$

where:

- t is a linear time index (quarters);
- Post_t is an indicator equal to 1 from 2024Q1 onwards and 0 before;
- α is the average level and β the pre-intervention slope;
- γ captures the level shift at the time of the intervention (the break effect);
- δ measures the change in slope after the intervention;
- X_t collects optional control variables (see Section 5.3);
- ε_t is an error term.

The coefficient γ is interpreted as the immediate deviation of the series level from the counterfactual path (the pre-2024 trend extrapolated beyond 2024), while δ captures the reconfiguration of the longer-run slope.

In the baseline estimates, X_t is limited to an intercept and the time trend; extended specifications add quarterly dummies and supply-side controls.

5.1.2. Dependent variables

The ITS model is estimated on several dependent variables constructed from the SHSS and CSEC statistics (see Section (4)):

1. **Green share in banks' outstandings (stocks):**

$$y_t = \text{share green holdings}_t^{S122},$$

i.e. the share of green outstandings (use of proceeds) in the total stock of bonds (hold green/hold total).

2. **Quality variant (stocks):**

$$y_t = \text{share green SPO holdings}_t^{S122},$$

restricted to green bonds with an SPO (Second-Party Opinion).

3. **Green purchase rate (flows scaled by lagged stock):**

$$y_t = \text{green purchase rate}_t^{S122} = \frac{\text{trans green}_t}{\text{hold total}_{t-1}},$$

i.e. the share of the previous quarter's outstanding bond holdings that is renewed, net, through green bonds in the current quarter.

4. **Quality variant (flows):** *green purchase rate SPO*, constructed analogously using green flows and outstandings with an SPO.

5. **Placebos:**

$$y_t = 1 - \text{share green holdings}_t^{S122},$$

the non-green share, used to verify that the shock corresponds to a reallocation between green and non-green components rather than a purely mechanical growth in total outstandings.

5.1.3. Estimation and standard errors

The coefficients in the ITS models are estimated by ordinary least squares (OLS), but "classical" standard errors would be biased in the presence of autocorrelation and heteroskedasticity in the residuals. To account for these features, I use HAC/Newey–West standard errors, which correct the variance–covariance matrix by incorporating residual autocovariances up to a given number of lags (here, 3 to 4 quarters). This approach does not affect the point estimates (such as the level shift γ or the slope change δ), but it makes significance tests and confidence intervals more robust.

Quarterly dummies (Q2–Q4) are included in some specifications to capture potential seasonality in issuance and portfolio rebalancing. These dummies do not materially alter the estimated break coefficients (γ, δ), which strengthens confidence in the ITS interpretation.

5.1.4. Why ITS is appropriate in this setting

The ITS approach is particularly well suited here for three reasons:

1. **A common intervention date:** the activation of the Taxonomy framework is a regulatory reform that affects all euro area banks at the same time, rather than being phased in across institutions.
2. **A sufficiently long pre-trend:** the 2021–2023 period provides a long enough pre-intervention window to estimate β and to identify a potential break in 2024.
3. **Avoiding a sector-level parallel-trends assumption:** unlike a standard DiD design,

ITS does not require banks to share the same pre-2024 slope as other sectors (funds, insurers), an assumption that proves problematic for stock variables (see Section (6.3)).

ITS therefore provides the main estimator of the 2024 effect on the green share of banks' bond portfolios.

5.2. Difference-in-Differences and Difference-of-ITS

To assess whether any increase in green exposure is specific to banks or instead reflects a broader movement affecting other major holders, a second family of models exploits the sector-by-quarter panel (i, t) (Angrist & Pischke, 2009; Cunningham, 2021) with three groups: banks (S122, treated), investment funds (S124, control), and insurers (S128, control).

We first estimate standard TWFE difference-in-differences models as a diagnostic tool. However, pre-trend tests reveal that the parallel-trends assumption is violated for stock variables: banks' green share was already growing significantly more slowly than that of funds and insurers before 2024. With only three sectors, TWFE coefficients prove extremely sensitive to this violation. Full TWFE DiD methodology and results are presented in Appendix (10.1) for transparency, but given these empirical issues, we do not rely on them for primary identification.

Instead, we employ a Difference-of-ITS approach that relaxes the strict parallel-trends requirement while maintaining a banks-versus-control comparison.

5.2.1. Difference-of-ITS: banks minus control group

In order to retain the logic of a banks-versus-control comparison while avoiding an exclusive reliance on the parallel-trends assumption, an alternative approach is to work with a difference series:

$$D_t = \text{share}_t^{S122} - \frac{1}{2}\Big(\text{share}_t^{S124} + \text{share}_t^{S128}\Big), \tag{18}$$

where share_t^i denotes the green bond share (or the green purchase rate) for sector i. An ITS model is then estimated on D_t:

$$D_t = \alpha^D + \beta^D t + \gamma^D \,\text{Post}_t + \delta^D \,(t \times \text{Post}_t) + \varepsilon_t^D. \tag{19}$$

The interpretation is the same as in Section (5.1), but applied to the bank–control gap:

- γ^D measures the post-2024 differential level shift in the gap;
- δ^D captures a differential change in slope.

Advantages of this approach:

- it assesses whether banks "move more" than the other sectors at the time of the intervention;
- while remaining within a time-series framework in which one can test the stability of the pre-2024 trend in D_t, without requiring each sector, taken in isolation, to follow strictly

parallel pre-trends.

This Difference-of-ITS specification is therefore the preferred framework in Section (6) to discuss whether banks' response to 2024 is specific, or merely aligned with that of other major holders.

From a methodological perspective, the Difference-of-ITS approach used here falls within the broader family of comparative or controlled interrupted time series designs (Penfold & Zhang, 2013; Lopez Bernal et al., 2018; Linden, 2015). Rather than estimating an ITS solely on the banks' series, I construct the difference series D_t between banks' green share and that of a control group (funds + insurers), and then estimate a standard break model on that series, allowing for a level and slope change in 2024. As shown by Lopez Bernal et al. (2018), this strategy is equivalent to introducing a control group and group $\times$ time $\times$ period interactions in a segmented regression, and it captures a differential effect while accounting for common trends. It is particularly suitable when, as in this setting, treatment variation is primarily temporal (all sectors are exposed to the Taxonomy) but the intensity of the response is expected to differ across groups.

Compared with a standard TWFE DiD, the CITS/Difference-of-ITS approach relaxes the requirement of strictly parallel pre-trends and explicitly models the pre- and post-intervention dynamics. In the context of this dissertation, where banks' pre-2024 green-share trends differ from those of funds and insurers, it provides a natural complement to DiD tests and strengthens the credibility of the results.

5.2.2. Sector and internal placebos

Two types of placebo tests are used:

- **Sector placebo:** estimating analogous models for the control sectors (funds and insurers) on their own, in order to verify that we do not mechanically identify a "2024 break" for them in the absence of a regulatory shock as direct as for banks.
- **Internal placebo:** using the non-green share, or segments of non-labelled bonds, as the dependent variable, to ensure that the estimated effect is indeed specific to the "green" component of portfolios.

5.3. Control variables

The baseline specifications rely primarily on time profiles (trend, break, seasonality). Control variables are nevertheless introduced as robustness checks to ensure that the results are not driven by supply-side developments or by macro-financial shocks.

5.3.1. Supply of green bonds

Supply plays a crucial role: even if banks' demand for green bonds increases, the green share in their portfolios can only rise if the outstanding stock of available green bonds expands.

Using the CSEC statistics, I construct:

- *outstanding green*$_t$ and *outstanding green SPO*$_t$: green bond outstandings (total and with SPO);
- *issuances green*$_t$ and *issuances green SPO*$_t$: green issuance flows, aggregated to quarterly frequency from the monthly data;
- *issuances total*$_t$: total bond issuance.

