The Pricing and Persistence of Green Bond Design: Evidence from U.S. Municipal Bonds

Abstract

We examine whether a green bond’s credibility is carried by its green label or by the specific design features through which an issuer structures its use-of-proceeds commitment, and whether the features investors price are the ones issuers sustain. Using U.S. municipal green bonds issued between 2012 and 2025, we study both the static and dynamic pricing of individual design features, at issuance and as the market matures, and issuer continuation across issues. We find that investors do not price the number of disclosed features, but specific ones tied to proceeds traceability and external review, and this selectivity sharpens as the market matures. Issuers, in turn, continue features according to their own reuse benefits and costs, so some priced features are used selectively while some features whose pricing effect has faded persist as reusable infrastructure. Credibility thus resides in a green bond’s design architecture, not its label, with pricing and persistence governed by different forces.

Keywords: Green bonds; Municipal bonds; Green bond design; External review; Investor learning; Issuer dynamics

JEL-Classification: D82; G12; G14; G32; H74; Q56

1. Introduction

Green bonds are use-of-proceeds debt instruments: the issuer commits to allocate an amount equal to the proceeds to eligible environmental projects and to disclose how this commitment is structured (ICMA, 2025). This creates an information problem at issuance and an incentive problem after issuance. Investors observe the bond's financial terms, the green designation, the issuer's documentation, and any external assessment. They cannot observe at issuance how the issuer will allocate, track, report, or verify the use of proceeds over the life of the bond. Green bond design therefore has a dual role. Before issuance, observable design features may help investors distinguish more credible from less credible green commitments. After issuance, the same features can operate as bonding and monitoring mechanisms that make deviations from the use-of-proceeds commitment more costly. The relevant pricing question is therefore not only whether a bond is designated green, but which features of green bond design carry information that investors price.

Prior research shows that green bond pricing depends on issuer type, market segment, sample period, and identification design. A recent systematic literature review of financial market sustainability initiatives in green bonds shows that pricing effects are most consistent when market mechanisms improve the credibility, comparability, or interpretability of green bond information. Evidence for external review and rating-related mechanisms is particularly strong, while evidence on issuer behavior remains limited (Romeo et al., 2026). In U.S. municipal bonds, the evidence is also mixed. Karpf and Mandel (2018) show that the value of the green label changes over time, Larcker and Watts (2020) find no issue-day greenium in same-day matched issues, and Baker et al. (2022) show small pricing and ownership differences between green and ordinary municipal bonds that weaken in tighter same-issuer comparisons. Within the U.S. municipal green bond market, investors also distinguish among green bonds when project use or external verification makes the green claim more credible: green power bonds receive more favorable pricing (Bhanot et al., 2022), and externally verified green bonds have lower issuance yields than unverified green bonds (Singh et al., 2025). These findings suggest that the relevant question is not only whether a bond is labeled green, but which features of green bond design make the use-of-proceeds commitment credible enough to be priced by investors and continued by issuers.

We examine this question along three dimensions. First, do investors price green bond design as a simple accumulation of disclosed features, or do they distinguish features with different information content? Second, does the pricing of these features change as investors gain experience? Third, do issuers continue design features in later green bond issues, or is continuation selective once costs, reuse benefits, and frictions are considered? The analysis is grounded in information economics and agency theory. Information can be costly to acquire (Stigler, 1961) and quality uncertainty can prevent investors from distinguishing stronger from weaker green commitments (Akerlof, 1970) before issuance. Observable and costly design features can then serve as signals when they separate stronger from weaker commitments (Spence, 1973), including in financial markets where informed parties can convey project quality through observable actions (Leland and Pyle, 1977). Because proceeds allocation, tracking, reporting, and verification occur after issuance, the same design features also address post-issuance hidden action. They can support monitoring of issuer actions and mitigate moral hazard (Holmström, 1979), while functioning as bonding and monitoring mechanisms that reduce agency costs (Jensen and Meckling, 1976).

The U.S. municipal green bond market provides a useful empirical laboratory for our questions. First, it contains substantial within-green bond variation in design: bonds range from partial and full alignment with the four core features of the International Capital Market Association's (ICMA) Green Bond Principles (GBPs) to alignment with their additional features green bond framework and external review. This allows us to observe individual feature pricing instead of relying on a green-versus-conventional contrast. Second, the market operates within a single national institutional environment, reducing the cross-country heterogeneity in regulation and disclosure that may confound global green bond samples. Third, the sample spans the market's development from early adoption to a more mature green bond segment, allowing us to trace whether the pricing of individual design features changes over time. Fourth, repeated municipal issuers allow us to connect investor pricing at issuance to issuer continuation in later deals. We construct a sample of 22,302 green U.S. municipal bond tranches issued between 2012 and 2025 using Bloomberg and London Stock Exchange Group (LSEG) data. We code ICMA core features, full alignment, green bond framework disclosure, external review, and Climate Bonds Initiative (CBI) Certification. Yields and conventional bond characteristics are measured at the tranche level, while green bond design variables are measured at the deal level and assigned to the corresponding tranches.

Our empirical strategy proceeds in three steps. Static issuance-yield regressions estimate how individual design features are priced at issuance. We compare green municipal bonds with other green municipal bonds while controlling for conventional bond-pricing determinants, issuer fixed effects, issue-month fixed effects, and state-by-year fixed effects. Time-varying regressions interact each design feature with calendar time and report year-specific marginal effects. Issuer-dynamics models then move from tranche-level pricing to deal-level issuer histories. We estimate Mundlak-Chamberlain correlated random effects logit models that decompose issuer-history effects into within-issuer continuation and between-issuer regime differences.

Across these steps, our estimates show that green bond design is priced selectively. At issuance, investors do not reward the number of disclosed core features. Pricing instead concentrates in features tied to proceeds traceability and external review, especially management of proceeds and CBI certification. Over time, pricing becomes more selective rather than uniformly stronger: management of proceeds and ICMA alignment gain pricing relevance, whereas reporting and framework disclosure lose marginal pricing relevance as they become more standardized. On the issuer side, persistence follows reuse and regime effects rather than investor pricing alone. Some features that investors price are not automatically continued by the same issuer, while reusable disclosure infrastructure can persist even after its marginal pricing relevance fades, consistent with continuation that tracks net benefit rather than pricing alone.

We make three contributions. First, we move green bond pricing from greenness proxies to the level of individual design features, showing that design is priced selectively – in specific features, not in the label or the number of disclosures. Second, where prior work documents time variation in the average greenium, our study shows that the variation operates at the feature level: market maturation does not lift all features but reallocates pricing across them. Third, we add issuer-side evidence to the sustainable debt literature by showing that continuation occurs at the level of design features and depends on issuer regimes, reuse benefits, and costs. The findings imply that investors should not treat green bond design as a checklist. Issuers should evaluate design features as cost-benefit decisions, and sustainability initiatives should focus on the comparability and verifiability of pricing-relevant information rather than disclosure volume alone.

The remainder of the paper is organized as follows. Section 2 reviews the related literature. Section 3 develops the hypotheses. Section 4 describes the institutional background, data, and methodology. Section 5 presents the empirical results. Section 6 discusses implications. Section 7 concludes.

2. Literature Review

Research on green bond design and its information content spans three dimensions: greenness and use of proceeds, standards and alignment, and issuer-authored disclosure. Investors respond to clearer links between proceeds and eligible green activities. Bonds with a higher share of proceeds used for green projects are priced more favorably, especially when proceeds are fully green (Deng et al., 2020), and use-of-proceeds classifications explain cross-sectional variation in green bond premia (Dekker et al., 2025). Bond- and issuer-level greenness shape investors' perceived greenness and the resulting greenium (Hu et al., 2024) and officially certified labeled green bonds reduce yield spreads more clearly than green characteristics alone (Q. Li et al., 2022). On standards and alignment, higher compliance with the ICMA GBPs is associated with stronger investor demand measured through bid-ask and yield-spread outcomes (Nanayakkara and Colombage, 2021), while stricter Korea Green Bond Guidelines do not generate an incremental pricing benefit over ICMA GBPs (Keum, 2025). Investors also require compensation for selected green bond prospectus risk-factor disclosures, especially EU Taxonomy compliance and asset-framework risks (McGee et al., 2025). Issuer-authored disclosure matters primarily when it makes green bond information more specific or easier to process. Framework disclosure, annual reports, and document readability improve secondary-market liquidity (Lebelle et al., 2022). Project-level transparency and higher environmental information disclosure quality are associated with lower green bond yields or spreads (Jankovic et al., 2022; Tang et al., 2023; Zhou and Gao, 2026), while environmental information transparency is favorably reflected in green bond credit ratings (Yang et al., 2023). Textual evidence also shows that green bonds exhibit an information-disclosure advantage over conventional bonds, particularly when they are certified or allocate a larger share of proceeds to green projects, and that this advantage is associated with lower information asymmetry and greater investor attention (R. Li et al., 2025). Less readable prospectuses increase credit spreads whereas green terms and positive tone reduce them (Sharma and Sharma, 2025). Across these dimensions, credibility is read through broad indicators (greenness, standards, and disclosure) rather than the individual design features investors evaluate, the level our analysis takes up.

The second relevant strand studies the U.S. municipal green bond market and reports two central findings. First, the green label itself is not uniformly priced. The municipal market allows tight comparisons because issuers often sell green and ordinary securities with similar issuer risk, maturity, tax status, and credit support (Larcker and Watts, 2020; Baker et al., 2022). In this setting, the estimated label premium is highly sensitive to identification. It varies over time in broader municipal samples (Karpf and Mandel, 2018), disappears in same-day matched green and ordinary tranches (Larcker and Watts, 2020), and appears only as a small premium in broader samples or later secondary-market trading (Baker et al., 2022). Second, investors differentiate within municipal green bonds when the green design contains clearer information. Green municipal power bonds with easily identifiable environmental benefits command lower yields relative to other green municipal bonds (Bhanot et al., 2022) and externally labeled, or verified, green municipal bonds are issued at lower yields than internally labeled, unverified green municipal bonds (Singh et al., 2025). This strand provides identification rather than granularity. It offers a clean municipal setting in which green information is still read through the label, project category, or verification status, whereas we read it at the level of individual design features.

A third strand examines external review. This literature first shows that external reviews can affect green bond pricing and liquidity by reducing uncertainty about the credibility of the green claim. External review and issuer reputation help reduce information asymmetry and improve financing conditions, especially for private issuers (Bachelet et al., 2019). Certified corporate green bonds generate stronger stock-market reactions, consistent with certification making the green bond signal more credible (Flammer, 2021). In primary bond markets, external review is associated with an additional issuance-yield discount for non-financial corporate green bonds, although pricing effects differ across issuer types (Fatica et al., 2021). More granular evidence shows that the content and quality of external review matter as well. Green bond premia are stronger when SPO-based greenness evaluations assign darker shades of green (Dorfleitner et al., 2022). SPO-based greenness ratings improve liquidity, with the effect concentrated among corporate and municipal issuers (Dorfleitner et al., 2023). SPOs also appear particularly informative when formal credit ratings are absent, but not when rated bonds already provide conventional credit information (Ghitti et al., 2025). At the same time, the literature cautions against treating external review as uniformly credible. Certification effects are stronger when the certifying agency is professional and reputable (Xing and Wu, 2025). The post-issuance environmental-disclosure response to green bond issuance is stronger when bonds are certified by an independent third party (Liu et al., 2026), but certification does not always translate into better environmental outcomes and may induce strategic R&D manipulation (Sun and Hao, 2025). More broadly, green bond issuance can be associated with selective disclosure and greenwashing (Y. Li et al., 2025), and certification markets may face credibility problems when certifier competition weakens standards (Glavas, 2026). This evidence establishes that external review matters and that its quality can matter. Within our design-feature framework, we ask whether it is the quality of external review, not its mere presence, that is priced.

A fourth strand concerns information production and learning in capital markets. It finds that prices do not only reflect a fixed set of publicly observable characteristics but also information produced, aggregated, and reassessed through market activity. In primary markets, information is produced before issuance through investor demand revelation, bookbuilding, and order-book formation. This information enters offer prices and allocations, although price adjustment to newly revealed information is often incomplete (Benveniste and Spindt, 1989; Hanley, 1993; Cornelli and Goldreich, 2003). Learning also extends across issuances. Information generated during one issuance process can affect subsequent issuance decisions, issuance cycles, and related issuances exposed to common valuation factors (Lowry and Schwert, 2002; Benveniste et al., 2003). Asset-pricing evidence reinforces the idea that the pricing relevance of signals can change over time. Return-predictive characteristics can lose pricing relevance when liquidity, trading activity, and arbitrage capacity increase (Chordia et al., 2014), and the apparent value of accounting-based characteristics can weaken out of sample, raising questions about signal reliability (Linnainmaa and Roberts, 2018). Green bond research provides evidence consistent with this broader learning perspective, but studies time variation mostly at an aggregate level. In U.S. municipal bonds, the value of the green label changes over time (Karpf and Mandel, 2018). In global corporate primary markets, a significant greenium emerges only from 2019 onward and is linked to demand pressure and the growth of sustainable asset management (Caramichael and Rapp, 2024). Investors also revise compensation for disclosed green bond risk factors as sustainable finance regulation develops, especially around EU Taxonomy compliance and asset-framework risks (McGee et al., 2025). Repeated green bond issuance can reduce information asymmetry and lower yields, suggesting that issuer history itself becomes an information channel (Hyun et al., 2023). We take this learning to the level of individual design features, asking which of them remain informative over time.

A fifth strand concerns dynamic financing choice and persistence in capital markets. Its central insight is that financing decisions are not reset at each issuance. Firms adjust financing policies only when the expected benefits of moving toward a new structure exceed adjustment costs, so observed financing choices can remain sticky even when target conditions change (Leary and Roberts, 2005). Financing histories also have persistent effects. Current capital structure reflects past deficits, investment, and valuation histories, not only contemporaneous targets (Kayhan and Titman, 2007), and persistent firm-level effects explain a large share of cross-sectional capital-structure variation (Lemmon et al., 2008). This persistence extends to debt market design. Firms often specialize in particular debt types, suggesting that debt structure itself can be persistent rather than continuously re-optimized (Colla et al., 2013). Capital-market relationships can also have value when they embed private information, monitoring, investor networks, or switching costs, although such relationship capital appears stronger for equity underwriting than for debt underwriting (Yasuda, 2005; Fernando et al., 2012). Together, this literature implies that continuation can be understood as a net-benefit decision. Issuers may retain prior financing practices when reuse benefits, relationship capital, reputation, or switching costs outweigh the benefits of redesign. Green bond and sustainable debt research provide related evidence that issuer history matters, but it usually studies dynamics at the level of market access or repeated segment choice. Return green bond issuers benefit from an additional premium, which Fatica et al. (2021) interpret as a reputation effect at least for non-financial corporates. Frequent green bond issuance is associated with lower yields and reduced information asymmetry (Hyun et al., 2023). Borrowers with prior GSS issuance and external-assurance commitments are also more likely to return to the sustainable bond segment (Becker et al., 2025). We examine whether this persistence reaches individual design features – whether issuers continue specific features across their later green bond issues.

3. Theory and Hypotheses

Prior studies find that green bond outcomes depend on information about proceeds, standards, disclosure, and external review, but this information is generally measured through broad categories. We derive the first four hypotheses by varying the information environment in which investors interpret green bond design at issuance. We use information environments to refer to the observable information set available to investors when the bond is priced. This includes individual design features, a standardized regime, issuer-authored disclosure, third-party assessment, and external review quality. H1 starts from the least structured setting, in which investors observe individual design features outside a standardized regime. H2 adds a recognized standard that organizes these features into a common structure. H3 asks whether additional disclosure or external review still matters once this standard is already in place. H4 further distinguishes the quality of external reviews. H5 then turns from static information environments to changes in pricing over market maturity, and H6 shifts to issuer-side continuation decisions.

In the least structured information environment, investors observe individual design features but cannot rely on a standardized information package. This setting makes the distinction between feature accumulation and feature informativeness most visible. The relevant anchor is information economics, which treats information as costly to acquire and process (Stigler, 1961). Signaling theory specializes this to observable, costly actions that can sustain a separating equilibrium between stronger and weaker types (Spence, 1973). An observable characteristic becomes informative only if it changes beliefs about an unobserved quality dimension. Visibility alone is not enough, meaning a disclosed choice can be observed without helping investors separate stronger from weaker types. Leland and Pyle (1977) make the same logic relevant for financial markets. When issuers are better informed than outside investors and direct communication is limited by incentive and verification problems, investors rely on observable actions to infer quality.

Applied to green bonds, this logic implies that design features should not be treated as interchangeable. The uncertainty investors face at issuance is largely about the issuer's future conduct over the life of the bond, namely whether proceeds will in fact be allocated, tracked, reported, and externally reviewed as represented, rather than only about a quality fixed at the outset. Features that impose ongoing allocation, tracking, reporting, or external verification bind this future conduct. Because such binding is more burdensome for an issuer that does not intend to follow through, adopting it is incentive-incompatible for weaker commitments, and the commitment property becomes the source of the signal's credibility. Self-binding and separation coincide rather than compete.

To avoid defining informativeness ex-post, we define the theoretically more informative features ex-ante as those that bind or monitor the issuer's future conduct. Use of Proceeds is the baseline core feature in our sample and is fulfilled by all green bonds. Among the varying core features, Management of Proceeds is the most direct conduct-binding core feature because it concerns whether proceeds remain identifiable and controlled until allocation. Core feature Reporting supports ex-post monitoring, but its signal at issuance is more indirect because the promised information is delivered later. Core feature Process for Project Evaluation and

Selection clarifies screening and selection procedures but does not by itself track or control proceeds after issuance.

Features that bind conduct in this way address the relevant uncertainty more directly than features that mainly make the green bond more visible or easier to analyze. A simple feature count treats each disclosed feature as having the same marginal information content. That restriction is inconsistent with this logic. If investors use design features to update beliefs about the green bond, pricing should depend on the more informative feature within the design rather than on the number of disclosed features.

This distinction is clearest outside a recognized full-alignment regime. In that segment, investors cannot rely on a standardized product and must infer design quality from the individual features disclosed at issuance.

H1: *Among green bonds outside a standardized regime, lower issuance yields should be associated with conduct-binding design features rather than with a linear increase in feature count.*

The next information environment differs because the design features are no longer presented only as separate features but are organized under a standardized regime (ICMA GBPs). Whether this organization is priced beyond the features it bundles is genuinely open. A recognized standard might carry independent coordination value, or it might only repackage information investors can already read from the underlying features.

Stigler (1961) emphasizes that information is costly to acquire and compare. A recognized standard can reduce these costs by giving investors a common structure for interpreting a green bond's design. In this sense, alignment is not just another disclosed feature. It can make several underlying features easier to evaluate together. Farrell and Saloner (1985) show that standardization can create value by improving compatibility and coordination. In the present setting, the relevant analogue to compatibility is informational. Investors can compare issues more easily when design features are organized under a common market standard.

This creates a different prediction from a pure label effect. If a standard merely names a bond as green, it should add little information. If it organizes the issuer's use-of-proceeds claim, management of proceeds, and reporting commitment in a recognized format, it can reduce interpretation costs and make the design more comparable across bonds. At the same time, its incremental pricing value should be weaker than the pricing value of conduct-binding individual design features when investors can observe those features directly. The standard then partly summarizes information already available in the disclosed design rather than creating a new conduct-binding commitment.

H2: *Full alignment with a recognized green bond standard should be associated with a smaller issuance yield discount than conduct-binding individual design features.*

Conditional on this standardized information environment, the marginal information problem changes. Investors already observe a standardized (ICMA GBPs) core-feature structure, so additional features should carry incremental information only if they change what investors can infer beyond the standardized structure. The relevant distinction is the source of information. Framework disclosure is issuer-authored. It can reduce processing costs by organizing the issuer's use-of-proceeds commitment, management of proceeds, and reporting approach. Public disclosure can reduce information asymmetry and lower the cost of capital when it improves market liquidity (Diamond and Verrecchia, 1991). Yet voluntary disclosure is strategic when disclosure is costly and market participants understand that managers may withhold or shape unfavorable information (Verrecchia, 1983). Applied to green bonds, framework disclosure may clarify the issuer's narrative, but it does not change who evaluates the green bond design. The issuer remains the party describing its own commitment.

External review has a different role. It does not add more issuer-authored information but introduces an outside evaluator into the information process. When buyers cannot assess quality at low cost, an expert intermediary can help validate quality and reduce adverse selection problems (Biglaiser, 1993). Finance research provides a parallel certification argument: in capital raising, reputable underwriters can certify issue prices when insiders may possess adverse information (Booth and Smith, 1986). External review is not underwriting, but it serves a related information-source role in the green bond setting by reducing reliance on the issuer's own representation and providing an outside check on the design. This distinction matters most within a standardized regime. Once investors already observe a standardized design, additional issuer-authored disclosure may have limited marginal value because much of the structure is already known. External review, by contrast, can still reduce uncertainty because it changes who evaluates the design.

The prediction is therefore not that every additional feature should be priced equally within the standardized green bond segment. Instead, the marginal pricing effect should depend on the source of the information. Issuer-authored disclosure should have weaker incremental value once a standardized baseline exists. External review should have stronger incremental value because it reduces reliance on the issuer's own statement.

H3: *Within a standardized regime, external reviews should be associated with a larger issuance yield discount than framework disclosure.*

The final static information environment remains within the standardized regime and decomposes external review into external review quality categories. H3 establishes the information-source distinction between issuer-authored disclosure and external review. H4 asks whether the external review quality changes the information conveyed by that outside evaluation.

Lizzeri (1999) models certification intermediaries as agents that acquire information about privately known quality and decide what information to reveal to uninformed market participants. A key implication is that certification need not disclose full quality to be valuable. Even a coarse certification rule can matter if it reveals that quality exceeds a relevant threshold. The information value of certification therefore depends on the threshold, the assessment procedure, and the credibility of the intermediary. Finance research provides a capital-market analogue. Booth and Smith (1986) develop a certification hypothesis in which underwriters certify that issue prices are consistent with inside information, and in which credibility depends on reputational bonding by the certifying intermediary. Although external review is not underwriting, the analogy is useful because both mechanisms introduce an outside certifier into a capital-raising setting with asymmetric information.

Applied to green bonds, this implies that external review quality should matter. A basic external review may reduce reliance on the issuer's own statement, but its information content can vary with scope and procedure. A higher review tier should provide more precise threshold information because it classifies the bond as meeting a defined external review standard.

Consistent with the logic developed in H1, this classification can also increase expected accountability around post-issuance allocation, tracking, and reporting. Investors observe an external review category that makes the issuer's future conduct more subject to an external standard.

This distinction is again most relevant within a standardized regime. Once investors already observe a standardized design and any additional external review, the remaining question is whether the review mechanism provides additional threshold information beyond review presence. If investors use external reviews to update beliefs about the credibility of the use-of-proceeds commitment, the pricing effect should increase with review quality. The strongest yield discount should therefore be associated with the highest review tier rather than with generic external review alone.

H4: *Within a standardized regime, issuance yield discounts should increase with review quality, with the strongest expected discount for the highest review tier.*

The preceding hypotheses describe how investors interpret green bond design within static information environments. H5 introduces market maturity into the information environment. As the green bond market matures, investors repeatedly observe design features, external review categories, pricing outcomes, and issuer follow-through. The relevant question is therefore whether market experience changes how investors weight the different parts of the design architecture.

Information economics provides the relevant mechanism. Grossman and Stiglitz (1980) show that information is costly and that prices cannot fully reflect all available information when investors must be compensated for acquiring it. Public signals can also change investors' incentives to acquire private information and alter the equilibrium allocation of private information across signal sources (Lundholm, 1991). Investors therefore have incentives to economize on information processing rather than evaluate every observable characteristic with equal intensity. Limited attention models reinforce this point. Even publicly available information may be processed differently depending on salience, complexity, and ease of interpretation (Hirshleifer and Teoh, 2003). More directly, models of endogenous information choice show that investors choose what to learn about and may specialize in information that is expected to be most useful for their decisions (Van Nieuwerburgh and Veldkamp, 2010).

Applied to green bonds, this logic implies that the pricing of design features should change as investors gain experience with the market. In early stages, investors may rely on broad, visible or easily observable features because these help classify the bond and reduce basic uncertainty. As similar disclosures become common and easier to interpret, their marginal differentiating value should decline. By contrast, design features that remain more useful for distinguishing stronger from weaker green bond designs should retain or gain pricing relevance because they remain costly to imitate, conduct-binding, externally disciplined, or useful for coordinating interpretation.

This prediction differs from a general time trend in the greenium. It is not that all green bond design features should become more valuable as the market grows. Rather, pricing should become more selective. As investors learn which features continue to differentiate stronger from weaker green bond design, yield discounts should become concentrated in features that continue to differentiate credible design, while discounts should weaken for features that become standardized, common, or less differentiating.

H5: *As the market matures, issuance yield discounts should become more concentrated in design features that continue to differentiate credible green bond designs, and should weaken for design features that become standardized, common, or less differentiating.*

H6 shifts from investor pricing to issuer-side continuation. Investor pricing and issuer continuation need not coincide because they are governed by different economic margins. Investors price design features when they help interpret credibility at issuance. Issuers continue design features when prior use creates organizational, reputational, or relationship-based advantages that make reuse attractive relative to redesign. A feature can therefore be valued by investors but still be used selectively by issuers if it is costly to maintain. Conversely, a feature can persist even after its marginal pricing effect weakens if prior implementation creates reusable infrastructure.

Dynamic theories of learning and frictions provide the mechanism. Arrow (1962) shows that experience can reduce costs through learning-by-doing. Applied to green bond design, prior use can create reusable routines, templates, internal processes, and relationships with outside evaluators or advisors. A design feature that has already been implemented may therefore be cheaper to use again than to introduce for the first time. Klemperer (1987) shows that switching costs can make established choices costly to change. In this setting, changing design practices, replacing external parties, or rebuilding internal procedures can make continuation attractive even when the marginal pricing benefit is not large.

Reputation provides a second continuation channel. In repeated interactions with imperfect information, current behavior can affect how future counterparties interpret an actor's type (Kreps and Wilson, 1982). In debt markets, reputation can mitigate borrower–lender incentive conflicts over time because track records become valuable when lenders cannot directly observe borrower actions or project choice (Diamond, 1989). Monitoring and reputation are also linked in debt contracting. When reputation is less established, external monitoring can help control incentive problems, whereas stronger reputation can reduce the need for costly monitoring (Diamond, 1991). More generally, repeated market interaction can support contractual performance when current quality is difficult to observe (Klein and Leffler, 1981), and reputation can sustain quality when buyers cannot fully observe quality before purchase (Shapiro, 1983). Applied to green bonds, continuing previously used design features can help preserve a reputation for consistent implementation because investors cannot fully observe at issuance whether the issuer will maintain allocation, tracking, and reporting discipline over the life of the bond. Discontinuing them may weaken that reputation or force investors to reassess the credibility of the issuer's green bond design.

These mechanisms imply observable history dependence in issuer continuation rather than automatic continuation. Prior adoption and prior use intensity should proxy for accumulated experience, reusable infrastructure, and reputation. Recent use should be especially relevant because routines, relationships, and documentation remain active. Longer inactivity should weaken continuation because routines depreciate, relationships may lapse, and reputational continuity becomes less immediate. At the same time, continuation should not be automatic. Design features with high maintenance costs, limited reuse value, or declining marginal differentiation value may be used more selectively.

H6: *Issuer-history measures should predict subsequent design feature use: prior adoption, prior use intensity, and recent use of a design feature should be positively associated with its subsequent use, whereas longer inactivity should be negatively associated with subsequent use.*

4. Research Design and Data

4.1. Institutional Background

The U.S. municipal green bond market is well suited for studying green bond design because it combines substantial variation in labels, verification, and design features with a large pool of green bonds that are not fully aligned with the four ICMA core features. It also provides a long issuance history, with comprehensive green municipal bond data beginning in 2012, and a geographically homogeneous institutional environment within the United States. These features allow us to study variation within green municipal bonds while avoiding part of the cross-country heterogeneity that complicates global green bond samples. The setting is also increasingly used in the empirical literature, which highlights the U.S. municipal market as an informative setting for studying green bond pricing and ownership (Karpf and Mandel, 2018; Larcker and Watts, 2020; Baker et al., 2022).

We organize green bond design around the Green Bond Principles of the International Capital Market Association. The ICMA GBPs are voluntary process guidelines that recommend transparency and disclosure and promote integrity in the green bond market. They define four core features for ICMA alignment: Use of Proceeds, Process for Project Evaluation and Selection, Management of Proceeds, and Reporting. They also identify Green Bond Frameworks and External Reviews as key recommendations for heightened transparency (ICMA, 2025). This structure maps directly into our empirical variables. Core Feature Count measures the number of disclosed core features, and ICMA Alignment equals one when all four core features are present. Framework captures issuer-authored framework disclosure. Any External Review captures whether any third-party external review is present, including CBI Certification.

We treat ICMA Alignment as a complete core design structure rather than as a pure green label. We further separate issuer-authored framework disclosure from third-party external review and distinguish broad review presence from review quality. Any External Review equals one for any third-party external review, including CBI Certification. External Review Quality partitions this information into three categories: No External Review, External Review Only, and CBI Certification. External Review Only therefore refers to reviewed bonds that are not CBI-certified. CBI Certification is tied to the Climate Bonds Standard and Sector Criteria, relies on assessment by Climate Bonds approved verifiers (Climate Bonds Initiative, 2026a), and awards a certification label after review of the verification report and supporting documentation (Climate Bonds Initiative, 2026b).

The design features also differ in expected cost intensity. We do not observe monetary feature costs directly, but the institutional requirements imply differences in setup, implementation, external review, and continuation costs. Use of Proceeds and Process for Project Evaluation and Selection mainly require classification and process disclosure. Management of Proceeds and Reporting require tracking, periodic updating, and recurring disclosure. Frameworks create front-loaded issuer disclosure costs that may be reusable across later issues. External Reviews add third-party coordination and review costs. CBI Certification is expected to be more demanding than generic external review because it involves approved verifier assessment, Climate Bonds review, pre- and post-issuance requirements, and both certification and verifier fees (Climate Bonds Initiative, 2026b). Table 1 summarizes the institutional meaning, information channel, expected cost structure, and empirical operationalization of each design feature.

Table 1

4.2. Sample and Descriptives

We construct the sample from Bloomberg's universe of U.S. municipal green bonds. Bloomberg provides the green bond classification, the ICMA related feature indicators, and the main bond- and tranche-level characteristics, including issuance yield, issue date, maturity, coupon type, issue size, tax status, ratings, and contractual features. We complement review information with LSEG. The use of Bloomberg green bond classifications follows prior work on the U.S. municipal green bond market, while recognizing that a database green classification is not equivalent to external review or ex-post implementation evidence (Karpf and Mandel, 2018; Larcker and Watts, 2020; Baker et al., 2022; Singh et al., 2025).

Table 2 reports the sample construction process. The raw file contains 42,894 securities. We retain fixed-rate and zero-coupon bonds, exclude observations without issuance-yield information, remove sustainability-linked bonds, restrict the sample to issues from 2012 onward, and exclude bonds with maturities below one year or above fifty years. We then retain securities classified as green. The final pricing sample contains 22,302 green U.S. municipal bond tranches. The sample sizes in Tables 2, 3, and 6 refer to different stages of the analysis. Table 2 first reports the full pricing sample of 22,302 tranches after the general cleaning filters.