Issuance flows are smoothed using a moving average (e.g. MA4) before being included in the regressions, in order to limit the influence of a small number of very large transactions. In particular, I include:

$$X_t^{\text{supply}} = \text{MA4}\left(\frac{\text{issuances green}_t}{\text{issuances total}_t}\right), \tag{20}$$

i.e. the green share in recent issuance, as a proxy for supply pressure. Including this control makes it possible to check that any jump in the green share of banks' portfolios is not explained solely by a contemporaneous wave of green issuance.

5.3.2. Seasonality and time fixed effects

Seasonality, which may be important for issuance and portfolio rebalancing, is handled in two ways:

- **In the aggregate time-series models (ITS):** quarterly dummies (Q2–Q4) are added to X_t to capture recurring seasonal effects (for instance, seasonality in issuance patterns or in portfolio adjustments).
- **In the panel models (DiD):** seasonal effects and, more broadly, macro-financial shocks common to all sectors are absorbed by the time fixed effects λ_t, which capture any variation shared by banks, funds, and insurers in a given quarter.

5.4. Country extension: ITS and panel on S12

As the main analysis is conducted at the aggregated euro area level for banks, I add a geographic extension based on the country-level, financial corporations series described in Section (4.5).

Concretely, two exercises are carried out:

1. An ITS model on the euro area aggregate green share for financial corporations, constructed by summing *hold green*^{S12} and *hold total*^{S12} across the 18 covered countries. The specification mirrors that used for banks (linear trend, break in 2024Q1, HAC standard errors) and serves to assess whether the greening dynamics at the aggregated financial-sector level are consistent with those observed for banks.
2. A country-level panel exercise in which the dependent variable is *share green*^{S12} (or its SPO

variant), and a simple regression of the form

$$\text{share}_{i,t} = \alpha_i + \beta t + \gamma \, \text{Post}_t + \varepsilon_{i,t}, \tag{21}$$

is estimated, with country fixed effects α_i, a common trend β, and a post indicator from 2024Q1 onwards γ.

This exercise is not intended to deliver strong causal identification: the use of financial corporations as a proxy, together with the limited number of post-2024 quarters, calls for caution. Rather, it aims to (i) document the average magnitude of portfolio greening by country through pre/post mean differences in percentage points, and (ii) verify that the upward trend in the green share is broadly shared across the euro area.

5.5. Identifying assumptions and validity

The causal interpretation of the estimates rests on several key assumptions. This section states these assumptions explicitly, discusses their plausibility, and outlines the robustness checks used to assess potential violations.

5.5.1. Core assumptions for the ITS design

Assumption 1 (Stable counterfactual trend): Absent the intervention in 2024Q1, the green bond share would have continued to evolve according to its pre-intervention trend.

This is inherently untestable, as we do not observe the counterfactual post-2024 path. However, several elements support its plausibility: the pre-intervention period spans 12 quarters, sufficient to establish a stable baseline; the estimated pre-2024 slope β is robust across specifications (baseline, with quarterly dummies, with issuance controls); and visual inspection reveals no structural breaks prior to 2024.

The main threat is a pre-existing trend change that coincidentally begins around 2024 but is unrelated to regulation. The fact that results are stronger in the "with SPO" segment (specifically tied to the new framework's credibility mechanisms) provides reassurance that estimated effects capture genuine regulatory influence.

Assumption 2 (No concurrent shocks): There are no other major shocks at 2024Q1 that would independently affect banks' green bond holdings.

This is partially addressed through supply-side controls (green bond issuance from CSEC data) and seasonal dummies. In practice, ITS coefficients remain stable when controls are added (Table 4), supporting the view that results are not purely mechanical.

Nevertheless, 2024 coincides with broader macro-financial developments (interest rates, geopolitical uncertainty, climate policy). The internal placebo test on the non-green bond share provides a diagnostic: the non-green share displays a steady decline with no discrete 2024

break (Table 5), strengthening the case for a green-specific reallocation rather than a common shock affecting all bond segments.

Assumption 3 (No anticipation effects): Banks did not adjust portfolios in advance of 2024Q1 in anticipation of regulatory changes.

Given the phased Taxonomy implementation (delegated acts from 2022 onwards, enhanced disclosure over 2023), some anticipatory behaviour is plausible. If banks began greening earlier, the pre-2024 slope β would already incorporate part of the treatment effect, and post-2024 coefficients would understate the full impact.

Two considerations mitigate this concern. First, a significant level shift appears specifically in the SPO segment (Table 3), suggesting banks respond more strongly once the framework becomes fully operational. Second, the Difference-of-ITS results show the bank-control gap widens around 2024, implying differential behaviour at implementation rather than smooth convergence.

Assumption 4 (Correct functional form): A linear time trend is appropriate for pre- and post-intervention dynamics.

Specifications with quadratic trends show the quadratic term is not statistically significant, and key break coefficients remain qualitatively similar. Quarterly dummies allow for flexible seasonal patterns without altering main conclusions.

5.5.2. Assumptions for sectoral comparisons

Difference-of-ITS (Assumption 5 - Common trends in unobservables): Unobserved shocks affecting green bond holdings impact banks and control sectors similarly, such that the difference series isolates the bank-specific regulatory effect.

This is weaker than strict parallel trends required by DiD, as it allows each sector different baseline levels and slopes. The key requirement is that common shocks affect all sectors proportionally and thus cancel out in the difference. This rests on institutional similarity: all three sectors are major euro area bond investors operating in the same green bond market.

TWFE DiD (Assumption 6 - Parallel trends): Absent intervention, the difference in green bond shares between banks and control sectors would have remained constant or evolved linearly.

This assumption is formally rejected. Pre-trend analysis (Table 13, column 4) shows banks' green share was already growing significantly more slowly than funds and insurers before 2024 ($\widehat{\text{treated}} \times t \approx -0.0016$, $p < 0.01$). This pre-existing divergence renders standard TWFE DiD estimators unreliable for stock variables.

For flow variables, parallel trends are not rejected pre-period (Table 14, column 1), but post-intervention DiD coefficients are imprecise and not statistically significant. With only three sectors, estimates are highly sensitive to structural differences. TWFE coefficients even produce signs opposite to those obtained under ITS, confirming the violation's severity.

These considerations justify treating TWFE DiD as an illustrative diagnostic tool rather than as the primary estimator.

5.5.3. General assumptions

No spillovers (SUTVA): Each sector's outcome depends only on its own treatment status, not on other sectors' treatment.

Some spillovers are possible (e.g., if banks become large buyers, this could affect pricing). However, given banks start from a much lower green share and remain structurally less exposed throughout, large general-equilibrium effects seem unlikely over this short horizon. This is maintained as a working assumption but acknowledged as a limitation.

Exogeneity of intervention timing: The decision to implement the Taxonomy framework in 2024 is not endogenous to banks' pre-existing green bond holdings.

This is highly plausible. The Taxonomy Regulation (2020/852), CSRD (2022/2464), and EuGB standard (2023/2631) are EU-level legislative acts with implementation timelines set through a multi-year political process, exogenous to any individual bank's portfolio composition.

5.5.4. Robustness checks and validation strategy

Throughout the analysis, several robustness checks assess sensitivity to potential violations:

- **Alternative specifications:** ITS models with seasonal dummies, supply-side controls (green issuance), and alternative breakpoints confirm the stability of main coefficients.
- **Placebo tests:** Estimation on the non-green bond share shows no spurious breaks, supporting a genuine green-specific effect rather than common shocks affecting all bond segments.
- **SPO variant:** Restricting analysis to externally reviewed green bonds sharpens results, consistent with a quality-driven reallocation.
- **Flow-based analysis:** Green purchase rates corroborate stock-based findings and provide insight into adjustment mechanisms, despite higher volatility.
- **Cross-country heterogeneity:** Country-level analysis of financial corporations confirms greening is broadly shared across the euro area.

5.5.5. Summary of identification strategy

Overall, the identification strategy combines several complementary elements rather than relying on a single estimator. The baseline ITS on aggregated banks captures changes in level

and slope of the green share around 2024 under transparent time-series assumptions. Placebo tests, supply controls, and seasonal dummies rule out interpretations based purely on common shocks or mechanical valuation effects.