Because Core Feature Count and ICMA Alignment require complete information on all four ICMA core features, the ICMA Alignment comparison sample used for H2 contains 22,266 observations, of which 14,991 are non-ICMA-aligned and 7,275 are ICMA-aligned. The ICMA-aligned subset of 7,275 observations is the construction sample for H3 and H4. After regression-specific missing-value, fixed-effect, and singleton restrictions, the final Table 6 samples are 6,962 observations for H3 and 7,130 observations for H4. The H1 feature-level tests use a narrower non-ICMA-aligned feature sample of 13,415 observations because they require fewer than four core features and sufficient within-year variation in the individual design features used in those regressions. Table 3 reports variable-specific non-missing counts within these construction samples. Table 6 reports final regression samples after requiring non-missing values for the dependent variable, the relevant design variables, all controls, and fixed-effect identifiers and after dropping singleton observations induced by the fixed effects. Thus, the H2 construction sample of 22,266 becomes 21,841 observations in the final H2 regression, while the H1 construction sample of 13,415 becomes 13,167 observations in the main H1 regressions. The H1 specification that additionally includes Framework and Any External Review contains 13,165 observations because these variables require additional non-missing design information.

Table 2

The main pricing outcome is the yield at issuance. Issuance yields reflect the risk-free term structure, credit risk, tax treatment, liquidity, issue size, maturity, embedded options, ratings, and other contractual characteristics. We therefore interpret the coefficients on green bond design variables as the pricing of information about the credibility of the green bond only conditional on conventional bond pricing determinants and fixed effects. Negative coefficients indicate lower required yields, consistent with a credibility premium, whereas positive coefficients indicate higher required yields, consistent with perceived additional risk or greenwashing concerns. This interpretation follows the empirical logic in our research design, where the residual pricing component captures information about greenness after controlling for conventional bond pricing factors.

The key design variables follow the institutional structure described in Section 4.1. We code the ICMA core features as separate indicators where they vary in the data. Use of Proceeds is embedded in the green classification and is fulfilled for every green bond in our sample. It therefore does not vary across observations and is not included as a separate regressor. Core Feature Count equals one for Use of Proceeds plus the indicators for Process for Project

Evaluation and Selection, Management of Proceeds, and Reporting. ICMA Alignment equals one when Core Feature Count equals four. We further identify Framework, Any External Review, and External Review Quality. Any External Review equals one if any third-party external review is present, including CBI Certification. External Review Quality partitions this information into three categories: no external review, External Review Only, and CBI Certification.

The empirical analyses use different construction samples because the hypotheses refer to different institutional settings. H1 uses the non-ICMA-aligned feature sample to study feature accumulation and individual feature informativeness among bonds with incomplete core-feature structures. H2 uses the ICMA Alignment comparison sample to compare bonds with and without all four ICMA core features based on complete core feature information. H3 and H4 use the ICMA-aligned sample to study Framework, Any External Review, and External Review Quality conditional on the full ICMA core feature structure. The issuer-dynamics sample is constructed separately from repeated issuers and is used to measure prior adoption, prior intensity, inactivity, and recency in the issuer's own green bond history.

Table 3 reports descriptive statistics. Counts are variable-specific because not all design variables are observed for the same construction sample. Issuance Yield and the conventional bond characteristics are reported for the full pricing sample, whereas Core Feature Count, the individual core-feature indicators, and ICMA Alignment are reported for the 22,266 observations with complete core feature information. The average issuance yield is 2.49%, and the average maturity is 11.27 years. Within the complete core feature sample, the average Core Feature Count is 2.05 and 32.6% of observations are ICMA-aligned. In the full pricing sample, 32.5% have a Framework and 25.3% have Any External Review. These figures confirm that the data contain sufficient variation to distinguish feature accumulation, individual design features, ICMA alignment, issuer-authored framework disclosure, and external review quality.

Table 3

Figure 1 and Figure 2 show how ICMA alignment and review quality evolve over time. These figures illustrate that the market becomes more structured over the sample period, but also that non-ICMA-aligned bonds and bonds without external review remain an important part of the market. This time-series variation motivates the market-learning analysis and supports the use of separate full, non-ICMA-aligned, ICMA-aligned, and issuer-dynamics samples.

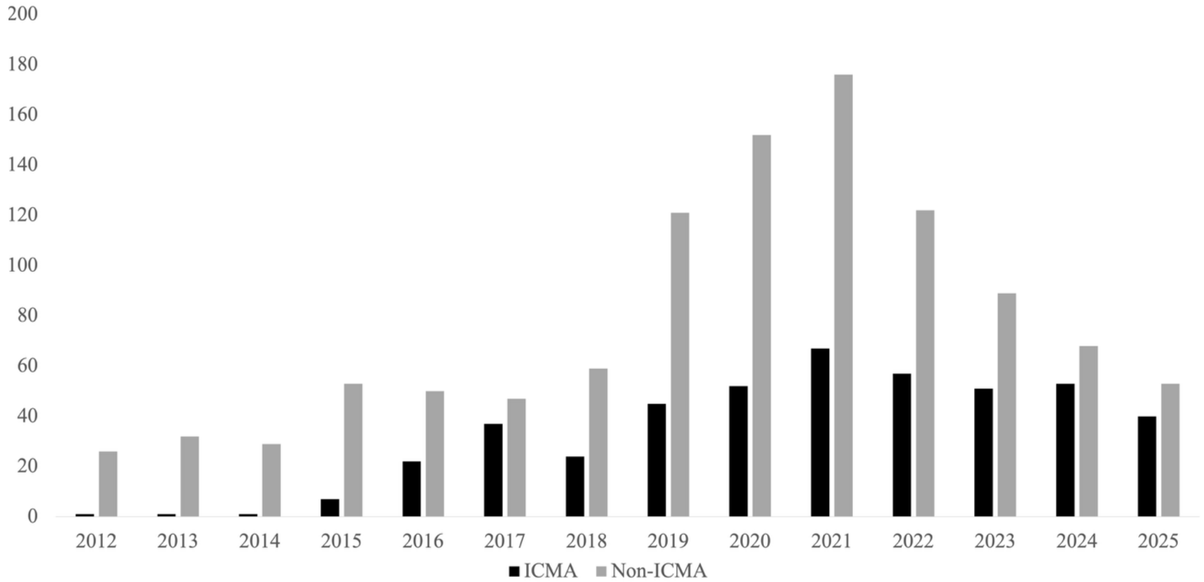


Figure 1. Number of ICMA-aligned and non-ICMA-aligned green U.S. municipal bond deals in dataset over time

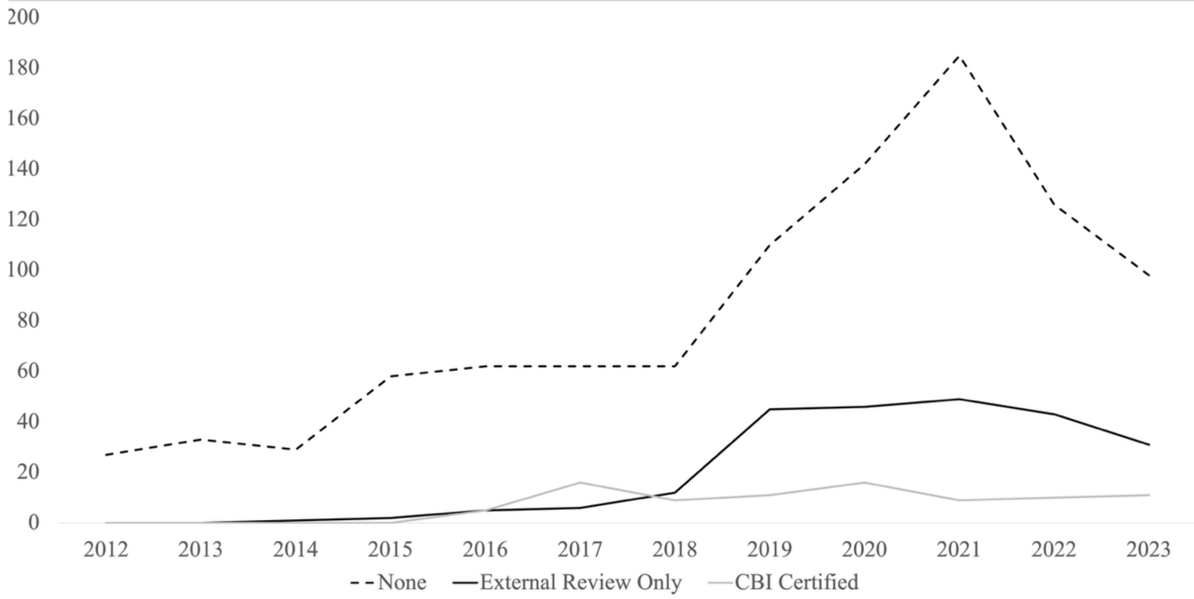


Figure 2. Number of verified green U.S. municipal bond deals in the dataset over time

Table 4 reports pairwise correlations for the full sample. The design variables are strongly related, as expected from the GBPs structure. Core Feature Count is highly correlated with the individual core features and ICMA alignment, and Any External Review is positively correlated with other design variables. At the same time, unconditional correlations with issuance yield are not informative about pricing effects because issuance yields are strongly affected by conventional bond characteristics such as maturity and the risk-free term structure. This motivates the multivariate specifications in Section 4.3.

(Table 4)

4.3. Methodology

4.3.1. Static Pricing

We first estimate static issuance-yield regressions to test whether green bond design features are priced in the primary market. The unit of observation is the tranche-level municipal security. Green bond design variables are measured at the deal level and assigned to the corresponding tranches, whereas issuance yields and conventional bond characteristics vary at the tranche level. Because all tranches in the pricing sample are classified as green, the regressions estimate conditional yield differences within green municipal bonds. This corresponds to our research question of whether the design features of the green bond contain priced information beyond conventional bond-pricing determinants.

We use issuance yields rather than secondary-market yields because green bond design is disclosed before or at issuance, and the issuance yield captures whether investors incorporate this information into the issuer's initial cost of funds. Secondary-market yields would additionally reflect post-issuance liquidity, trading pressure, ownership changes, and information arriving after the design choice. This focus is consistent with recent primary market green bond pricing studies that analyze whether green bonds lower issuers' borrowing costs at issuance (Caramichael and Rapp, 2024). Our baseline specification is:

$$Yield_{\tau ist} = \alpha + \beta Feature_{\mathrm{d}(\tau)t} + \gamma \chi_{\tau ist} + \mu_i + \lambda_m + \delta_{s\times y} + \varepsilon_{\tau ist} \quad (1)$$

$Yield_{\tau ist}$ is the yield at issuance of tranche τ, issued by issuer i, located in state s, at time t. $Feature_{\mathrm{d}(\tau)t}$ denotes the green bond design variable or vector of design variables for the deal d to which tranche τ belongs. $\chi_{\tau ist}$ includes conventional tranche-level bond pricing controls measured at issuance. These are Tax Status, Maturity, log Issue Size, Tranche Rating, Callable, Putable, Sinkable, Bank Qualified status, and the matched Treasury Yield. Putable occurs only in a negligible number of tranches and is therefore included where estimable but omitted automatically in specifications in which it is collinear with the fixed effects or has no usable within-sample variation. Tax Status enters as federal tax-status category indicators: we distinguish tax-exempt bonds, bonds subject to the federal Alternative Minimum Tax (AMT), and federally taxable bonds. Because the reported specifications include Tax-Exempt and

Taxable indicators, Subject to AMT is the omitted category.. We include issuer fixed effects μ_i , issue-month fixed effects λ_m, and state-by-year fixed effects $\delta_{s\times y}$.

Issuer fixed effects absorb time-invariant issuer characteristics such as credit quality, reputation, disclosure style, investor base, and repeated access to the municipal market. This follows the U.S. municipal green bond literature, which either compares securities from the same issuer on the same day (Larcker and Watts, 2020) or includes issuer fixed effects in pooled municipal yield regressions (Baker et al., 2022). Issue-month fixed effects control for common issuance market conditions at a higher frequency than year fixed effects. This is important because municipal issuance yields move with short-run changes in the Treasury curve, credit conditions, market liquidity, and investor demand. Prior U.S. municipal green bond work uses issue-month matching (Larcker and Watts, 2020) or maturity-rating-issue-month fixed effects (Baker et al., 2022) to hold such market conditions constant. State-by-year fixed effects absorb time-varying state-level factors, including state tax treatment, local fiscal conditions, regulation, and local preferences for sustainable investments. Controlling for state is important in municipal bond pricing because state taxation affects asset prices (Larcker and Watts, 2020).

Standard errors are two-way clustered by issuer and issue month. Issuer-level clustering allows pricing errors to be correlated across multiple tranches and issues from the same issuer, consistent with the clustering approach used in municipal green bond regressions (Baker et al., 2022). Month-level clustering allows for correlated errors across securities issued under the same market conditions (Petersen, 2009; Cameron et al., 2011). This inference strategy is consistent with recent primary-market green bond pricing work that clusters by issuer and year-month (Caramichael and Rapp, 2024) as well as with standard recommendations for multi-way clustering in finance panel data (Petersen, 2009; Cameron et al., 2011).

The coefficient vector β is interpreted as a conditional pricing association between green bond design and issuance yields. A negative coefficient indicates a lower required yield, consistent with investors assigning credibility value to the design feature. A positive coefficient indicates a higher required yield, consistent with perceived additional risk or remaining concerns about the design feature. We do not interpret the estimates as causal effects of randomly assigned design features.

The design vector and sample vary by hypothesis. For H1, we restrict the sample to non-ICMA-aligned green bonds with fewer than four ICMA core features. We first include Core Feature Count to test whether investors price feature accumulation. We then replace the count with the individual core design features for Process for Project Evaluation and Selection, Management of Proceeds, and Reporting to test feature informativeness. For H2, we use the ICMA alignment comparison sample and include ICMA Alignment, defined as the presence of all four ICMA core features. For H3, we restrict the sample to ICMA-aligned bonds and include Framework and Any External Review to compare issuer-authored disclosure with external review. For H4, we again use the ICMA-aligned sample and replace Any External Review with two External Review Quality indicators, External Review Only and CBI Certification. The omitted category is an ICMA-aligned bond with no external review.

We estimate these specifications separately because the design variables are nested by construction and differ in their institutional interpretation. Core Feature Count is constructed as one for Use of Proceeds plus the disclosed indicators for Process for Project Evaluation and Selection, Management of Proceeds, and Reporting, while ICMA Alignment equals one only when all four core features are present. Framework disclosure and external review are also more common among bonds that disclose a more complete set of green bond design information. A single saturated regression would therefore combine feature accumulation, ICMA alignment, issuer-authored disclosure, and review quality in coefficients that are difficult to interpret. The sample-specific specifications align each test with the relevant institutional comparison. Section 5.3 reports inverse-probability-weighted robustness checks for the external review quality tests to assess whether the results are sensitive to observable selection into external review categories.

4.3.2. Dynamic Perspective

4.3.2.1. Investors

To examine whether the pricing of green bond design changes over the sample period, we extend Eq. (1) by interacting the relevant design feature variables with centered calendar year. This specification is a time-varying coefficient model. It imposes a linear functional form on the evolution of each feature's pricing effect and should therefore be interpreted as a model-based summary of gradual repricing, not as evidence that the true pricing path is necessarily linear. We use this specification because it pools information across all years, keeps the fixed effect structure and control set identical over time, and avoids the small sample and collinearity problems that arise in separate year-by-year regressions with rich fixed effects. It also provides a direct test of linear time variation in each feature's pricing effect. In functional-form checks, we also considered more flexible specifications, including nonlinear and year-specific alternatives, but use the linear specification as the main representation. Similar approaches are used in recent green bond research to study time-varying risk premia (Caramichael and Rapp, 2024; McGee et al., 2025), and the question is also motivated by evidence that green bond issuance premia are not stable over calendar time (Caramichael and Rapp, 2024). We estimate:

$$Yield_{\tau ist} = \alpha + \beta_1 Feature_{\mathrm{d}(\tau)t} + \beta_2 (Feature_{\mathrm{d}(\tau)t} \times Year_t^c) + \gamma \chi_{\tau ist} + \mu_i \quad (2)$$
$$+\lambda_m + \delta_{s \times y} + \varepsilon_{\tau ist}$$

$Year_t^c$ is the calendar issue year centered at 2012, so that $Year_t^c = 0$ for 2012 and $Year_t^c = 13$ for 2025. The main effect of calendar year is absorbed by the issue-month and state-by-year fixed effects. The coefficient β_1 gives the estimated pricing effect of $Feature$ at the start of the sample, while $\beta_2$measures the annual change in that effect. The year-specific marginal effect is:

$$ME_t(Feature) = dYield_{\tau ist} \, / \, dFeature_{\mathrm{d}(\tau)t} = \beta_1 + \beta_2 Year_t^c \quad (3)$$

For indicator variables, $ME_t(Feature)$ is the estimated yield difference in year t between tranches whose deal has the design feature and otherwise comparable tranches whose deal does not. A negative marginal effect indicates a yield discount. A negative β_2 indicates that the yield effect becomes more negative over time, whereas a positive β_2 indicates that the yield effect becomes less negative or more positive over time. We compute year-specific marginal effects and 95% confidence intervals for the same hypothesis-specific samples used in the static pricing tests.