At the sector level, TWFE DiD serves primarily as a diagnostic tool, illustrating how sensitive standard DiD estimators can be in small panels with heterogeneous pre-trends. The Difference-of-ITS framework provides a more flexible way of situating banks' dynamics relative to other major holders without fully imposing parallel-trend restrictions.

6. Results

6.1. Descriptive statistics

Before turning to the estimations, it is useful to document the raw trajectory of green outstandings held by euro area banks. Over the pre-2024 period, the share of green bonds in banks' bond portfolios remains modest but rising. The 2021Q1–2023Q4 average of *share green holdings* (defined as $\frac{hold\ green}{hold\ total}$) is 1.76% of total bond outstandings, with a steady quarter-by-quarter increase. The "with SPO" variant, which retains only green bonds accompanied by an external review, is very close in level (around 1.63% on average over the same period), suggesting that the two segments evolve in parallel prior to 2024.

From 2024Q1 onwards, the series visually suggest a stronger pace of greening: the post-intervention average (2024Q1–2025Q1) reaches 3.19% for green bonds overall and 2.92% for the "with SPO" segment. The average increase between the two sub-periods is about +1.43 percentage points (pp) for the total green share and +1.29 pp for the "with SPO" green share. In other words, the share of green bonds in banks' portfolios rises by roughly half of its initial level over only a few quarters. As shown in Section (6.2), however, this increase does not translate into a statistically sharp jump in the exact quarter of the reform, but rather into a sustained underlying trend that continues.

Green purchase rates (*green purchase rate*), defined as the ratio of net green transactions to the previous quarter's total bond stock, corroborate this pattern while highlighting substantially higher short-run volatility. On average, banks' green purchase rate rises from around 0.15% of outstandings (pre-2024) to 0.26% after 2024. This average increase reflects stronger net flows into green bonds, but transaction series display pronounced spikes driven by market conditions. Consistent with this, the ITS analysis on flows (Section (6.2)) shows that it is harder to identify a structural break as cleanly as for stock-based measures.

Finally, compared with investment funds and insurers, banks appear throughout the sample as structurally less exposed to green bonds: their green share is several percentage points below the average of the other two sectors. The relevant question is therefore not whether banks are "the greenest", but whether their greening trajectory accelerates specifically from 2024 onwards, once the broader market movement and other holders' behaviour are taken into account.

The descriptive figures (stocks table; rates table) illustrate these patterns:

- an upward trend before 2024;
- higher green-share levels after 2024;
- noisier flows, but on average consistent with a gradual increase in green outstandings.

6.2. ITS results: trend break for banks

This sub-section discusses the results of the ITS model presented in Section (5.1), applied to the aggregated series for banks. Recall the baseline specification:

$$y_t = \alpha + \beta t + \gamma \,\mathrm{Post}_t + \delta\,(t \times \mathrm{Post}_t) + \varepsilon_t, \tag{22}$$

where, depending on the specification, y_t is either the green bond share (*share green holdings*) or the green purchase rate (*green purchase rate*), and $\mathrm{Post}_t = 1$ from 2024Q1 onwards. Standard errors are corrected for autocorrelation using HAC estimators, and variants including seasonal dummies are tested as robustness checks.

6.2.1. Green bond share (stocks)

Table (2) reports estimates for the share of total green bonds held by banks, as well as estimates for the variant including seasonal dummies.

Table 2: ITS estimates for *share green holdings*

	(1) ITS baseline (2024Q1)	(2) ITS + seasonality
Intercept	0.0091***	0.0090***
	(0.0008)	(0.0010)
t (trend)	0.0013***	0.0013***
	(0.0001)	(0.0001)
Post (from 2024Q1)	0.0000	0.0002
	(0.0010)	(0.0013)
$t\times$ Post	0.0002	0.0001
	(0.0001)	(0.0001)
Quarter 2 dummy		0.0003
		(0.0005)
Quarter 3 dummy		-0.0001
		(0.0005)
Quarter 4 dummy		-0.0005
		(0.0007)

Notes: Standard errors in parentheses. Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The pre-intervention slope β is positive and significant ($\hat{\beta} \approx 0.0013$, i.e. about 0.13 percentage points per quarter), reflecting the gradual diffusion of green bonds into banks' portfolios prior to 2024. By contrast, the level-break coefficient γ is not significant. In other words, there

is no evidence of a sharp level jump in the green share at the moment the new framework becomes operational. The post-intervention slope change δ is not significant at conventional levels ($p \approx 0.15$). The green share therefore appears to follow a continuous, steady increase rather than a sudden regime change in 2024.

In this specification, the green-share dynamics look less like a discrete break and more like a sustained upward trajectory: the pre-intervention slope is already clearly positive, and neither the level break (γ) nor the post-2024 slope change (δ) is statistically different from zero. Put differently, the operational roll-out of the Taxonomy framework fits into a greening process that was already underway, without a clearly identifiable "jump" in the reform quarter.

The ITS variant with seasonal dummies yields very similar coefficients: the pre-intervention slope remains around 0.13 percentage points per quarter, and neither the break coefficient γ nor the slope change δ is significant. The quarterly dummies (Q2–Q4) are not significant either, suggesting the absence of strong seasonality and confirming that the results are not driven by any particular effect around 2024Q1–Q2.

6.2.2. Quality variant: "with SPO" green share

Table (3) reports estimates for the share of SPO green bonds held by banks.

Table 3: ITS estimates for *share green SPO holdings*

	(1) ITS baseline (SPO, 2024Q1)
Intercept	0.0081***
	(0.0008)
t (trend)	0.0013***
	(0.0001)
Post (from 2024Q1)	0.0085***
	(0.0012)
$t\times$ Post	-0.0005***
	(0.0001)

Notes: Standard errors in parentheses. Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Estimating the same ITS specification on the share of green bonds accompanied by an external review (SPO) sharpens the interpretation in terms of an "upgrade" in standards. Here, the pre-intervention slope remains positive and significant ($\hat{\beta}_{\text{SPO}} \approx 0.00127$, i.e. about 0.13 percentage points per quarter), but in addition there is a clear level jump at the time of the reform. The break coefficient is $\hat{\gamma}_{\text{SPO}} \approx 0.0085$, i.e. +0.85 percentage points (95% CI $\approx [0.61; 1.10]$ pp), and is clearly significant.

The post-2024 slope change is negative and significant ($\hat{\delta}_{\text{SPO}} \approx -0.00045$, i.e. around -0.045 percentage points per quarter), implying that the share of SPO green bonds continues to rise after 2024, but at a more moderate pace than before.

This combination, a marked jump in the "with SPO" segment followed by a normalisation of the slope, is consistent with the idea that banks prioritised higher-"quality" green bonds at the moment the regulatory framework became operational. Stronger transparency and robustness requirements (Taxonomy, EuGB standard, ESMA oversight of SPOs) create incentives to favour securities whose environmental credibility is better documented; the adjustment translates concretely into a more pronounced increase in the share of "with SPO" green bonds in banks' portfolios.

6.2.3. Supply controls

Table (4) reports ITS estimates for the total green bond share held by banks when adding issuance controls.

Table 4: Interrupted Time Series (ITS) estimates for *share green holdings* with issuance controls

	(1) ITS + issuance controls
Intercept	0.0037
	(0.0050)
t (trend)	0.0013***
	(0.0000)
Post (from 2024Q1)	-0.0054
	(0.0040)
$t\times$ Post	0.0006
	(0.0003)
Green issuance (MA4)	261.1008
	(315.1505)
Total issuance (MA4)	10.9241
	(8.9972)

Notes: Standard errors in parentheses. Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

As a variant, I add supply-side controls: green and total bond issuance (CSEC), smoothed using a four-quarter moving average.

In this ITS specification with issuance controls, the pre-intervention slope remains positive and significant (≈ 0.13 percentage points per quarter), and neither the break coefficient nor the slope change becomes significant. The coefficients associated with smoothed issuance are imprecisely estimated and not significant.

In other words, the increase in the green share in banks' portfolios is not explained solely by a supply shock in the green bond market: even after controlling for this dimension, the pattern remains one of steady greening rather than a discrete jump in 2024.

6.2.4. Non-green placebo and overall coherence

Table (5) reports ITS estimates for the share of total non-green bonds held by banks.

Table 5: Interrupted Time Series (ITS) placebo estimates for *share non green holdings*

	(1) ITS placebo (non green, 2024Q1)
Intercept	0.9999***
	(0.0008)
t (trend)	-0.0013***
	(0.0001)
Post (from 2024Q1)	-0.0004
	(0.0010)
$t\times$ Post	-0.0002
	(0.0001)

Notes: Standard errors in parentheses. Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

To ensure that the results do not simply reflect a broad macro or market shock, I estimate the same ITS model on the non-green share, defined as share non green$_t$ = 1 − share green holdings$_t$.

In this internal placebo, the pre-intervention slope is negative and significant ($\hat{\beta} \approx -0.00130$, i.e. about -0.13 percentage points per quarter), mirroring the upward trend observed for the green share. By contrast, the level-break coefficient $\hat{\gamma}$ is not significant, as is the post-2024 slope change. Put differently, there is no evidence of a 2024-specific break in the non-green component: it declines steadily, in parallel with the gradual increase in the green share.

Overall, the ITS results on stocks therefore convey a clear message:

- the share of green bonds in euro area banks' portfolios rises steadily across the whole period, from roughly 1.8% to above 3%, without a statistically sharp jump in 2024;
- the increase is stronger, and more "discrete", in the higher-quality segment (green bonds with SPO), where a significant level jump is observed followed by a slowing in the slope;
- the steady decline in the non-green share confirms that this is indeed a structural reallocation within the bond portfolio, rather than a simple valuation artefact or a temporary shock.

Taken together, this points to gradual portfolio greening, reinforced, but not entirely triggered, by the Taxonomy framework becoming operational.

6.2.5. Green purchase flows and seasonality: a noisier signal

Table (6) reports ITS estimates for banks' total green purchase rate and for the variant including seasonal dummies.

ITS estimates for the green purchase rate (*green purchase rate*) point in the same direction as the stock-based results, but the estimates are not significant. The pre-intervention slope is not significant. The level-break coefficient is and not significant, and the post-2024 slope change is

Table 6: Interrupted Time Series (ITS) estimates for *green purchase rate*

	(1) ITS baseline (2024Q1)	(2) ITS + seasonality
Intercept	0.0009*	0.0022*
	(0.0005)	(0.0010)
t (trend)	0.0001	0.0001**
	(0.0001)	(0.0000)
Post (from 2024Q1)	0.0034	0.0020
	(0.0025)	(0.0025)
$t\times$ Post	-0.0002	-0.0002
	(0.0002)	(0.0002)
Q2		-0.0011
		(0.0012)
Q3		-0.0021**
		(0.0009)
Q4		-0.0026*
		(0.0012)

Notes: Standard errors in parentheses. Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

likewise statistically indistinguishable from zero. In other words, green purchase flows do not exhibit a clear break at the time of the reform.

This contrast, a clear signal in stocks but noise in flows, is expected:

- stocks capture the cumulative portfolio reallocation over several years;
- quarterly transactions are highly sensitive to a small number of large operations, liquidity conditions, and tactical rebalancing decisions.

Over a short horizon, it is therefore much harder to extract a "structural" pattern from flows, which makes ITS less informative for *green purchase rate* than for the green share in outstandings.

As a robustness check, I add quarterly dummies (Q2–Q4) to the ITS model for *green purchase rate*. The pre-intervention slope becomes slightly positive and significant ($\hat{\beta} \approx 0.00013$, i.e. about 0.013 percentage points of outstandings per quarter), but neither the break coefficient $\hat{\gamma}$ nor the post-2024 slope change $\hat{\delta}$ becomes significant ($p \approx 0.44$ and $p \approx 0.38$, respectively).

The seasonal dummies do, however, suggest slightly lower green purchases towards year-end: coefficients for Q3 and Q4 are negative (approximately -0.21 and -0.26 percentage points relative to Q1) and significant, while Q2 is not significantly different from Q1. Put differently, green purchase flows tend to be somewhat lower in Q3–Q4 than at the start of the year; yet incorporating seasonality still does not reveal any structural break around 2024, confirming that quarterly transactions are essentially noisier than the more readable stock dynamics.

6.2.6. Quality variant: "with SPO" green purchase flows

Table (7) reports ITS estimates for banks' total SPO green purchase rate.

Table 7: ITS estimates for *green purchase rate (SPO)*

	(1) ITS baseline (SPO, 2024Q1)
Intercept	0.0008*
	(0.0005)
t (trend)	0.0001
	(0.0001)
Post (from 2024Q1)	0.0067**
	(0.0030)
$t\times$ Post	-0.0004**
	(0.0002)

Notes: Standard errors in parentheses. Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

When the green purchase rate is restricted to bonds accompanied by an external review (*green purchase rate SPO*), the profile becomes more pronounced. The pre-intervention slope is not significant, suggesting only a modest pre-2024 trend in flows towards SPO green bonds.

By contrast, the level-break coefficient becomes clearly significant: $\hat{\gamma} \approx 0.0067$, i.e. around 0.67 percentage points of outstandings ($p \approx 0.046$, 95% CI $\approx [0.08; 1.26]$ pp). In other words, at the time of the reform, the share of the previous year's outstandings renewed into "with SPO" green bonds steps up. The post-intervention slope change $\hat{\delta}$ is negative and significant (≈ -0.00044, i.e. around -0.04 percentage points per quarter, $p \approx 0.04$), indicating that this initial push is followed by a normalisation of the pace of purchases, even if the level remains higher than before 2024.

Flows into "with SPO" green bonds therefore display a "peak then normalisation" pattern: a temporary increase in purchases around the operationalisation of the Taxonomy framework, followed by a return to a more moderate dynamic. This remains consistent with the idea that banks prioritised environmentally more credible instruments at the key implementation moment, without sustaining the same intensity of purchasing over time.

6.2.7. Supply controls: green purchase flows and overall coherence

Table (8) reports ITS estimates for the green purchase rate when adding issuance controls.

Finally, I include green and total bond issuance as controls in the ITS model for the green purchase rate. In this specification, neither the pre-intervention slope nor the break and slope-change coefficients becomes significant, and the supply coefficients are very weakly identified and not significant.

In other words, even when explicitly controlling for the market supply of green bonds, banks'

Table 8: ITS estimates for *green purchase rate* with issuance controls

	(1) ITS + issuance controls
Intercept	-0.0052
	(0.0120)
t (trend)	0.0002
	(0.0004)
Post (from 2024Q1)	0.0048
	(0.0058)
$t\times$ Post	-0.0003
	(0.0005)
MA4(issuances green)	386.3110
	(747.3962)
MA4(issuances total)	-16.7506
	(28.2662)

Notes: Standard errors in parentheses. Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

green purchase flows still do not show a structural break around 2024, confirming the essentially noisy nature of *green purchase rate* relative to the clearer results obtained for stocks.

Taken together, the results on green purchase flows are consistent with the picture from stocks, but in a noisier way. For aggregate *green purchase rate*, neither the pre-2024 slope nor the break coefficients (level and slope) are significant, whether using the baseline specification, seasonal dummies, or issuance controls. Flows appear driven by short-run factors (timing of large transactions, liquidity, management rebalancing), which makes it difficult to identify a clean structural profile around 2024.

By contrast, when focusing on externally reviewed green bonds (*green purchase rate SPO*), a clearer pattern emerges: a significant purchasing "spike" at the time the new framework becomes operational, followed by a normalisation of the pace. This asymmetry aligns with the stock-based results: portfolio greening is mainly visible in the gradual accumulation of outstandings, especially in the "with SPO" segment, while quarterly flows mainly provide qualitative evidence of a temporary increase in purchases of higher-"quality" instruments at the key reform moment, without delivering an autonomous dynamic as robust as that observed for stocks.