The interaction coefficient and the year-specific marginal effects capture different aspects of the investor learning results. The coefficient $\beta_2(Feature_{\mathrm{d}(\tau)t} \times Year_t^c)$ tests for a linear time trend in the pricing effect of a specific feature. The year-specific marginal effects show whether the feature is associated with a statistically significant yield effect in a given calendar year. A statistically insignificant interaction coefficient does not imply that the feature is never priced. It only implies that the model does not detect a significant linear trend in the feature's pricing effect. Section 5.2.1 summarizes both sets of estimates, while Appendix A reports the full interaction coefficients and year-specific marginal effects.

Although the marginal effects are reported separately by year, they are estimated from one pooled interaction model. For each year, the reported effect is the linear combination $ME_t = \beta_1 + \beta_2 Year_t^c$. Its standard error is computed from the variance-covariance matrix of $\beta_1$and β_2, including their covariance. Hence, statistical significance can vary across years even though the underlying coefficients are estimated in a single model.

4.3.2.2. Issuers

To analyze issuer side continuation, we move from tranche-level pricing regressions to deal-level issuer histories. For each issuer and each design feature, we order the issuer's green bond deals by issuance date. The dependent variable y_{it} equals one if issuer i uses the specific design feature in deal t. All history variables are calculated only from the issuer's own prior green bond deals, so that current feature use is related to information available before the current deal.

We estimate a Mundlak–Chamberlain correlated random-effects logit model with a within–between decomposition of the history proxy. A pooled-logit would estimate only an overall persistence association and would not distinguish whether persistence comes from within-issuer continuation or from persistent differences between issuers. A conditional fixed-effects logit is not applicable in our setting because many issuer-feature panels contain too few outcome/feature switchers, which would drop many issuers and make several sparse feature models difficult to estimate. The CRE approach adds the issuer-specific mean of the time-varying history proxy, allowing this history proxy to be correlated with unobserved issuer heterogeneity while preserving both within- and between-issuer variation (Mundlak, 1978; Chamberlain, 1982; Wooldridge, 2019).

This approach is also used in recent empirical finance and sustainability applications when researchers need to separate within-unit dynamics from persistent between-unit heterogeneity. Simion and Rigoni (2025) use a correlated hybrid model with Mundlak corrections in a household bank-bond setting to address unobserved attributes correlated with time-varying bank and branch characteristics. Lööf et al. (2022) report within and between estimates in a correlated-random-effects model of ESG ratings and stock tail risk. In a green-innovation setting, Bryson et al. (2025) use nonlinear CRE specifications following Wooldridge (2019) to allow explanatory variables to be correlated with unobserved firm heterogeneity. We follow this empirical logic but use a Mundlak–Chamberlain CRE-logit tailored to sparse issuer-feature histories. For each feature and history proxy we estimate:

$$\Pr(y_{it} = 1 \mid \cdot) = \Lambda\big(\alpha + \beta_W\big(x_{i,t-1} - \bar{x}_i\big) + \beta_B\bar{x}_i + z'_{it}\delta + \lambda_{\text{year}(t)} + a_i\big) \quad (4)$$

Here, y_{it} indicates current use of the design feature by issuer i in deal t. $x_{i,t-1}$ is a pre-deal history proxy for the same feature, and $\bar{x}_i$ is the issuer-specific mean of that history proxy over the estimation sample. The term $x_{i,t-1} - \bar{x}_i$ captures within-issuer variation, while $\bar{x}_i$ captures between-issuer variation. z_{it} contains deal-level controls in levels, $\lambda_{\text{year}(t)}$ denotes issue-year fixed effects, and a_i is a random issuer effect. Standard errors are clustered at the issuer level. Because the issuer-dynamics models are estimated at the deal level, we aggregate tranche-level controls to issuer-date deals before estimation. Current feature use equals one if the feature appears on any tranche of the deal. Maturity and Tranche Rating are collapsed using the median across tranches. Callable, Sinkable, and Bank Qualified equal one if any tranche in the deal has the characteristic. Treasury Yield is averaged across tranches, Tax Status is assigned using the modal tax-status category and log Issue Size is based on total deal issue size. Putable is not included in these logit models because it occurs only in a negligible number of tranches and provides no stable deal-level variation for the continuation analysis.

The coefficient β_W captures the within-issuer association. It indicates whether the same issuer becomes more likely to use a design feature when its own prior history of that feature increases relative to its issuer-specific mean. The coefficient β_B captures the between-issuer association. It indicates whether issuers with higher average prior use are structurally more likely to use the feature. Thus, a positive between coefficient is consistent with persistent issuer-level regimes or issuer types, whereas the within coefficient captures continuation or reversal within the same issuer as its own history evolves. Because the model is nonlinear, these coefficients are interpreted on the logit index scale. We use them to distinguish within-issuer continuation patterns from between-issuer heterogeneity, not as causal effects of randomly assigned history.

We estimate Eq. (4) separately for each design feature and for each issuer-history proxy. All history proxies are strictly lagged and are computed only from eligible prior deals of the same issuer. Table 5 defines the proxies. They capture four dimensions of issuer history: prior adoption, prior intensity, inactivity, and recency. Prior adoption indicates whether the issuer has ever used the feature before. Prior intensity captures how often, or how consistently, the issuer has used the feature in earlier eligible deals. Recency captures whether the feature was used in the issuer's three immediately preceding eligible deals, where routines, templates, or external relationships are more likely to remain active. Inactivity captures the opposite channel: longer gaps since last use may indicate that routines, relationships, or reputational continuity have depreciated.

Table 5

The interpretation follows the within–between structure of the CRE-logit model. A positive within coefficient indicates that the same issuer becomes more likely to use a feature when its own prior history of that feature increases. A positive between coefficient indicates that issuers with higher average history of the feature are structurally more likely to use it. For prior adoption, prior intensity, and recency proxies, H6 predicts positive effects when continuation benefits remain positive. For inactivity proxies, the expected sign is negative because longer gaps should weaken continuation. We enter the proxies separately because they measure related dimensions of the same history process and are therefore correlated by construction. In addition, several feature histories are sparse, which makes more saturated specifications difficult to estimate.

Not all feature-proxy combinations are estimable. The issuer dynamics sample is unbalanced, and several design features are rarely used or switch infrequently within issuers. In addition, some history proxies restrict the effective sample by construction. Gap measures are defined only after a feature has been used at least once, and last-three-deal measures require at least three prior eligible deals. For sparse outcomes, logit models may have too little outcome variation, complete or quasi-complete prediction, collinearity with controls or year fixed effects, or non-convergence. We therefore report only estimable and interpretable specifications in the appendix tables and summarize the main issuer-dynamics patterns graphically in Section 5.2.2. Full feature-specific outputs are reported in Appendices B and C.

We use this specification to implement the Mundlak–Chamberlain CRE logic for the issuer-history proxy. We do not describe the model as a full Wooldridge–Bates Correlated Random Effects with Unbalanced Panels (CREU) specification. Such extensions add further terms to model unbalancedness and selection patterns, including issuer-specific shares of observations in each issue year, issuer-level means of time-varying controls, and variables based on the number of usable observations for each issuer in the respective estimation sample (Wooldridge, 2019; Bates et al., 2024). We explored these richer specifications, but several sparse issuer-feature outcomes became non-estimable once the additional terms were included. The main specification therefore keeps the within–between decomposition transparent and estimable across design features. The estimates are interpreted as controlled within–between associations, not as causal effects or as estimates from a full CREU model. Appendix C reports pooled-logit benchmark models that use the same issuer-history proxies, deal-level controls, issue-year fixed effects, and issuer-clustered standard errors, but do not decompose persistence into within-issuer continuation and between-issuer regime differences. For the graphical comparison in Section 5.2.2, we additionally compute average marginal effects (AMEs) from the CRE-logit models separately for the within-issuer and between-issuer Mundlak components. The standard errors of these AMEs are computed by the delta method using the issuer-clustered variance-covariance matrix from the underlying CRE-logit model. We also estimate a pooled-logit reference effect on the corresponding CRE estimation sample, so that within, between, and pooled effects are compared within the same feature-specific sample.

5. Results

5.1. Static Pricing

Table 6

Table 6 reports the static issuance-yield regressions for H1–H4. They test whether investors price variation in the design of the green bond after controlling for conventional bond pricing determinants, issuer fixed effects, issue-month fixed effects, and state-by-year fixed effects. Since yields are measured in percentage points, a coefficient of -0.10 corresponds to a ten basis point lower issuance yield.

Columns (1)–(3) examine H1, which distinguishes feature accumulation from feature informativeness among non-ICMA-aligned green bonds. Column (1) shows no evidence that investors price the number of disclosed core features. The coefficient on Core Feature Count is small and statistically insignificant. In signaling terms, visibility alone is not sufficient. An observable design choice should be priced only if it changes beliefs about the quality of the product (Spence, 1973; Leland and Pyle, 1977).

Columns (2) and (3) show that this absence of a count effect masks substantial heterogeneity across individual design features. Management of Proceeds is associated with a large and statistically significant yield discount of about 61 basis points in Column (2) and about 60 basis points in Column (3). By contrast, Process for Project Evaluation and Selection and Reporting are not statistically significant. This evidence supports H1 in a selective sense. Investors do not price feature accumulation per se. They price the feature most directly tied to proceeds traceability and the risk that funds are not managed as described.

Column (3) adds the recommended transparency and external review mechanisms to the non-ICMA-aligned sample. Framework disclosure is associated with a smaller yield discount of about 6 basis points, while Any External Review is not significant in this segment. The framework result suggests that issuer-authored documentation can matter when the green bond is otherwise less standardized. At the same time, the much smaller coefficient compared with Management of Proceeds indicates that the pricing value of additional disclosure is limited relative to design features that address proceeds tracking more directly. Overall, the H1 results support the main prediction that investors price feature informativeness rather than feature quantity.

Column (4) tests H2 by estimating the incremental pricing of alignment with all four ICMA core features. The coefficient on ICMA Alignment is negative, at about 7 basis points, but not statistically significant at the 10% level ($p \approx 0.11$). This result does not provide evidence of a large standalone standardization premium. Instead, it is consistent with the hypothesis that a recognized standardization regime carries at most a modest additional yield discount. From the perspective of information economics and standardization, full alignment may reduce interpretation and comparison costs (Stigler, 1961; Farrell and Saloner, 1985). However, because the standardization indicator partly summarizes underlying design features that investors can also observe, its incremental pricing value is limited.

Column (5) turns to H3 and restricts the sample to ICMA-aligned bonds. Within this already structured segment, Framework disclosure is not associated with a significant additional yield discount. Any External Review, by contrast, is associated with a significant yield discount of about 24 basis points. This supports the theoretical distinction between issuer-authored disclosure and third-party assessment. Disclosure theory suggests that public disclosure can reduce information asymmetry and the cost of capital (Diamond and Verrecchia, 1991), but issuer-provided information remains strategic (Verrecchia, 1983). Once the full core feature structure is already in place, an additional framework appears to add little marginal information.

External Review changes the source of evaluation and therefore continues to reduce uncertainty about the green bond.

Column (6) tests H4 by decomposing external review into External Review Only and CBI Certification, using ICMA-aligned bonds without external review as the baseline category. Both external review categories are associated with lower issuance yields. External Review Only carries a discount of about 19 basis points, while CBI Certification carries a discount of about 23 basis points and is more precisely estimated. This is consistent with the certification logic that external review can provide public information about whether a claim satisfies a relevant threshold (Lizzeri, 1999). The evidence indicates that investors price review within ICMA-aligned green bonds. It is also consistent with an external review quality ladder, although the difference between External Review Only and CBI Certification is modest. The results should therefore not be read as evidence that generic external review has no value.

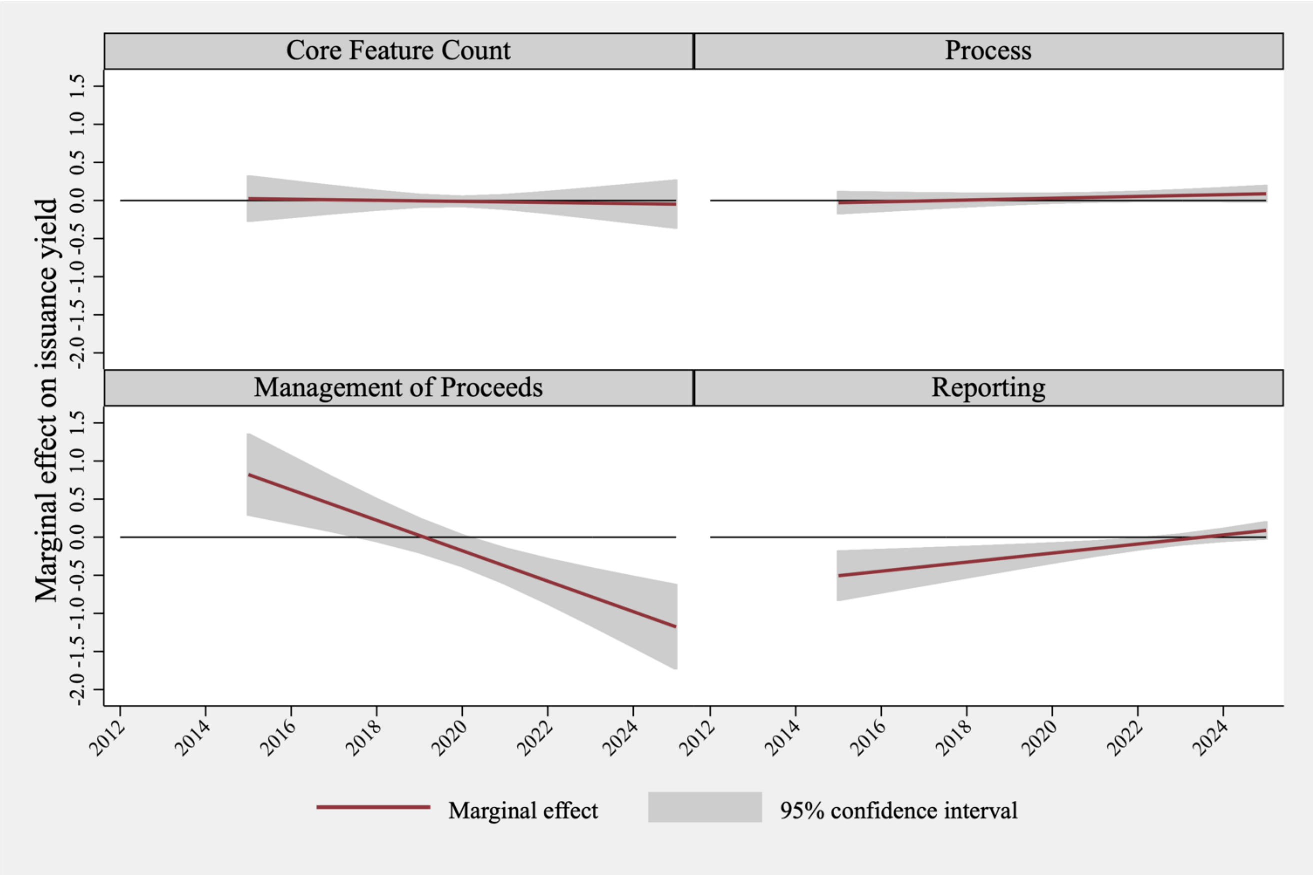
Taken together, the static pricing results show that green bond design is not priced as a simple feature-accumulation problem. Investors do not price a simple count of disclosed core features, and ICMA alignment carries only a small and statistically weak incremental discount. Pricing is instead concentrated in specific features and external review mechanisms that speak more directly to the credibility of the green bond, namely, Management of Proceeds outside the ICMA-alignment regime, and External Review and CBI Certification within the ICMA-aligned segment. The market differentiates among design features rather than treating green bond design as a homogeneous label or disclosure bundle.