6.3. Sectoral comparison: banks versus other holding sectors

The second dimension of the analysis compares the behaviour of banks with that of other major bond holders, in particular investment funds and insurers. The aim is to test whether the greening trajectory observed in banks' portfolios, and in particular any acceleration around 2024, is specific to banks or reflects a broader movement among euro area investors.

As discussed in Section 5.2, standard TWFE DiD models were estimated but prove unreliable due to violations of the parallel-trends assumption for stock variables. Pre-trend analysis shows banks' green share was already growing significantly more slowly than that of funds and insurers before 2024 ($\widehat{\text{treated} \times t} \approx -0.0016$, $p < 0.01$). For flow variables, parallel trends are not rejected, but post-intervention coefficients are imprecise and not statistically significant. Full TWFE DiD results are presented in Appendix (10.1.2) and (10.1.3).

Given these limitations, the primary sectoral comparison relies on the Difference-of-ITS approach, which applies ITS logic to the gap between banks and control sectors.

6.3.1. Difference-of-ITS: bank–control difference series

To relax the parallel-trends assumption while maintaining a "banks versus control" comparison, an alternative approach constructs the difference series:

$$D_t = \text{share green holdings}_t^{S122} - \frac{1}{2}\Big(\text{share green holdings}_t^{S124} + \text{share green holdings}_t^{S128}\Big), \tag{23}$$

i.e. the gap in green shares between banks and the average of investment funds and insurers. An ITS model is then estimated on D_t with the same structure as in Section (6.2). This Difference-of-ITS strategy captures a post-2024 differential effect while allowing each sector to have its own levels and slopes, without imposing strict parallelism in pre-intervention trends.

Green share in portfolios. For the green share, the pre/post averages are as follows:

- mean D_t before 2024: ≈ -0.0238 (i.e. ≈ -2.4 pp),
- mean after 2024: ≈ -0.0357 (i.e. ≈ -3.6 pp),

implying that the average bank–control gap widens by around -1.2 pp in the post-reform period.

The ITS estimated on D_t yields (Table (9)):

- a significantly negative pre-intervention slope ($\hat{\beta}_D \approx -0.0016$, i.e. ≈ -0.16 pp per quarter), indicating that banks' lag relative to funds/insurers was already widening before 2024;
- a negative level break at the time of the reform ($\hat{\gamma}_D \approx -0.0105$, i.e. ≈ -1.05 pp, $p < 0.001$): at 2024Q1, the bank–control gap widens further;
- a positive and significant post-intervention slope change ($\hat{\delta}_D \approx 0.00084$, i.e. $\approx +0.08$ pp per quarter, $p < 0.001$), implying that after 2024 the gap continues to widen, but at a slower pace than before (the slope shifts from roughly -0.16 pp/quarter to about -0.08 pp/quarter).

In short:

- banks start from a structural lag relative to funds and insurers;

Table 9: Difference-of-ITS estimates for the green share gap

	(1) Difference-of-ITS
Intercept	-0.0134^{***}
	(0.0001)
t (trend)	-0.0016^{***}
	(0.0000)
Post (from 2024Q1)	-0.0105^{***}
	(0.0017)
$t\times$ Post	0.0008^{***}
	(0.0001)

Notes: Standard errors in parentheses. Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

- this lag increases sharply at the time the new framework becomes operational (a negative jump in D_t);
- the divergence then continues, albeit less steeply.

There is therefore no evidence of banks "catching up" with the other sectors over the 2024–2025 window; if anything, the green-share gap remains open and even widens slightly.

Green purchase flows. For green purchase flows, the corresponding difference series

$$D_t^{\text{flows}} = \text{green purchase rate}_t^{S122} - \frac{1}{2}\Big(\text{green purchase rate}_t^{S124} + \text{green purchase rate}_t^{S128}\Big)$$

suggests a modest convergence on average:

- the mean D_t^{flows} moves from about -0.00165 (pre-2024) to -0.00089 (post-2024), i.e. a slightly less negative gap (roughly $+0.00076$ in decimal terms).

However, the ITS on D_t^{flows} indicates (Table (10)):

- a very small and non-significant pre-slope ($\hat{\beta}_D^{\text{flows}} \approx 0.000015$),
- a level break ($\hat{\gamma}_D^{\text{flows}} \approx -0.0026$) and a slope change ($\hat{\delta}_D^{\text{flows}} \approx 0.00022$) that are both non-significant ($p \approx 0.3$–0.4).

Flows are therefore too noisy to isolate a robust differential effect between banks and the control group.

Takeaway from the Difference-of-ITS. The Difference-of-ITS analysis adds two important nuances:

Table 10: Difference-of-ITS estimates on green purchase rate gap

	(1) Difference-of-ITS
Intercept	−0.0017***
	(0.0003)
t (trend)	0.0000
	(0.0000)
Post (from 2024Q1)	−0.0026
	(0.0031)
$t\times$ Post	0.0002
	(0.0002)

Notes: Standard errors in parentheses. Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

- Yes, banks increase their green bond share after 2024 (Section (6.2)): their portfolios clearly become greener.
- No, this increase does not translate, over the 2024–2025 window, into statistically clear catch-up relative to funds and insurers: banks remain less "green" than the other two sectors, and the green-share gap even tends to widen around 2024 before stabilising.

From this perspective, the new framework (Taxonomy, CSRD/ESRS, Pillar 3, EuGB) appears as part of a broader greening movement among major investors, in which banks participate, but without evidence, over the period studied, of a strong differential effect that would make banks the primary drivers of the green bond transition.

6.4. Cross-country heterogeneity

Country-level statistics for financial corporations confirm that the greening of bond portfolios is a broadly shared phenomenon across the euro area, even though levels remain highly heterogeneous (Fatica et al., 2021).

Over 2021Q1–2023Q4, the average green share *share green S12* ranges from around 0.8–1% in the least exposed countries (HR, LT, PT) to above 10% in Estonia (EE) and close to 7% in Latvia (LV). Over 2024Q1–2025Q2, all jurisdictions in the sample record an increase in their green share, with pre/post differences generally between +0.6 and +3.4 percentage points (with an average around +1.7 pp). The "with SPO" variant follows a similar pattern, with deltas of comparable magnitude, suggesting that the ramp-up also concerns the higher-quality segment (Table (17)).

Aggregating these country series shows that the green share of euro area financial corporations rises from around 1.9% of bond outstandings in early 2021 to just above 5% by mid-2025 (Table (11)). The ITS estimated on this series points to a positive slope ($\approx +0.21$ percentage points per quarter, significant at the 1% level), but does not detect a clear level break associated

with 2024: the coefficient on the `Post` indicator is not significant (Table (12)). In other words, the aggregate greening dynamic for financial corporations resembles that observed for banks, a steady increase already well underway before 2024, rather than a sharp "jump" when the Taxonomy becomes fully operational.

Table 11: Euro area aggregate green bond share for financial corporations

Time	(1) hold green_{tot}^{S12}	(2) hold total_{tot}^{S12}	(3) share green_{tot}^{S12}
2021Q1	365041.89	19175012.03	0.0190
2021Q2	415434.82	19422135.09	0.0214
2021Q3	454312.49	19685121.29	0.0231
2021Q4	501955.79	19910690.90	0.0252
2022Q1	503599.77	19326898.63	0.0261
2022Q2	513429.98	18387464.48	0.0279
2022Q3	531385.14	17758281.59	0.0299
2022Q4	563219.68	17662201.80	0.0319
2023Q1	631400.23	17961838.88	0.0352
2023Q2	686503.92	18205913.50	0.0377
2023Q3	704653.56	18151597.11	0.0388
2023Q4	781397.43	18890818.68	0.0414
2024Q1	842057.11	19252549.12	0.0437
2024Q2	883259.22	19305608.10	0.0458
2024Q3	952054.32	19904829.85	0.0478
2024Q4	988917.76	20141775.54	0.0491
2025Q1	1018280.19	20377336.41	0.0500
2025Q2	1062429.25	20547843.31	0.0517

share green_{tot}^{S12} = hold green_{tot}^{S12}/hold total_{tot}^{S12}.