5.2. Dynamic Perspective

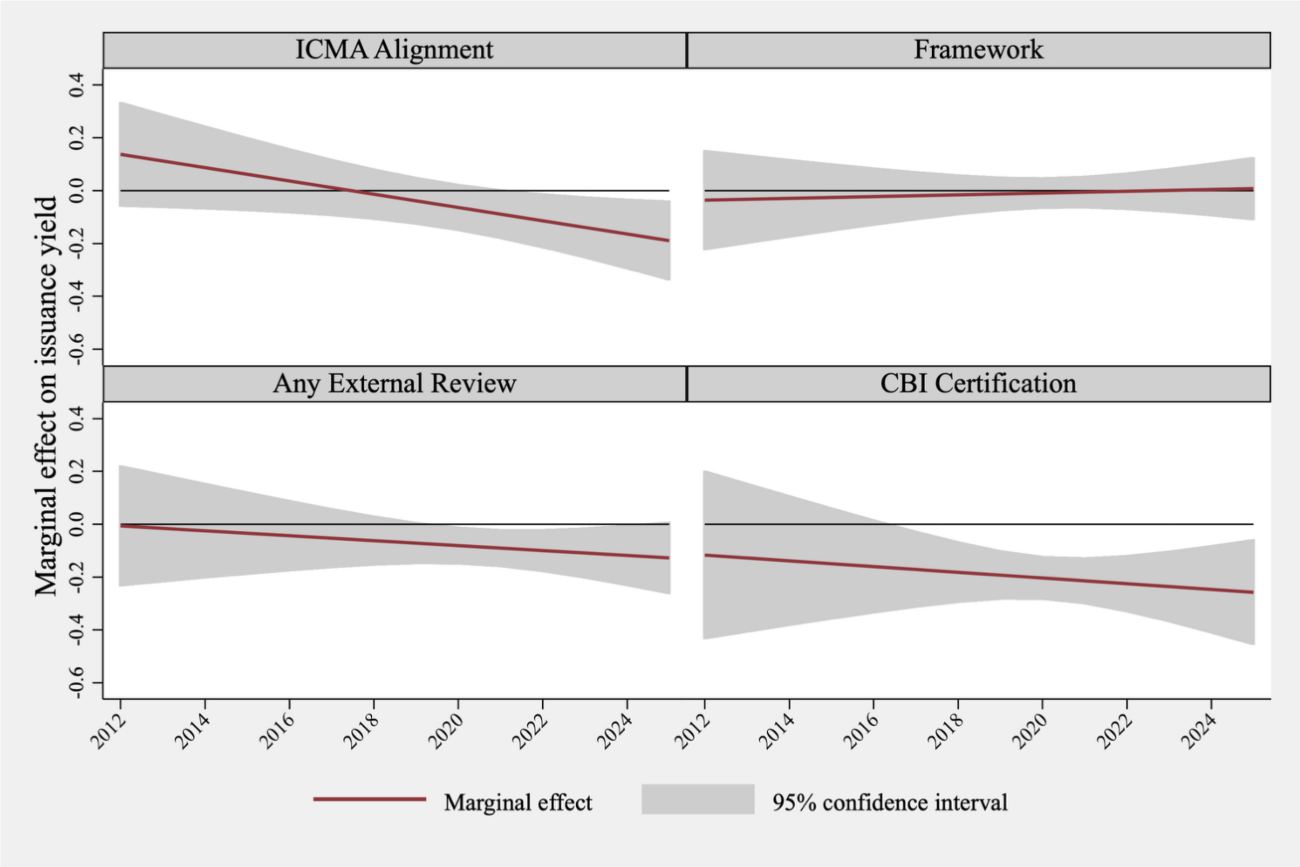
5.2.1. Investors

Figure 3 visualizes the time-varying pricing results. The figure reports year-specific marginal effects and 95% confidence intervals for the main specifications. Panel A focuses on Core Feature Count and the individual core features in the non-ICMA-aligned sample. Panel B reports selected design features in the full pricing sample. Panel C reports Framework and external review categories within the ICMA-aligned sample. The full interaction regressions and the complete year-specific marginal effects are reported in Appendix A. H5 predicts selective repricing. With market maturity, pricing should become more concentrated in design features that continue to differentiate credible green bond design, while features that become standardized, common, or less differentiating should lose marginal pricing relevance.

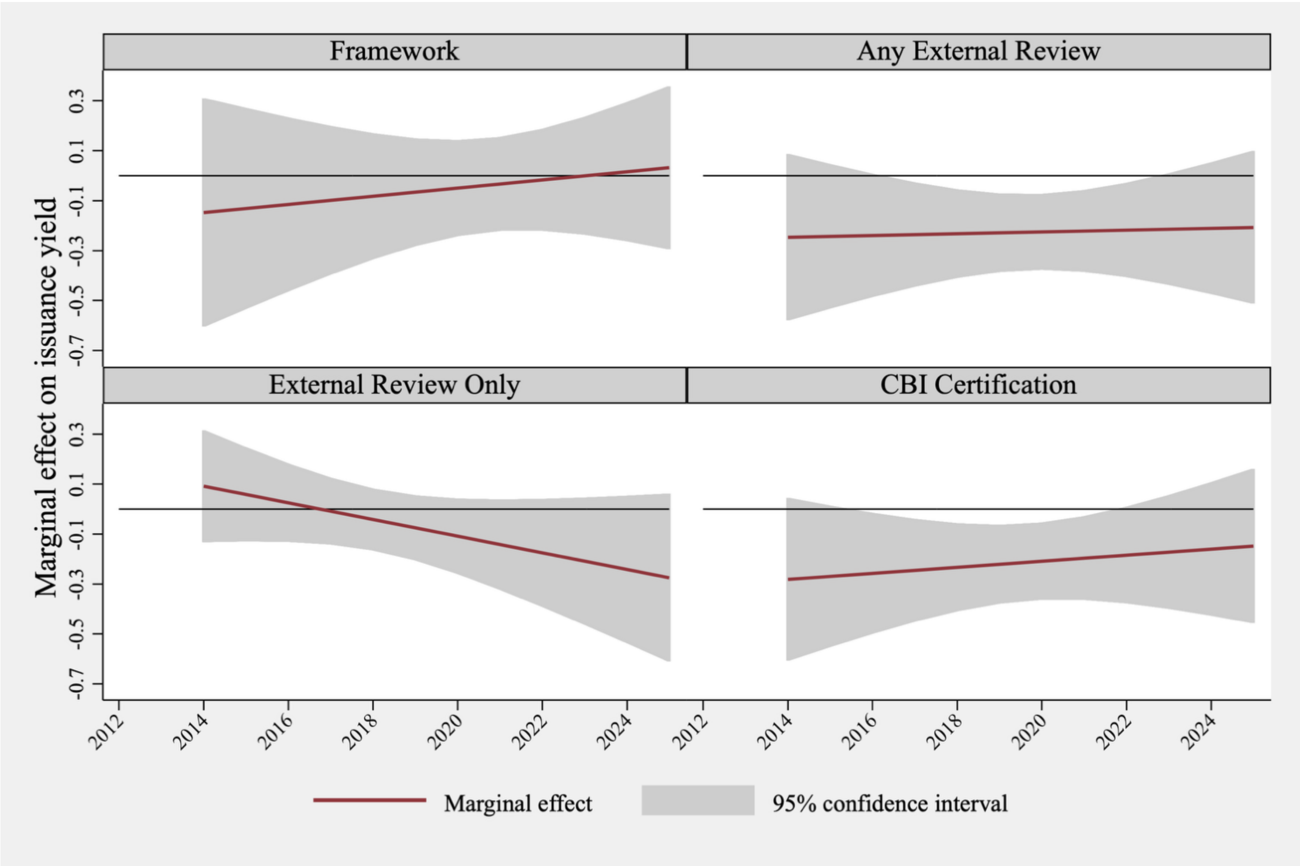
Figure 3. Time-varying marginal effects of green bond design features



Panel A. Non-ICMA-aligned core features



Panel B. Full pricing sample design features



Panel C. ICMA-aligned framework and external review quality

Note. The red line reports model-implied year-specific marginal effects on Issuance Yield from the pooled linear time-varying coefficient model. The shaded area reports 95% confidence intervals. The horizontal line marks zero. Negative marginal effects indicate lower issuance yields. Effects are statistically different from zero at the 5% level in years in which the confidence interval does not include zero.

Figure 3, Panel A confirms that investors do not learn to price green bond design as a simple accumulation of disclosed core features. Core Feature Count remains economically small and statistically insignificant throughout the non-ICMA-aligned sample. Its interaction with calendar time is also insignificant, as reported in Appendix A. Thus, the time-varying analysis confirms the static result that the number of disclosed core features is not the margin on which investors update pricing.

The individual core features in Panel A show a different pattern. Process for Project Evaluation and Selection remains statistically insignificant throughout the period. Management of Proceeds, however, changes markedly over time. Its marginal effect moves from positive estimates in early years to statistically significant yield discounts from 2021 onward. The negative and significant interaction with calendar time indicates a systematic negative linear component in this time-varying effect. This finding is consistent with H5 and with Management of Proceeds as the core feature most directly tied to proceeds traceability and control. It speaks to whether funds remain identifiable and controlled until allocation, which is important when investors cannot observe implementation at issuance.

Reporting displays the opposite. It is associated with a yield discount in the earlier and middle part of the sample, but the discount attenuates and becomes statistically insignificant after 2022. The positive and significant interaction with calendar time confirms that the reporting discount weakens over the sample period. This is consistent with reporting commitments losing marginal pricing value as reporting becomes more standardized and less differentiating.

Appendix A shows that Framework disclosure in the non-ICMA-aligned sample follows a similar attenuation pattern. It is associated with significant yield discounts from 2015 to 2020, but these discounts disappear in the later years. The interaction with calendar time is positive but not statistically significant, so the evidence is best interpreted as an early pricing effect that fades rather than as a precisely estimated linear trend. This supports the view that Framework disclosure can help investors process less standardized green bonds early in the market but becomes less differentiating as framework disclosure becomes more routine.

Appendix A also shows that Any External Review is not significantly priced in the non-ICMA-aligned sample. Its year-specific marginal effects are insignificant, and its interaction with calendar time is close to zero. This suggests that broad review presence alone does not provide a stable pricing signal when the underlying core-feature structure is incomplete.

Figure 3, Panel B shows the clearest standardization-related repricing pattern for ICMA alignment. The marginal effect becomes more negative over time and turns statistically significant in the later years of the sample. The negative and significant interaction with calendar time confirms this trend. This result helps explain why the static ICMA alignment effect is weak on average: the average estimate pools early years, in which ICMA Alignment is not yet priced, with later years, in which the complete core feature structure carries a clearer yield discount. This supports H5 by showing that investors increasingly attach value to the standardized core feature bundle as the market becomes more familiar with the ICMA structure.

Figure 3, Panel C shows that within the ICMA-aligned sample, Framework disclosure does not gain marginal pricing value over time. It remains statistically insignificant throughout the period and has no significant time trend. This is consistent with H3 and with the view that issuer-authored disclosure adds little incremental information once investors already observe the full ICMA core feature structure.

Panel C also shows that Any External Review remains more relevant within the ICMA-aligned sample. Its marginal effect is negative in the middle years of the sample and statistically significant from 2017 to 2022, although the interaction with calendar time is not significant. This distinction is important. The evidence does not indicate a monotonic strengthening of the Any External Review discount, but it does show that external review is priced in parts of the ICMA-aligned segment. The result is therefore better interpreted as persistent relevance over a central part of the sample rather than as a simple increasing time trend.

Panel C further shows the distinction between year-specific pricing and linear repricing for External Review Quality. External Review Only is not significantly priced in the ICMA-aligned sample. CBI Certification, by contrast, is associated with negative marginal effects through

2022 and is statistically significant from 2016 to 2021. The interaction with calendar time is not significant, so the evidence does not support a linear strengthening of the CBI Certification discount. The later point estimates remain negative but are less precisely estimated and no longer statistically significant after 2022. This supports the External Review Quality interpretation in H4, because the strongest year-specific pricing evidence is attached to CBI Certification rather than External Review Only, but it does not imply that the CBI Certification discount increases monotonically as investors gain experience.

Overall, the investor-learning results support H5, but selectively. The market does not increasingly reward all green bond design features. Pricing becomes more differentiated across the design architecture. Management of Proceeds and ICMA Alignment gain pricing relevance over time. Reporting and Framework disclosure in the non-ICMA-aligned segment lose marginal pricing relevance as they become more standardized or less differentiating, while Framework has no incremental pricing relevance once ICMA alignment is already observed. External review mechanisms remain relevant within the ICMA-aligned segment, especially when review takes the form of CBI Certification. Market maturity therefore does not simply increase the value of green labels or disclosure volume. It changes which parts of green bond design investors price.

5.2.2. Issuers

We next examine whether issuers continue the green bond design features used in previous deals. Figures 4 and 5 provide the descriptive background for this analysis. They show that the U.S. municipal green bond market matures over the sample period, but they do not identify whether persistence reflects repeated use by the same issuer or stable differences between issuer types. This distinction is the purpose of the CRE-logit analysis. Figure 4 shows the diffusion of ICMA alignment at the deal level. ICMA alignment becomes more common after the mid-2010s, indicating that the complete ICMA core feature structure gradually becomes a regular design regime in the market. This trend motivates the issuer-dynamics analysis because aggregate diffusion alone cannot distinguish whether the same issuers repeatedly maintain ICMA alignment or whether a stable subset of issuers is structurally more likely to issue ICMA-aligned green bonds.

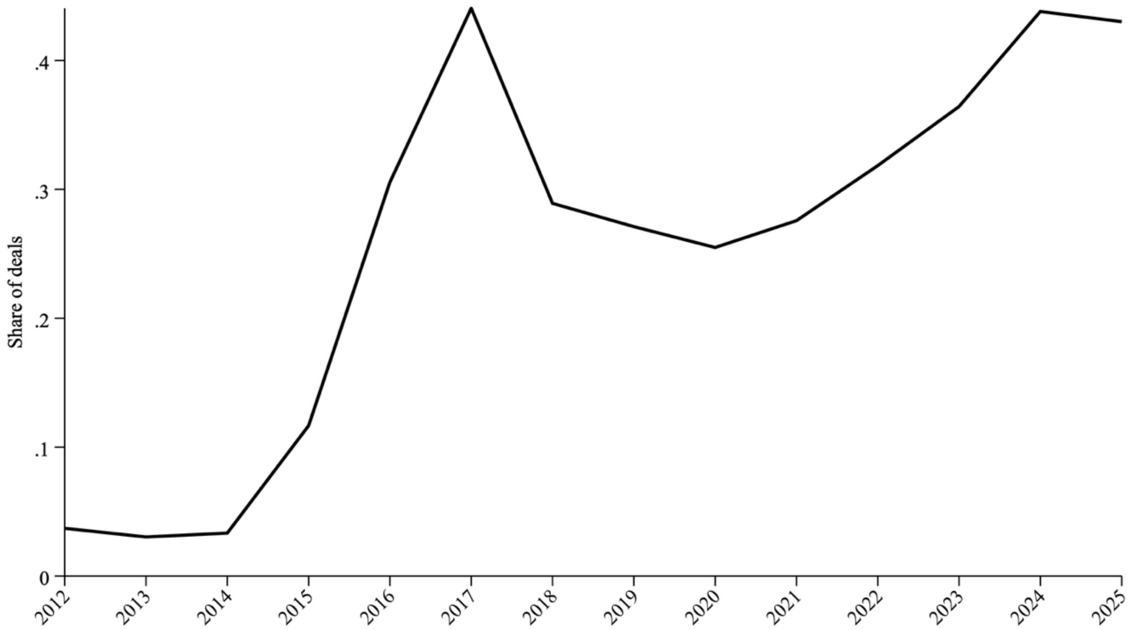


Figure 4- Share of ICMA-aligned deals in the full sample over time

Figure 5 shows the diffusion of selected design features in the full sample. Framework and Any External Review diffuse and then stabilize, while CBI Certification remains a smaller and more selective External Review Quality category. These figures indicate market-level maturation in green bond design, but they do not show whether feature persistence is driven by same-issuer continuation, reusable disclosure infrastructure, repeated relationships with outside evaluators, or persistent differences between issuer types.