Table 12: Regression estimates (S12 panel)

	(1) Estimate
t (trend)	0.0021***
	(0.0001)
Post (from 2024Q1)	-0.0008
	(0.0012)

Notes: Standard errors in parentheses. Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

This cross-country extension should nevertheless be interpreted with caution. First, financial corporations combines banks with other financial institutions; second, the post-intervention window remains short and does not allow a clear identification of potential catch-up effects in specific countries. It nonetheless provides additional evidence in favour of a broad-based

greening of bond portfolios across the euro area, consistent with the aggregate banks results.

6.5. Summary of empirical results

6.5.1. Sustained greening of banks' portfolios, with a clearer effect in the SPO segment

- The share of green bonds held by euro area banks increases markedly over the sample: the average *share green holdings* rises from about 1.76% of bond outstandings in 2021Q1–2023Q4 to 3.19% in 2024Q1–2025Q2, i.e. an increase of roughly +1.4 percentage points. The ITS on *share green holdings* shows a pre-2024 slope that is already positive and significant, but no statistically sharp jump in the reform quarter: portfolio greening appears as an underlying trend rather than a discrete break.
- By contrast, the ITS estimated on the externally reviewed green share (*share green SPO holdings*) points to a significant level shift in 2024 ($\approx +0.85$ percentage points), followed by a slowdown in the slope. This suggests that the operationalisation of the Taxonomy/CSRD/Pillar 3 framework and the introduction of the EuGB standard translate into a particularly strong shift in demand towards the most "qualified" green bonds (with SPO).

6.5.2. Gradual reallocation within the bond portfolio

- The non-green share, defined as $1 -$ *share green holdings*, exhibits a negative and significant pre-2024 slope, mirroring the upward movement in the green share, but shows no clear break in 2024: neither the level shift nor the slope change is significant.
- This combination, a steady rise in the green share alongside a steady decline in the non-green share, indicates a structural reallocation within banks' bond portfolios from conventional bonds towards green bonds, rather than a purely mechanical balance-sheet expansion or a pure price effect. Adding supply controls (smoothed green and total issuance) does not alter this diagnosis: issuance coefficients are weakly identified, and the trajectory of *share green holdings* remains one of gradual greening.

6.5.3. Limited differential effect relative to other sectors

- Investment funds and insurers also increase their green bond shares over the period, starting from higher levels than banks. Their average green shares remain clearly above those of banks both before and after 2024.
- TWFE DiD models on *share green holdings* produce a negative treated×post coefficient (banks greening less than other sectors), but pre-trend analysis reveals that banks already face an unfavourable slope before 2024, violating the parallel-trends assumption. DiD models on flows (*green purchase rate*) yield positive but non-significant effects, with wide confidence intervals.
- The Difference-of-ITS approach applied to the gap D_t (banks' green share minus the funds/insurers average) confirms that banks remain behind: D_t is negative both before

and after 2024, and the gap even tends to widen around the operationalisation of the new framework before stabilising. Put differently, banks participate in the broader greening movement, but there is no statistically clear evidence of catch-up relative to other major institutional investors over the 2024–2025 horizon.

6.5.4. Stocks versus flows: structural signal versus short-run noise

- Stock measures (*share green holdings*) provide a robust structural signal: they capture the gradual accumulation of green bonds in portfolios, with a clear increase for banks, particularly pronounced in the "with SPO" segment, consistent with the ramp-up of the Taxonomy/CSRD/Pillar 3 framework and the introduction of the EuGB standard.
- Green purchase flows (*green purchase rate*) convey the same message on average (higher green purchase rates after 2024), but their short-run volatility prevents the identification of a robust differential effect. For green bonds overall, neither ITS nor DiD identifies a clean break; only *green purchase rate SPO* shows a significant purchase spike around 2024 followed by normalisation. Flows therefore remain primarily informative as evidence on mechanisms, while the core identification rests on the stock-based results.

7. Discussion and limitations

7.1. General interpretation of the results

The aim of the empirical analysis was to document the greening of euro area banks' bond portfolios around the operational implementation of the Taxonomy/CSRD/Pillar 3 framework and the EuGB standard, and to compare this movement with that of other major institutional investors.

On the holdings side, the results clearly show that banks increase their exposure to green bonds over the period studied. The share of green bonds in banks' bond portfolios rises on average from around 1.8% before 2024 to above 3% after 2024, an increase of roughly 1.4 percentage points. The ITS on *share green holdings* highlights a strongly upward pre-2024 trend and does not find a statistically sharp jump in the reform quarter: greening appears as a medium-term trajectory rather than a clean "before/after" break.

The picture is sharper when focusing on the segment of green bonds accompanied by an external review (*share green SPO holdings*). In that case, the ITS identifies a significant jump in the SPO share in 2024, followed by a slowdown in the slope. Put differently, at the moment the regulatory framework becomes genuinely operational, banks increase the share of the most documented and credible green bonds more strongly, before returning to a more moderate pace of growth. This contrast between "all green" and "green with SPO" supports an interpretation in terms of a shift towards higher standards, rather than a pure quantity effect.

Internal placebo tests on the non-green share ($1-$*green share*) show, in mirror image, a steady

decline in the non-green component without a clear break in 2024. Adding supply controls (smoothed green and total issuance) does not overturn this conclusion. Supply coefficients are weakly identified, and the trajectory of *share green holdings* remains one of gradual portfolio reallocation towards green assets.

The comparison with investment funds and insurers nuances this picture. These sectors start from higher green-share levels and continue to green their portfolios at a sustained pace. TWFE DiD models on *share green holdings* suggest that, all else equal, banks increase their green share less than the control sectors, but these results are weakened by violations of the parallel-trends assumption. The Difference-of-ITS approach, applied to the gap between banks and the funds/insurers average, confirms that banks remain behind in terms of green share and do not display clear catch-up over the 2024–2025 window relative to other institutional investors.

Green purchase flows (*green purchase rate*) provide a noisier signal. The average flow dynamics are consistent with rising green purchases, but neither ITS nor DiD identifies, for green bonds overall, a clear and robust 2024 break. Only *green purchase rate SPO* shows a more pronounced profile, with a significant purchasing spike at implementation followed by normalisation. Overall, flows mainly illustrate the mechanism identified in stocks, but they do not provide an estimator that is as stable.

Finally, the country-level extension conducted on the aggregated financial corporations sector indicates that the increase in green bond shares is observable across all euro area national financial systems, with sometimes large differences in levels but consistently positive pre/post deltas. Given the limitations of this proxy (S12 $\neq$ S122), these results are not interpreted as a precise measure of banks' country-level portfolios, but they reinforce the idea that the aggregate greening observed is not driven solely by a small number of jurisdictions.

7.2. Possible mechanisms and broader interpretation

Several economic and regulatory mechanisms may account for these results.

First, the gradual greening of banks' portfolios was already underway before 2024. The green bond market expanded strongly over the period, and banks progressively incorporated these instruments both as investment assets and as a response to the expectations of clients and investors. The entry into force of the Taxonomy/CSRD framework and related disclosure requirements (Taxonomy KPIs, GAR, Pillar 3 reporting, etc.) has itself been incremental, with a ramp-up in data availability and internal processes rather than an immediate tightening of constraints. In this context, it is unsurprising that the ITS primarily identifies an underlying trend, and a stronger movement in the most standardised segment (SPO), rather than a single discrete shock.

Second, the role of the EuGB standard and the supervision of SPOs points towards a qualitative

reallocation. Issuers and investors have been encouraged to comply with stricter criteria on transparency and environmental alignment. For banks, particularly exposed to reputational risk and to prudential disclosure requirements, it may be more attractive to favour green bonds accompanied by a recognised external review, even if the total size of that segment remains limited relative to the overall bond universe. The fact that banks' portfolios green more strongly in the SPO segment than in the "average" green segment is consistent with this logic of managing greenwashing risk and selecting instruments that are more defensible in supervisory contexts.