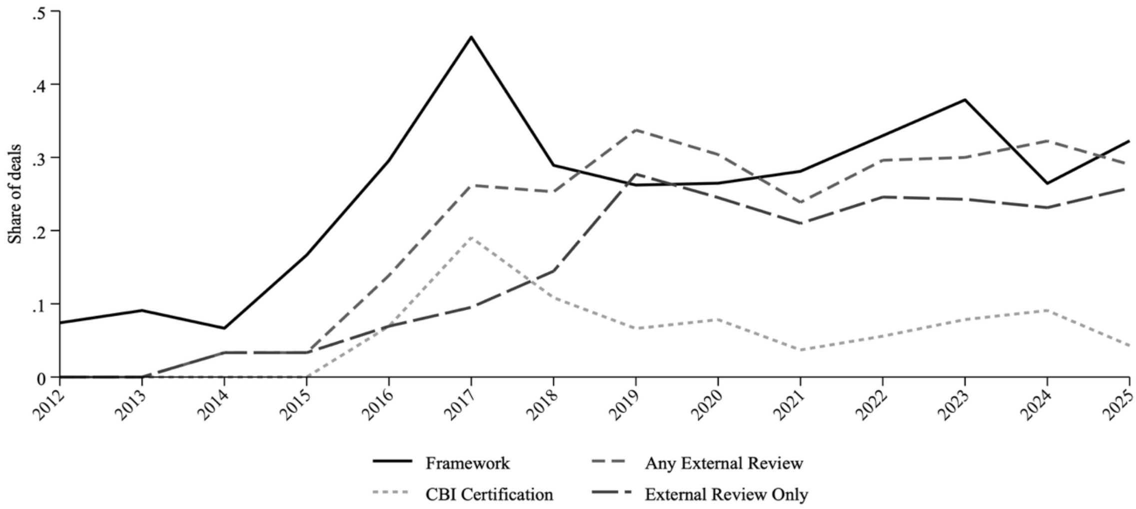
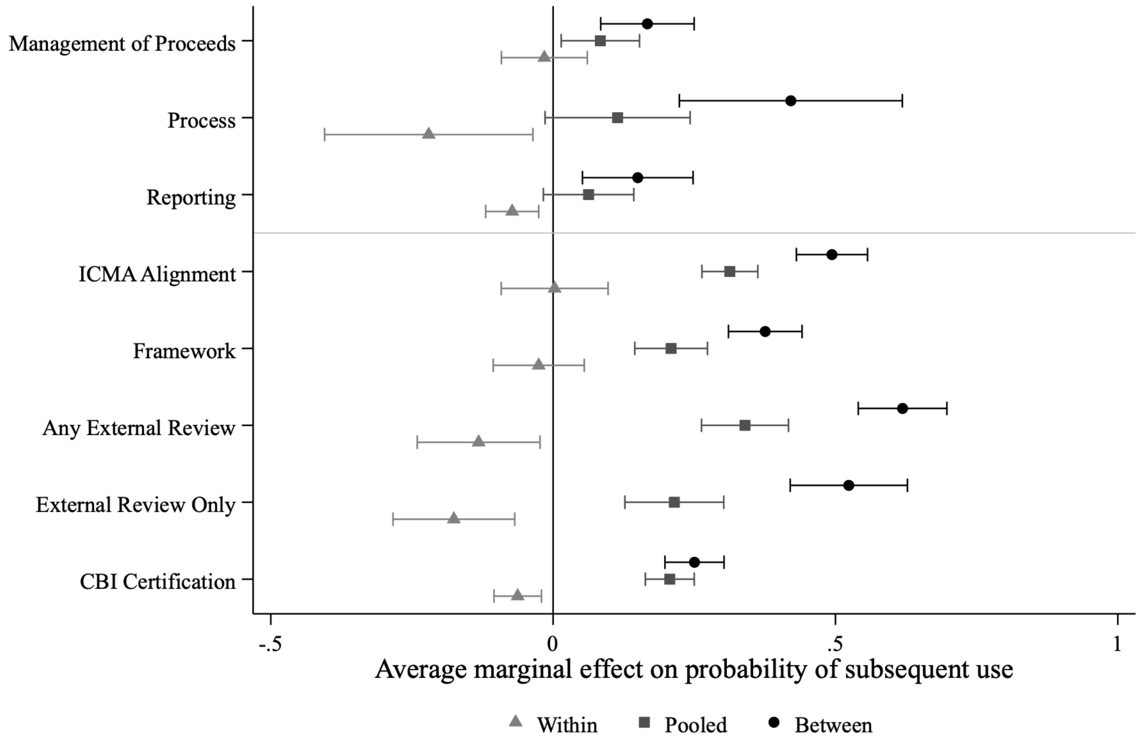


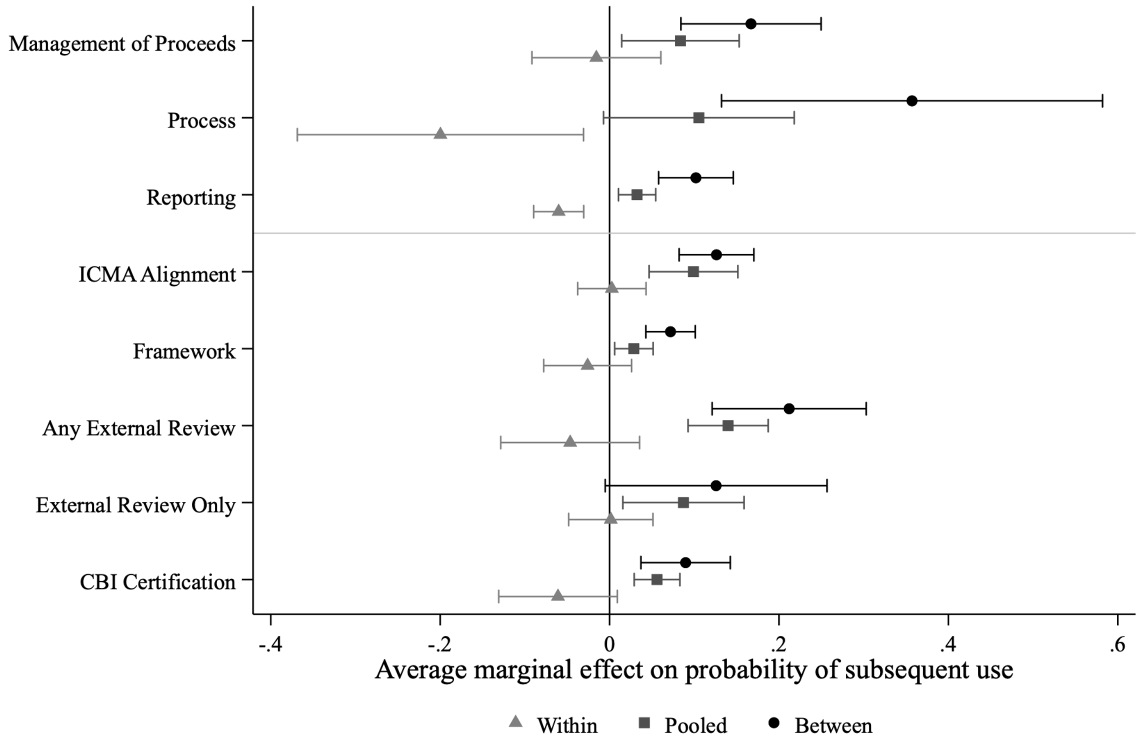
Figure 5. Share of deals with specific features in the full sample over time

Figure 6 visualizes the issuer-dynamics results for the two main issuer-history proxies, Ever Used and Prior Use Count. The figure reports AMEs on the probability of subsequent design-feature use. For each design feature, the triangle reports the within-issuer effect from the CRE-logit model, the circle reports the between-issuer effect from the same CRE-logit model, and the square reports the pooled-logit reference effect estimated on the corresponding CRE estimation sample. Horizontal lines report 95% confidence intervals based on issuer-clustered standard errors. The vertical line at zero indicates no association with subsequent use. The full CRE-logit results for all issuer-history proxies are reported in Appendix B, and the corresponding pooled-logit benchmark models are reported in Appendix C.

Figure 6. Issuer-history effects on subsequent design-feature use



Panel A. Ever used



Panel B. Prior use count

Note. Panel A reports AMEs for Ever Used. Panel B reports AMEs for Prior Use Count. Within and between effects are obtained from CRE-logit models using separate Mundlak components. The pooled effect is estimated from a pooled-logit model on the corresponding CRE estimation sample. Horizontal bars report 95% confidence intervals based on issuer-clustered standard errors. The vertical line at zero indicates no association with subsequent design-feature use. Effects are statistically different from zero at the 5% level when the confidence interval does not include zero.

Figure 6 shows that issuer histories predict subsequent design feature use, but the CRE decomposition changes the interpretation of persistence. The pooled logit reference effects are generally positive for Ever Used and Prior Use Count. The CRE logit decomposition shows, however, that much of this association is between-driven. Between-issuer AMEs are positive for most design features, whereas within-issuer AMEs are often small, statistically insignificant, or negative. The figure therefore supports H6 as observable history dependence, but not as a universal same-issuer continuation pattern.

Because Figure 6 focuses on prior adoption and prior use intensity, the interpretation below also draws on the full set of history proxies reported in Appendix B. This is important because recency and inactivity measures capture different aspects of issuer continuation than cumulative prior use. The figure provides the visual summary of the within–between contrast, while the appendices provide the complete evidence across issuer-history measures.

ICMA Alignment provides the clearest evidence of an issuer-level design regime. In Figure 6, the between-issuer AMEs are positive and statistically different from zero for both Ever Used and Prior Use Count, while the within-issuer AMEs are close to zero and not statistically significant. Appendix B shows the same pattern across the broader set of history proxies: the between coefficients are positive and significant across prior adoption, prior intensity, historical share, and recency proxies, while the within coefficients are not statistically significant. Issuers that historically rely on the complete ICMA core feature structure are therefore more likely to remain ICMA-aligned, but the pattern is mainly between-driven. This suggests that ICMA Alignment behaves less like a feature gradually reinforced by repeated own use and more like a persistent issuer-level design regime. Once the standard-based structure, documentation, and internal procedures are established, reuse benefits and switching costs can make continuation attractive.

Framework requires a broader reading than the cumulative-history proxies alone. In Figure 6, the between-issuer effects are positive, while the within-issuer effects for Ever Used and Prior Use Count are weak. Appendix B shows, however, that recency proxies generate positive within-issuer effects. This aligns with Framework as reusable disclosure infrastructure. Cumulative use primarily distinguishes framework-oriented issuer types, whereas recent own use captures same-issuer continuation through active templates, legal language, and internal routines. Framework continuation can therefore persist even when the investor-learning results show that framework disclosure loses marginal pricing relevance over time.

The non-ICMA-aligned core features behave differently. For Process for Project Evaluation and Selection and Reporting, Figure 6 shows positive pooled and between effects but negative within effects. Appendix B confirms that the positive association is mainly between-driven. Some issuers are structurally more likely to disclose these features, but repeated own use does not create stronger same-issuer continuation. This observation is in line with the pricing evidence. Process is not priced and does not gain pricing value over time, while Reporting loses its early pricing relevance. For issuers, this pattern is consistent with a weak or declining net continuation benefit, especially when recurring disclosure and updating costs are considered.

Management of Proceeds is more nuanced. It has the strongest investor-pricing evidence among the varying core features, but Figure 6 and Appendix B show mainly between-issuer persistence and no broad same-issuer reinforcement. This suggests that proceeds tracking is valuable to investors, but potentially costly enough that issuers use it selectively rather than mechanically continuing it after prior use.

The external review variables also point to persistent issuer-level regimes rather than automatic same-issuer continuation. Any External Review and External Review Only show positive pooled and between effects in Figure 6, while their within-issuer effects are weak or negative. Appendix B shows that this evidence extends beyond the two plotted history proxies. Some issuers are therefore structurally more review-oriented, while prior own use of external review does not automatically create a routine of continued review use. This aligns with External Review Only being used selectively, replaced, or upgraded depending on deal-specific credibility needs. CBI Certification shows the clearest form of selective higher-threshold review. The between effects for prior adoption and prior count are positive, but the corresponding within effects are negative. This does not contradict the pricing results. CBI Certification is priced by investors, but its higher direct and compliance-related requirements are consistent with issuers using it only when the expected credibility, reputation, or financing benefit is sufficiently large.

Taken together, Figure 6 and Appendix B results support the observable implications of H6. Issuer-history measures contain systematic information about subsequent design feature use, but the CRE decomposition shows that this relationship often reflects persistent issuer-level regimes rather than continuation by the same issuer. ICMA Alignment behaves like a stable issuer-level design regime. Framework shows the clearest same-issuer continuation through recent use, consistent with reusable disclosure infrastructure. Process, Reporting, and Management of Proceeds show limited or negative same-issuer reinforcement despite positive between-issuer persistence. External review mechanisms, especially CBI Certification, remain selective despite their pricing relevance. These results are consistent with the net-benefit logic developed in Section 3. Prior use can create reuse, relationship, and reputation benefits, but continuation remains selective when maintenance, review, certification, or redesign costs are important. Investor pricing and issuer continuation are therefore related but not identical: features can be priced by investors without being mechanically continued by issuers, while features with reusable infrastructure can persist even after their marginal pricing effect weakens.

5.3. Robustness

We address observable selection into external review by re-estimating the review quality pricing regressions with inverse probability weights. External review is voluntary and may be correlated with observable tranche characteristics that also affect issuance yields. For each binary comparison, we estimate propensity scores using the conventional bond-pricing controls from the baseline regressions, excluding Putable because it is almost always zero in the sample. Treated observations are weighted by the inverse of their estimated treatment probability, and control observations are weighted by the inverse of their estimated non-treatment probability (Hirano et al., 2003; Imbens and Wooldridge, 2009). This follows propensity-score methods that adjust treated and control observations under a selection-on-observables assumption (Rosenbaum and Rubin, 1983; Hirano et al., 2003; Imbens and Wooldridge, 2009). We apply this approach to four comparisons within the ICMA-aligned sample: Any External Review versus no external review, External Review Only versus no external review, CBI Certification versus no external review, and CBI Certification versus External Review Only. The IPW estimates are interpreted as robustness checks rather than causal treatment effects because they adjust only for observed characteristics and do not address selection on unobserved issuer quality, sustainability capacity, or greenwashing risk. The IPW results are reported in Table 7.

Table 7

The IPW results support the main external review quality interpretation. Bonds with any external review continue to exhibit lower issuance yields relative to bonds without review. However, after reweighting, the effect is driven by CBI Certification rather than by generic external review. External Review Only is not significantly different from no external review, while CBI Certification remains associated with lower yields both relative to no external review and relative to External Review Only. This suggests that the baseline discount for generic external review is more sensitive to observable selection, whereas the CBI Certification effect is more robust. We therefore interpret the evidence as support for an external review quality interpretation, not as evidence that all forms of external review are equally informative.