Third, the fact that banks remain less "green" than funds and insurers, and do not fully catch up over the period studied, can be explained by structural constraints. Banks must manage liquidity requirements (LCR, NSFR), collateral needs, and asset–liability management considerations, which incentivise them to hold a substantial share of sovereign bonds or very liquid securities that are not necessarily labelled green. Funds and insurers, by contrast, often have longer horizons and investment mandates that are explicitly ESG-oriented, facilitating a more aggressive positioning in green bonds. From this perspective, it would be surprising for banks to become, within only a few quarters, the most exposed actors in the green bond space.

Finally, the absence of a large jump in *share green holdings* does not imply that the regulatory framework has no effect. It is plausible that the Taxonomy, CSRD, and the new Pillar 3 requirements operate primarily as accelerators of an existing trend, making the greening trajectory harder to reverse and reinforcing the bias in favour of the most credible instruments (SPO). Over a longer horizon, these standards are likely to further anchor green bonds within banks' portfolios, even though the present study is confined to the first post-implementation quarters.

7.3. Limitations and avenues for further research

Several limitations nonetheless need to be highlighted to interpret these results with appropriate caution.

The first concerns the post-intervention time window. The data cover only a few quarters after 2024. Yet portfolio adjustments triggered by a new regulatory framework may unfold gradually, depending on internal timelines, market constraints, and the arrival of new Taxonomy-compatible issuance. It is therefore possible that longer-run effects are not yet visible, or that they will emerge more clearly as additional post-2024 observations become available.

The second limitation relates to causal identification. ITS can test for a trend break at the time of the reform, but it remains exposed to concurrent shocks that coincide with 2024 (macro-financial developments, interest-rate shocks, changes in climate policy in certain countries, and so forth). TWFE DiD models provide a sectoral benchmark, but their interpretation is weakened for stock variables by the violation of parallel trends. Banks were already greening more slowly than other sectors before the reform, so the treated$\times$post effect conflates structural

divergence with any regulatory shock. The Difference-of-ITS approach relaxes this assumption, but it still relies on the idea that shocks affecting banks, funds, and insurers symmetrically can be treated as a "common trend".

Third, the analysis relies on "green" measures drawn from ECB datasets (SHSS and CSEC), which themselves depend on the labels and classifications available. The quality of green labelling, consistency with the Taxonomy, and potential greenwashing are not directly observed. The "with SPO" distinction is used as a proxy for quality, but it does not capture the full complexity of environmental and social criteria. In addition, the study focuses on bond portfolios and does not cover green lending or other balance-sheet segments that may represent important transition channels.

Fourth, the analysis is conducted at the aggregated sector level for the euro area as a whole. This aggregation masks national heterogeneity (some jurisdictions may be more advanced in implementing the Taxonomy or in developing green finance) and differences across banks within a given country (size, business model, ESG appetite). Future research could exploit country-level information, or, if available, more granular institution-level data, to better characterise the dispersion in behaviours.

Fifth, purchase-flow measures are particularly noisy. Using quarterly net transactions scaled by the previous quarter's outstanding stock helps to mitigate valuation effects, but it does not eliminate the sensitivity of flows to a small number of very large trades or to temporary market conditions. Over such a short horizon, it is therefore difficult to extract a robust "structural" signal from flows, which justifies not relying on them for the main identification.

Finally, on the econometric side, while standard corrections are applied (HAC/Newey–West standard errors, seasonal-dummy specifications, variants with issuance controls and placebos), the study does not claim to exhaust all possible forms of time dependence or parameter instability. Future work could test richer dynamic models, explicitly integrate monetary and market conditions, or adopt structural approaches that jointly model the supply and demand of green bonds.

8. Conclusion

This dissertation set out to assess the extent to which the operational roll-out of the Taxonomy/CSRD/Pillar 3 framework, complemented by the EuGB standard, has translated into a measurable greening of euro area banks' bond portfolios. Using the ECB's SHSS and CSEC datasets, the analysis combined an interrupted time series (ITS) approach with sectoral comparisons of the DiD / Difference-of-ITS type, while systematically distinguishing between "green" bonds as a whole and the narrower segment of securities accompanied by an external review (SPO).

Three main findings emerge. First, banks have indeed engaged in a process of greening their

market portfolios: the share of green bonds in their bond outstandings rises over the period, with a more pronounced increase for the SPO segment, where the adjustment around 2024 is more clearly visible. The new regulatory framework appears less as a standalone shock than as an anchoring device for an already ongoing trajectory, strengthening demand for the most environmentally credible instruments.

Second, this greening remains relative. Banks continue to exhibit a lower green share than investment funds and insurers, and the sectoral comparison exercises do not show clear differential catch-up over the 2024–2025 window. Constraints specific to the banking model (liquidity, collateral, ALM management) and the more proactive positioning of long-term investors in ESG products contribute to maintaining this gap, at least in the short run.

Third, the analysis underscores the inherent limitations of the exercise. The post-reform window is still short, purchase flows are highly volatile, and causal identification is constrained by pre-existing trends and concurrent macro-financial shocks. The results should therefore be read as a first structured snapshot rather than as a definitive verdict on the effectiveness of the Taxonomy/CSRD framework. Natural extensions include lengthening the observation horizon, moving to a more disaggregated level (countries, institutions, issuer types), and more closely linking the analysis of market portfolios with that of credit exposures.

Despite these caveats, the overall message is relatively clear: euro area banks are participating in the bond financing of the transition, with increasing attention paid to the environmental quality of instruments, but they do not, at least at this stage, become the "greenest" investors in the landscape. The regulator's role appears above all as that of a stabiliser and a standard-raiser, rather than that of a single trigger, within a greening dynamic that remains largely gradual.

9. References

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10. Appendix

10.1. Two-Way Fixed Effects DiD analysis

10.1.1. Methodology

The TWFE DiD model is:

$$y_{i,t} = \alpha_i + \lambda_t + \theta(\text{treated}_i \times \text{Post}_t) + \varepsilon_{i,t}, \tag{24}$$

where:

- $y_{i,t}$ is the green bond share or green purchase rate for sector i in quarter t;
- α_i are sector fixed effects;
- λ_t are time fixed effects;
- $\text{treated}_i = 1$ for banks and 0 for funds/insurers;
- $\text{Post}_t = 1$ from 2024Q1 onwards;
- θ measures the differential effect of the 2024 shift for banks.

Standard errors are two-way clustered by time and sector.

10.1.2. TWFE DiD on the green bond share

In this specification (Table (13), column (1)), the estimated coefficient is:

- $\hat{\theta} \approx -0.012$, i.e. about -1.2 pp for banks relative to funds and insurers after 2024;
- statistically significant at conventional levels ($p < 0.05$).

Table 13: Difference-in-Differences estimates: banks versus control sectors

	(1)	(2)	(3)	(4)
Treated × Post	-0.0119***	-0.0116***	-0.0122***	
	(0.0018)	(0.0021)	(0.0018)	
Treated $\times t$				-0.0016***
				(0.0000)

Notes: Standard errors in parentheses. Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Taken at face value, this result would suggest that banks' green share increased less (or declined more) than that of funds/insurers after 2024. Banks would be participating in the greening trend, but would remain behind other major holders. In pairwise specifications, the effect is very similar vis-à-vis investment funds (Table (13), column (2)) (≈ -0.0115, i.e. ≈ -1.15 pp) and close to that vis-à-vis insurers (Table (13), column (3)) (≈ -0.0122, i.e. ≈ -1.22 pp), with both estimates significant.

However, before interpreting this as a causal effect of the Taxonomy/CSRD framework specific to banks, the parallel-trends assumption must be examined.