6. Discussion

The findings imply that green bond design is best understood as an information, bonding, and monitoring architecture rather than as a label or disclosure checklist. On the investor side, design features matter when they help assess the credibility of the use-of-proceeds commitment at issuance. On the issuer side, the same features are not continued mechanically. Continuation reflects a different economic logic: prior implementation can create reusable routines, documentation, relationships with outside evaluators, and reputational continuity, but maintaining or upgrading a feature can also require recurring disclosure, tracking, review, certification, or redesign costs. This helps explain why investor pricing and issuer continuation do not align one-to-one. A feature can carry pricing value but still be used selectively if it is costly to maintain, while a feature with weaker marginal pricing value can persist when it creates reusable disclosure infrastructure.

For investors, the results caution against treating green bond design as an additive checklist. More disclosed features do not necessarily provide more credible information. The relevant question is which features change the information environment around the bond by making the issuer's commitment more traceable, comparable, externally assessed, or easier to monitor. Features tied to proceeds traceability, standardized core feature structure, or outside evaluation are more likely to carry pricing value because they help distinguish stronger from weaker green bond commitments. By contrast, issuer-authored disclosure that becomes routine or duplicative can lose marginal value even if it remains visible. The implication for investors and data providers is that green bond assessment should focus on the content, source, and verifiability of design features rather than on disclosure volume or broad green labels alone.

The dynamic results also qualify how market maturity should be interpreted. A maturing green bond market does not uniformly increase discounts across all design features. Instead, maturity changes which parts of the design architecture remain differentiating. Standardization can create value when it makes design information easier to compare across bonds, but it can also reduce the marginal value of disclosure that becomes common or templated. This distinction matters for interpreting ICMA Alignment, Framework, Reporting, and external review categories. The value of a standard is not that it increases disclosure intensity. Its value depends on whether it improves comparability, interpretation, and credibility in a market where investors face costly information processing.

For issuers, the evidence supports a net-benefit interpretation of design continuation, but not a direct test of net benefits themselves. We do not observe the monetary costs or expected benefits of individual design features. The issuer-dynamics results are therefore best interpreted as observable implications of a continuation trade-off. Features with reusable documentation, established internal processes, or active relationships with outside evaluators can persist because prior implementation lowers the cost of future use. Features that require more intensive proceeds tracking, recurring reporting, external review, or certification can remain selective even when investors attach pricing value to them. This interpretation is consistent with the H6 logic: issuer histories predict subsequent design feature use, but continuation depends on whether accumulated experience, reusable infrastructure, reputation, and relationship benefits outweigh maintenance, review, certification, or redesign costs.

These findings have implications for sustainable finance standard-setting bodies, external reviewers, data providers, and regulators. Policies that encourage more disclosure are unlikely to be sufficient if additional disclosure is not comparable, verifiable, or useful for distinguishing credible green bond commitments. The results instead support a focus on the features that shape the information environment most directly: Management of Proceeds, allocation and impact reporting, and clearly differentiated External Review Quality categories. The distinction between Any External Review, External Review Only, and CBI Certification is particularly important. Treating all external reviews as equivalent can obscure differences in review scope, assessment procedure, and certification threshold.

At the same time, the evidence does not imply that the most extensive design package is optimal for every issuer or every bond. More demanding design features can improve credibility, but they can also increase setup, maintenance, review, and certification costs. A proportional approach is therefore preferable to a maximum-disclosure approach. Standards and data infrastructures should make the information content, scope, and post-issuance accountability of design features more transparent, while allowing issuers to adopt features that are credible and economically feasible in their financing context. Finally, our evidence concerns issuance pricing and issuer design choices, not realized environmental outcomes. The results therefore speak to the financial-market credibility of green bond design, not to whether financed projects ultimately deliver superior environmental impact.

7. Conclusion

We examine which observable green bond design features investors price at issuance and whether issuers continue these features across repeated green bond deals. The U.S. municipal green bond market allows us to examine these questions within a single institutional setting that combines substantial within-green variation across Core Features, ICMA Alignment, Framework, and external review categories with repeated issuer histories. The analysis links three margins of the same market process: pricing at issuance, changes in pricing over time, and issuer-side continuation across repeated green bond deals. The key finding is that green bond design is neither priced nor continued as an additive checklist. Investors price selected design features, and issuer persistence does not mechanically mirror investor pricing.

This shifts the interpretation of green bond credibility from the label to the design architecture. The evidence suggests that investors distinguish among design features according to their role in making the green commitment traceable, comparable, or externally assessed. Issuers, however, face a separate continuation decision. Features that are useful to investors may still be used selectively, while features that generate reusable disclosure infrastructure may persist even when their marginal pricing effect weakens.

The analysis has four main limitations. First, the U.S. municipal market provides a useful setting for within-green design comparisons, but the results may not generalize directly to corporate, sovereign, or cross-country green bond markets. Second, the outcomes are issuance pricing and issuer continuation, not realized environmental performance. Third, the pricing estimates are conditional associations. Fixed effects, bond controls, and IPW robustness checks reduce observable confounding, but unobserved issuer characteristics may still affect both design choices and yields. Fourth, feature costs are inferred from institutional requirements and issuer behavior rather than observed directly.

These limitations open several directions for future research. Future work could link design features to ex-post allocation, impact reporting, and realized environmental outcomes; test whether design-level pricing and continuation patterns extend to corporate and sovereign green bond markets; and examine how ownership, liquidity, and investor types interact with green bond design. More direct evidence on review fees, certification burdens, and internal implementation costs would also help explain why some design features are used selectively while others persist through reuse.

For financial markets, green bond credibility is therefore not a property of the label alone. It is mediated by observable design features that structure the use-of-proceeds commitment, make parts of future conduct more assessable, and create issuer-side continuation choices.

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Tables

Table 1. Green bond design features

Design feature	Role in ICMA GBPs	Institutional meaning	Information channel	Expected cost structure	Empirical operationalization
Use of Proceeds	Core Feature	Identifies eligible green projects or categories financed by the bond. The GBP describe Use of Proceeds as the cornerstone of a green bond.	Links bond funds to environmental activities and makes the green purpose observable.	Mainly ex-ante classification and documentation costs. Higher when eligibility must be documented across dispersed project portfolios, lower when municipal projects are already clearly defined.	Baseline core feature; fulfilled for all green bonds in the sample and therefore not separately included as a regressor.
Process for Project Evaluation and Selection	Core Feature	Explains environmental objectives, how projects fit eligible categories, and how environmental or social risks are identified and managed.	Clarifies screening, selection, and the link to taxonomies, eligibility criteria, and risk mitigants.	Administrative and governance costs for defining criteria, screening projects, and documenting risk management. May partly overlap with existing public capital-planning processes.	Process for Project Evaluation and Selection
Management of Proceeds	Core Feature	Requires proceeds or an equivalent amount to be credited to a sub-account, sub-portfolio, or otherwise tracked. Balances should be periodically adjusted until allocation.	Addresses traceability and misuse risk by showing how funds are controlled until allocated.	Internal treasury procedures, tracking systems or controls, documentation, periodic adjustment, and potentially third-party verification of tracking and allocation.	Management of Proceeds
Reporting	Core Feature	Requires up-to-date information on use of proceeds until full allocation and, where feasible, qualitative or quantitative impact information.	Supports ex-post monitoring of allocation and impact.	Recurring reporting costs for data collection, project descriptions, allocation updates, impact indicators, and methodology disclosure. Templates can become reusable.	Reporting
ICMA Alignment	ICMA aligned if all 4 core features are fulfilled	Indicates that all four GBP core features are present. This is a full design structure rather than a pure green label.	Bundles core information into a recognized and comparable market format.	Combined setup and implementation costs of the four core features. May create standardization and reuse benefits in later issues.	ICMA Alignment
Green Bond Framework	Recommended Feature	Issuer-authored document or legal documentation explaining alignment with the four core features and the issuer's broader sustainability strategy.	Organizes the issuer's narrative and reduces processing costs for investors.	Front-loaded drafting, legal, treasury, sustainability, and disclosure costs. Often reusable or updateable across later issues.	Framework
External Review	Recommended Feature	Outside provider assesses alignment of the bond, program, or framework with the four core features. Post-issuance verification of internal tracking and allocation is recommended.	Introduces an external evaluator and reduces reliance on issuer-authored disclosure.	External review fee, coordination with provider, data provision, and documentation. Cost and information content vary with review scope and rigor.	Any External Review
CBI Certification	External review-quality category; not a separate GBP recommendation	Voluntary label confirming that debt instruments meet the ICMA-aligned Climate Bonds Standard and science-based Sector Criteria, underpinned by independent Approved Verifier assessment.	Provides a higher-rigor public classification and threshold assurance of climate alignment.	Expected highest assurance cost intensity. Approved Verifier engagement, Climate Bonds review, fixed and variable certification fees for debt instruments, separately negotiated verifier fee, sector-criteria compliance, pre-/post-issuance requirements, and ongoing compliance.	CBI Certification; Included in Any External Review; highest category of External Review Quality

Note: Definitions of ICMA core and recommended features are based on ICMA (2025). Information on CBI Certification and certification resources is based on Climate Bonds Initiative (2026a, 2026b). CBI Certification is included in Any External Review and represents the highest category of External Review Quality in the empirical analysis.

Table 2. Sample construction

Step	Restriction / sample filter	Dropped observations	Remaining observations
1	Raw Bloomberg/LSEG universe	—	42,894
2	Keep fixed-rate and zero-coupon bonds	1,163	41,731
3	Drop missing issuance yield	86	41,645
4	Drop sustainability-linked bonds	2	41,643
5	Drop issues before 2012	491	41,152
6	Drop maturities below one year	1,016	40,136
7	Drop maturities above fifty years	1	40,135
8	Keep securities classified as green	17,833	22,302
9	Final pricing sample	—	22,302
Hypothesis-specific analysis samples			
Full pricing sample			22,302
Non-ICMA-aligned feature sample (<4 core features; sufficient within-year feature variation)			13,415
ICMA Alignment comparison sample (non-ICMA-aligned plus ICMA-aligned bonds)			22,266
of which: non-ICMA-aligned			14,991
of which: ICMA-aligned			7,275
Issuer-dynamics sample (repeated issuers; varies by design features)			varies by model

Note: The table reports sample construction and hypothesis-specific construction samples before regression-specific listwise deletion and singleton removal. Regression tables report final estimation samples after requiring non-missing dependent variables, design variables, controls, and fixed-effect identifiers, and after dropping singleton observations.

Table 3. Descriptive statistics, full pricing sample

Variable	count	mean	p50	sd	min	p25	p75	max
Issuance Yield (%)	22,302	2.493	2.490	1.133	0.051	1.660	3.250	14.970
Core Feature Count	22,266	2.051	1.000	1.382	1.000	1.000	4.000	4.000
Process for Project Evaluation and Selection (Y/N)	22,266	0.386	0.000	0.487	0.000	0.000	1.000	1.000
Management of Proceeds (Y/N)	22,266	0.328	0.000	0.470	0.000	0.000	1.000	1.000
Reporting (Y/N)	22,266	0.337	0.000	0.473	0.000	0.000	1.000	1.000
Framework (Y/N)	22,099	0.325	0.000	0.469	0.000	0.000	1.000	1.000
Any External Review (Y/N)	22,302	0.253	0.000	0.435	0.000	0.000	1.000	1.000
ICMA Alignment (Y/N)	22,266	0.326	0.000	0.469	0.000	0.000	1.000	1.000
External Review Quality	22,302	0.337	0.000	0.625	0.000	0.000	1.000	2.000
Maturity (years)	22,302	11.268	10.122	6.911	1.002	5.823	15.723	40.805
Log Issue Size	22,302	17.781	17.828	1.734	12.014	16.267	19.233	21.659
Tranche Rating	21,953	3.265	3.000	2.033	1.000	1.000	5.000	16.000
Callable (Y/N)	22,302	0.531	1.000	0.499	0.000	0.000	1.000	1.000
Putable (Y/N)	22,302	0.000	0.000	0.009	0.000	0.000	0.000	1.000
Sinkable (Y/N)	22,302	0.116	0.000	0.320	0.000	0.000	0.000	1.000
Bank qualified (Y/N)	22,284	0.155	0.000	0.362	0.000	0.000	0.000	1.000
Treasury Yield (%)	22,302	2.500	2.330	1.310	0.040	1.500	3.720	5.450
Tax status	22,279	2.183	2.000	0.636	1.000	2.000	2.000	3.000
Observations	22,302							

Note: Counts are variable-specific non-missing counts within the Full Pricing Sample. Core Feature Count, the individual core-feature indicators, and ICMA Alignment are reported for observations with complete core-feature information. External Review Quality is coded as 0 = no external review, 1 = External Review Only, and 2 = CBI Certification.

Table 4. Pairwise correlations, full pricing sample

Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**	**(13)**	**(14)**	**(15)**	**(16)**	**(17)**	**(18)**
(1) Issuance Yield	1.000																	
(2) Core Feature Count	0.065***	1.000																
(3) Process	0.025***	0.945***	1.000															
(4) Management of Proceeds	0.081***	0.982***	0.879***	1.000														
(5) Reporting	0.083***	0.976***	0.859***	0.974***	1.000													
(6) Framework	0.037***	0.854***	0.757***	0.864***	0.858***	1.000												
(7) Any External Review	0.055***	0.646***	0.710***	0.586***	0.575***	0.470***	1.000											
(8) ICMA Alignment	0.075***	0.982***	0.879***	0.996***	0.977***	0.863***	0.589***	1.000										
(9) External Review Quality	0.058***	0.629***	0.654***	0.590***	0.579***	0.490***	0.926***	0.593***	1.000									
(10) Maturity (years)	0.486***	0.103***	0.090***	0.107***	0.103***	0.085***	0.085***	0.105***	0.091***	1.000								
(11) Log Issue Size	0.088***	0.448***	0.366***	0.473***	0.463***	0.456***	0.259***	0.473***	0.301***	0.144***	1.000							
(12) Tranche Rating	0.084***	0.078***	-0.000	0.117***	0.109***	0.187***	0.114***	0.115***	0.078***	0.010	0.334***	1.000						
(13) Callable	0.403***	0.045***	0.052***	0.041***	0.036***	0.023***	0.061***	0.040***	0.054***	0.747***	0.023***	0.044***	1.000					
(14) Putable	0.003	0.003	0.002	0.003	0.003	-0.007	0.005	0.004	0.002	0.011	0.011	-0.002	0.009	1.000				
(15) Sinkable	0.246***	0.038***	0.032***	0.037***	0.042***	0.058***	-0.004	0.039***	-0.014*	0.493***	0.086***	0.112***	0.294***	-0.003	1.000			
(16) Bank Qualified	0.099***	0.232***	0.156***	0.260***	0.260***	0.269***	0.074***	0.259***	0.109***	0.090***	0.596***	0.306***	0.027***	-0.004	0.106***	1.000		
(17) Treasury Yield	0.773***	0.104***	0.048***	0.126***	0.130***	0.074***	0.032***	0.121***	0.034***	0.234***	0.160***	0.082***	0.179***	0.004	0.062***	0.105***	1.000	
(18) Tax Status	0.047***	0.093***	0.084***	0.093***	0.093***	0.076***	0.048***	0.094***	0.023***	0.094***	0.055***	0.016*	0.095***	-0.003	0.021**	0.124***	0.187***	1.000

Note: The table reports pairwise Pearson correlations for the Full Pricing Sample. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 5. Issuer history proxies used in the CRE-logit models

Proxy group	Proxy	Definition	Economic interpretation
Prior adoption	Ever Used	Indicator equal to one if issuer i used feature f in any prior eligible deal before deal t. Equal to zero for the issuer's first eligible deal.	Captures whether the feature has already been adopted and whether initial setup costs may have been incurred.
Prior intensity	Prior Use Count	Cumulative number of prior eligible deals in which issuer i used feature f. Equal to zero for the issuer's first eligible deal.	Captures repeated experience with the feature and potential learning-by-doing.
Prior intensity	Prior Use Share	Share of issuer i's prior eligible deals that used feature f. Defined only when at least one prior eligible deal exists.	Captures historical reliance on the feature, scaled by the issuer's own issuance frequency.
Inactivity	Gap since last use, deals	Number of eligible deal steps between the current deal and the most recent prior use of feature f. Defined only after prior use. A value of one means use in the immediately preceding eligible deal.	Captures decay in continuation through issuance-sequence inactivity.
Inactivity	Gap since last use, days	Calendar days between the current deal date and the most recent prior use of feature f. Defined only after prior use.	Captures decay in routines, relationships, or reputational continuity over calendar time.
Recency	Recent Use Count	Number of uses of feature f in the issuer's three immediately preceding eligible deals. Defined only when three prior eligible deals are available.	Captures whether routines, templates, or external relationships are still active.
Recency	Recent Use Share	Uses in last three deals divided by three. Defined only when three prior eligible deals are available.	Captures recent use intensity on a normalized scale.