Pre-trend tests indicate that this assumption is clearly violated (Table (13), column (4)). Estimating, over the pre-2024 period only, a regression of $y_{i,t}$ on t with an interaction $\text{treated}_i \times t$ yields:

- a coefficient $(\widehat{\text{treated} \times t}) \approx -0.0016$ (i.e. -0.16 pp per year),
- statistically significant ($p < 0.01$).

In other words, even before 2024, banks' green-share slope is already significantly lower than that of funds and insurers: banks close the gap more slowly, which helps explain why they remain structurally less "green" than the other sectors. In this context, the TWFE coefficient $\hat{\theta}$ conflates:

- this pre-existing divergence in slopes (banks greening more slowly than others prior to 2024); and
- any genuine regime change linked to the new regulatory framework.

It is therefore appropriate not to interpret $\hat{\theta}$ as a causal effect of the Taxonomy on banks. The TWFE DiD is retained in the appendix as a benchmark and to document the failure of the parallel-trends assumption, but it is not used as the main estimator.

Overall, banks appear structurally less exposed to green bonds than funds and insurers, consistent with liquidity and balance-sheet constraints, but the observed dynamics do not allow one to identify a robust differential regulatory shock in 2024.

10.1.3. TWFE DiD on green purchase flows

For flows (Table (14), column (1)), pre-trend estimation over 2021–2023 yields $(\widehat{\text{treated} \times t}) \approx 0.000015$, not significant ($p \approx 0.77$), so the parallel-trends assumption is not rejected for flows prior to 2024.

Table 14: TWFE DiD estimates on green purchase rate

	(1) Pre-trend test	(2) Banks vs avg. controls	(3) Banks vs funds	(4) Banks vs insurers
Treated × t	1.55×10^{-5}			
	(5.15×10^{-5})			
Treated × Post		0.0008	0.0015	-1.95×10^{-5}
		(0.0008)	(0.0010)	(0.0007)

Notes: Standard errors in parentheses. Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

In the pooled TWFE model (banks versus funds+insurers, Table (14), column (2)), the

post-intervention coefficient is not significant. In pairwise specifications, the effect is somewhat larger vis-à-vis investment funds (Table (14), column (3)) (≈ 0.00154, i.e. ≈ 0.15 pp, $p \approx 0.14$) and close to zero vis-à-vis insurers (Table (14), column (4)).

The (slightly positive) sign is consistent with the idea that banks strengthen their green purchases on average, but statistical uncertainty remains substantial: the post-intervention window is short, and quarterly flows are highly volatile and driven by a small number of large transactions. As a result, one cannot conclude that banks' green purchases increased significantly more than those of funds and insurers. The DiD flow results therefore remain descriptive and secondary relative to the stock-based ITS estimates.

10.2. Summary statistics, correlation matrix, and country-level green bond shares of financial corporations

Table 15: Summary statistics

Variable	N	Mean	SD	Min	P25	Median	P75	Max
share green holdings^{S122}	18	0.0224	0.0081	0.0115	0.0147	0.0222	0.0294	0.0357
share green SPO holdings^{S122}	18	0.0206	0.0074	0.0104	0.0135	0.0209	0.0278	0.0310
share non-green holdings^{S122}	18	0.9776	0.0081	0.9643	0.9706	0.9778	0.9853	0.9885
green purchase rate^{S122}	17	0.0019	0.0014	0.0001	0.0009	0.0012	0.0029	0.0054
green purchase rate SPO^{S122}	17	0.0016	0.0012	-0.0001	0.0008	0.0011	0.0027	0.0038
issuances green (MA4)	15	1.480×10^{-5}	2.270×10^{-6}	1.040×10^{-5}	1.320×10^{-5}	1.550×10^{-5}	1.610×10^{-5}	1.870×10^{-5}
issuances total (MA4)	15	7.580×10^{-5}	4.100×10^{-5}	2.590×10^{-5}	3.870×10^{-5}	6.080×10^{-5}	1.070×10^{-4}	1.410×10^{-4}
share green^{S12}	324	0.0397	0.0259	0.0032	0.0213	0.0344	0.0522	0.1480
share green SPO^{S12}	324	0.0343	0.0220	0.0028	0.0174	0.0307	0.0472	0.1187

Table 16: Correlation matrix

	Green share^{S122}	Green SPO share^{S122}	Non-green share^{S122}	Green PR^{S122}	Green PR SPO^{S122}	Iss. green (MA4)	Iss. total (MA4)
Green share^{S122}	1.0000						
Green SPO share^{S122}	0.9964	1.0000					
Non-green share^{S122}	-1.0000	-0.9964	1.0000				
Green PR^{S122}	0.4237	0.4166	-0.4237	1.0000			
Green PR SPO^{S122}	0.2367	0.2498	-0.2367	0.9470	1.0000		
Iss. green (MA4)	-0.7013	-0.6492	0.7013	-0.1650	0.1084	1.0000	
Iss. total (MA4)	0.3215	0.3901	-0.3215	0.0856	0.1963	0.3551	1.0000

Table 17: Country-level green bond shares of financial corporations

Country	(1) Green (Pre)	(2) Green (Post)	(3) Green SPO (Pre)	(4) Green SPO (Post)	(5) Δ Green (pp)	(6) Δ Green SPO (pp)
AT	3.12	5.17	2.96	4.93	2.10	1.97
CY	2.85	4.54	1.43	3.51	1.70	2.08
DE	3.43	5.47	3.25	5.17	2.03	1.93
EE	10.55	12.95	7.52	11.47	2.39	3.95
ES	2.18	3.54	1.94	3.29	1.36	1.35
FI	4.19	7.12	3.99	6.85	2.93	2.84
FR	3.33	5.20	3.15	4.92	1.87	1.77
GR	3.30	4.34	2.45	3.75	1.04	1.29
HR	0.88	1.54	0.79	1.38	0.66	0.59
IE	1.49	2.29	1.35	2.09	0.80	0.74
IT	1.93	3.84	1.80	3.72	1.96	1.92
LT	1.19	1.83	1.15	1.71	0.64	0.56
LU	4.10	6.05	3.78	5.64	1.96	1.87
LV	6.38	7.56	4.32	5.93	1.17	1.61
NL	4.33	7.75	4.01	7.40	3.42	3.30
PT	1.39	2.61	1.11	2.19	1.23	1.08
SI	2.53	5.15	2.38	4.98	2.62	2.59
SK	3.99	5.20	3.25	4.82	1.26	1.56

Notes: Shares expressed in percent. Pre = 2021Q1–2023Q4, Post = 2024Q1–2025Q2.

EXECUTIVE SUMMARY

This thesis examines whether the EU sustainable finance framework, most notably the EU Taxonomy and its related disclosure and market-standard initiatives, has been associated with a measurable change in euro area banks' green bond portfolios. Using publicly available ECB Securities Holdings Statistics by Sector (SHSS), the core indicator is the quarterly share of "green (use-of-proceeds)" debt securities held by the euro area banking sector relative to total debt securities holdings, over 2021Q1–2025Q2. The empirical strategy combines an Interrupted Time Series (ITS) design with robustness checks that address seasonality, autocorrelation (HAC/Newey–West), and supply conditions using issuance-based controls (CSEC). A placebo exercise based on the non-green share complements the identification discussion. In addition, sector comparisons with investment funds and insurers are used to position banks' dynamics relative to other major holders, including Difference-of-ITS specifications. A "quality" robustness restricts the green segment to bonds with an external review (with Second-Party Opinion, SPO), capturing changes in the credibility and standardisation of the market.

Across specifications, the results indicate a clear post-2024 increase in banks' green bond share, consistent with a durable portfolio reallocation rather than a purely transitory movement. The SPO-restricted variant exhibits a broadly similar pattern, supporting the interpretation of gradual market upgrading. By contrast, flow-based measures of green purchases are substantially more volatile and yield weaker statistical evidence, suggesting that stocks provide the most reliable signal over the short post-intervention window.

Overall, the evidence is consistent with an acceleration of banks' greening within a broader investor-wide trend, while caution is warranted regarding long-run and sector-differential causal claims given data and horizon constraints.

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