Table 6. Static pricing regressions

VARIABLES	(1) H1A	(2) H1B	(3) H1C	(4) H2	(5) H3	(6) H4
Core Feature Count	-0.013					
	(0.039)					
Process for Project Evaluation and Selection		0.029	0.011			
		(0.037)	(0.039)			
Management of Proceeds		-0.614***	-0.599**			
		(0.230)	(0.241)			
Reporting		-0.114	-0.074			
		(0.106)	(0.117)			
Framework			-0.063**		-0.030	
			(0.031)		(0.099)	
Any External Review			0.022		-0.236***	
			(0.026)		(0.084)	
ICMA Alignment				-0.074		
				(0.046)		
External Review Only						-0.191*
						(0.099)
CBI Certification						-0.227***
						(0.077)
Tax Exempt	-0.144***	-0.145***	-0.155***	-0.417***	-0.550***	-0.522***
	(0.051)	(0.051)	(0.047)	(0.068)	(0.062)	(0.061)
Taxable	0.926***	0.922***	0.911***	0.589***	0.501***	0.527***
	(0.114)	(0.113)	(0.110)	(0.083)	(0.119)	(0.106)
Maturity	0.053***	0.053***	0.053***	0.049***	0.048***	0.048***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Log Issue Size	-0.070**	-0.071**	-0.074**	0.050	0.126	0.131
	(0.032)	(0.033)	(0.032)	(0.031)	(0.087)	(0.084)
Tranche Rating	0.011	0.011	0.007	0.072***	0.063*	0.063*
	(0.018)	(0.018)	(0.017)	(0.020)	(0.037)	(0.038)
Callable	0.175***	0.176***	0.176***	0.195***	0.197***	0.196***
	(0.013)	(0.013)	(0.013)	(0.011)	(0.020)	(0.020)
Sinkable	-0.095***	-0.094***	-0.094***	-0.111***	-0.152***	-0.154***
	(0.018)	(0.018)	(0.018)	(0.019)	(0.040)	(0.040)
Bank Qualified	0.525***	0.524***	0.523***	0.432***	1.036***	0.635***
	(0.121)	(0.118)	(0.117)	(0.088)	(0.139)	(0.120)
Treasury Yield	0.528***	0.527***	0.526***	0.613***	0.590***	0.585***
	(0.040)	(0.040)	(0.040)	(0.036)	(0.054)	(0.053)
Constant	1.547***	1.548***	1.631***	-0.581	-1.680	-1.837
	(0.555)	(0.567)	(0.547)	(0.544)	(1.657)	(1.634)
Sample	Non-ICMA	Non-ICMA	Non-ICMA	Full	ICMA	ICMA
Observations	13,167	13,167	13,165	21,841	6,962	7,130
R-squared	0.973	0.973	0.973	0.961	0.960	0.960
Within R-sq.	0.894	0.895	0.895	0.866	0.851	0.850
Issuer FE	Yes	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes	Yes
StatexYear FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: The table reports linear issuance-yield regressions for H1–H4. The dependent variable is Issuance Yield, measured in percentage points. Green bond design variables are measured at the deal level and assigned to tranche-level observations. All specifications use the same conventional tranche-level bond-pricing control set: tax status, maturity, Log Issue Size, Tranche Rating, Callable, Putable, Sinkable, Bank qualified, and Treasury Yield. Putable is included where estimable; in specifications with no usable within-fixed-effect variation, it is automatically omitted because of collinearity. Tax status enters through category indicators; Subject to AMT is the omitted category. All specifications include issuer fixed effects, issue-month fixed effects, and state-by-year fixed effects. Standard errors, reported in parentheses, are two-way clustered by issuer and issue month. Negative coefficients indicate lower issuance yields. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 7. Inverse probability-weighting issuance-yield regression for external review quality

VARIABLES	(1) Any External Review Vs. No External Review	(2) External Review Only Vs. No External Review	(3) CBI Certification Vs. No External Review	(4) CBI Certification Vs. External Review Only
Any External Review Vs. No External Review	-0.198***			
	(0.074)			
External Review Only Vs. No External Review		0.010		
		(0.051)		
CBI Certification Vs. No External Review			-0.179**	
			(0.074)	
CBI Certification Vs. External Review Only				-0.244**
				(0.102)
Tax Exempt	-0.505***	-0.493***	-	-
	(0.073)	(0.070)		
Taxable	0.495***	0.438***	1.025***	0.980***
	(0.097)	(0.117)	(0.086)	(0.208)
Maturity	0.039***	0.046***	0.034***	0.045***
	(0.011)	(0.007)	(0.012)	(0.004)
Log Issue Size	0.166**	0.088	0.117	0.080
	(0.082)	(0.083)	(0.090)	(0.106)
Tranche Rating	0.155**	0.129*	0.288***	0.031
	(0.067)	(0.071)	(0.018)	(0.060)
Callable	0.228***	0.202***	0.243***	0.231***
	(0.036)	(0.034)	(0.033)	(0.028)
Sinkable	-0.241***	-0.217***	-0.222**	-0.054
	(0.064)	(0.050)	(0.106)	(0.053)
Bank Qualified	0.571***	0.584***	-	-
	(0.103)	(0.125)		
Treasury Yield	0.681***	0.581***	0.776***	0.644***
	(0.124)	(0.078)	(0.161)	(0.060)
Constant	-2.997*	-1.332	-3.175*	-1.404
	(1.632)	(1.633)	(1.703)	(2.004)
Sample	ICMA	ICMA	ICMA	ICMA
Observations	7,130	5,328	4,407	4,042
R-squared	0.931	0.956	0.918	0.963
Within R-sq.	0.750	0.818	0.736	0.874
Issuer FE	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes
StatexYear FE	Yes	Yes	Yes	Yes

Note: The table reports inverse-probability-weighted issuance-yield regressions within the ICMA-Aligned sample. The dependent variable is Issuance Yield, measured in percentage points. Each column reports a binary comparison of external review categories: Any External Review versus no external review, External Review Only versus no external review, CBI Certification versus no external review, and CBI Certification versus External Review Only. Weights are the inverse of the estimated propensity score for treated observations and the inverse of the estimated non-treatment probability for control observations. Propensity scores are estimated using conventional bond-pricing controls. All specifications include the baseline controls, issuer fixed effects, issue-month fixed effects, and state-by-year fixed effects. Robust standard errors are reported in parentheses. The estimates are interpreted as robustness checks under selection on observables, not as causal treatment effects. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Appendix A

Appendix A.1. Time-varying pricing regressions: coefficients on design features and year interactions

VARIABLES	(1) H1a Core Feature Count × Year^c	(2) H1b Core Features × Year^c	(3) H1c Framework / Any External Review × Year^c	(4) H2 ICMA Alignment × Year^c	(5) H3 Framework / Any External Review × Year^c (ICMA-Aligned)	(6) H4 External Review Quality × Year^c (ICMA-Aligned)
Core Feature Count	0.046					
	(0.248)					
Core Feature Count × Year^c	-0.007					
	(0.031)					
Process for Project Evaluation and Selection		-0.064	0.010			
		(0.111)	(0.039)			
Process × Year^c		0.012				
		(0.012)				
Management of Proceeds		1.422***	-0.594**			
		(0.422)	(0.246)			
Management of Proceeds × Year^c		-0.200***				
		(0.052)				
Reporting		-0.684***	-0.094			
		(0.231)	(0.110)			
Reporting × Year^c		0.059***				
		(0.021)				
Framework			-0.204**		-0.180	
			(0.086)		(0.292)	
Framework × Year^c			0.018		0.016	
			(0.011)		(0.032)	
Any External Review			0.050		-0.254	
			(0.112)		(0.218)	
Any External Review × Year^c			-0.003		0.004	
			(0.013)		(0.026)	
ICMA Alignment				0.137		
				(0.101)		
ICMA Alignment × Year^c				-0.025**		
				(0.012)		
External Review Only						0.158
						(0.155)
External Review Only × Year^c						-0.033
						(0.023)
CBI Certification						-0.306
						(0.213)
CBI Certification × Year^c						0.012
						(0.026)
Sample	non-ICMA-Aligned	non-ICMA-Aligned	non-ICMA-Aligned	Full Pricing Sample	ICMA-Aligned	ICMA-Aligned
Observations	13,167	13,167	13,165	21,841	6,962	7,130
R-squared	0.973	0.973	0.973	0.962	0.960	0.960
Within R-sq.	0.894	0.895	0.895	0.866	0.851	0.850
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Issuer FE	Yes	Yes	Yes	Yes	Yes	Yes
Issue-month FE	Yes	Yes	Yes	Yes	Yes	Yes
State-by-year FE	Yes	Yes	Yes	Yes	Yes	Yes
SE clustering	Issuer and issue month	Issuer and issue month	Issuer and issue month	Issuer and issue month	Issuer and issue month	Issuer and issue month

Note: The table reports pooled interaction regressions for the investor-learning analysis. The dependent variable is Issuance Yield, measured in percentage points. Controls are the same as in Table 6. Putable is included where estimable and otherwise omitted because of collinearity. Year^c is centered calendar year, defined as Year^c = t − 2012. The coefficient on Feature × Year^c measures the linear change in the feature's pricing effect over calendar time. The year-specific marginal effects are reported in Tables A.2–A.[x]. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Appendix A.2. Year-specific marginal effects: Core Feature Count, non-ICMA sample

Year	Design feature	Marginal effect (SE)	t-stat	p-value	95% CI	N
2015	Core Feature Count	0.025 (0.156)	0.16	0.875	[-0.281, 0.331]	13,167
2017	Core Feature Count	0.010 (0.097)	0.10	0.917	[-0.180, 0.200]	13,167
2018	Core Feature Count	0.003 (0.069)	0.04	0.966	[-0.133, 0.139]	13,167
2019	Core Feature Count	-0.004 (0.047)	-0.09	0.927	[-0.096, 0.087]	13,167
2020	Core Feature Count	-0.011 (0.039)	-0.30	0.766	[-0.087, 0.064]	13,167
2021	Core Feature Count	-0.019 (0.052)	-0.36	0.721	[-0.121, 0.084]	13,167
2022	Core Feature Count	-0.026 (0.077)	-0.34	0.737	[-0.177, 0.125]	13,167
2023	Core Feature Count	-0.033 (0.105)	-0.32	0.753	[-0.239, 0.173]	13,167
2024	Core Feature Count	-0.040 (0.135)	-0.30	0.765	[-0.304, 0.224]	13,167
2025	Core Feature Count	-0.048 (0.165)	-0.29	0.773	[-0.370, 0.275]	13,167

Note: The table reports year-specific marginal effects computed from the pooled interaction model as $\beta + \theta Year^c$. The dependent variable is Issuance Yield, measured in percentage points. Negative marginal effects indicate lower issuance yields. Standard errors and confidence intervals are computed from the variance-covariance matrix of the estimated main effect and interaction coefficient. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Appendix A.3. Year-specific marginal effects: Core features, non-ICMA sample

Year	Design feature	Marginal effect (SE)	t-stat	p-value	95% CI	N
2015	Process for Project Evaluation and Selection	-0.029 (0.078)	-0.37	0.713	[-0.182, 0.124]	13,167
2017	Process for Project Evaluation and Selection	-0.005 (0.058)	-0.09	0.928	[-0.120, 0.109]	13,167
2018	Process for Project Evaluation and Selection	0.006 (0.050)	0.13	0.897	[-0.091, 0.104]	13,167
2019	Process for Project Evaluation and Selection	0.018 (0.042)	0.43	0.668	[-0.065, 0.101]	13,167
2020	Process for Project Evaluation and Selection	0.030 (0.037)	0.80	0.425	[-0.043, 0.103]	13,167
2021	Process for Project Evaluation and Selection	0.042 (0.036)	1.17	0.245	[-0.028, 0.112]	13,167
2022	Process for Project Evaluation and Selection	0.053 (0.038)	1.42	0.159	[-0.020, 0.127]	13,167
2023	Process for Project Evaluation and Selection	0.065 (0.043)	1.52	0.131	[-0.019, 0.149]	13,167
2024	Process for Project Evaluation and Selection	0.077 (0.050)	1.53	0.129	[-0.022, 0.176]	13,167
2025	Process for Project Evaluation and Selection	0.089 (0.059)	1.50	0.137	[-0.027, 0.205]	13,167
2015	Management of Proceeds	0.822*** (0.275)	2.99	0.003	[0.283, 1.361]	13,167
2017	Management of Proceeds	0.422** (0.184)	2.29	0.024	[0.061, 0.784]	13,167
2018	Management of Proceeds	0.222 (0.146)	1.53	0.130	[-0.063, 0.508]	13,167
2019	Management of Proceeds	0.022 (0.117)	0.19	0.849	[-0.208, 0.253]	13,167
2020	Management of Proceeds	-0.177 (0.108)	-1.64	0.104	[-0.390, 0.035]	13,167
2021	Management of Proceeds	-0.377*** (0.123)	-3.08	0.003	[-0.618, -0.137]	13,167
2022	Management of Proceeds	-0.577*** (0.154)	-3.75	<0.001	[-0.879, -0.275]	13,167
2023	Management of Proceeds	-0.777*** (0.194)	-4.00	<0.001	[-1.158, -0.396]	13,167
2024	Management of Proceeds	-0.977*** (0.239)	-4.09	<0.001	[-1.445, -0.509]	13,167
2025	Management of Proceeds	-1.177*** (0.286)	-4.11	<0.001	[-1.738, -0.616]	13,167
2015	Reporting	-0.506*** (0.169)	-2.99	0.003	[-0.837, -0.174]	13,167
2017	Reporting	-0.387*** (0.129)	-3.01	0.003	[-0.639, -0.135]	13,167
2018	Reporting	-0.327*** (0.109)	-3.01	0.003	[-0.540, -0.114]	13,167
2019	Reporting	-0.268*** (0.089)	-2.99	0.003	[-0.443, -0.092]	13,167
2020	Reporting	-0.208*** (0.071)	-2.93	0.004	[-0.348, -0.069]	13,167
2021	Reporting	-0.149*** (0.055)	-2.71	0.008	[-0.256, -0.041]	13,167
2022	Reporting	-0.089** (0.043)	-2.07	0.041	[-0.174, -0.005]	13,167
2023	Reporting	-0.030 (0.040)	-0.74	0.458	[-0.108, 0.049]	13,167
2024	Reporting	0.030 (0.047)	0.63	0.529	[-0.063, 0.122]	13,167

Year	Design feature	Marginal effect (SE)	t-stat	p-value	95% CI	N
2025	Reporting	0.089 (0.061)	1.46	0.146	[-0.030, 0.209]	13,167

Appendix A.4. Year-specific marginal effects: Framework and Any External Review, non-ICMA sample

Year	Design feature	Marginal effect (SE)	t-stat	p-value	95% CI	N
2015	Framework	-0.151*** (0.055)	-2.76	0.007	[-0.258, -0.044]	13,165
2017	Framework	-0.115*** (0.037)	-3.13	0.002	[-0.187, -0.043]	13,165
2018	Framework	-0.097*** (0.030)	-3.21	0.002	[-0.157, -0.038]	13,165
2019	Framework	-0.080*** (0.027)	-2.90	0.004	[-0.133, -0.026]	13,165
2020	Framework	-0.062** (0.029)	-2.13	0.035	[-0.118, -0.005]	13,165
2021	Framework	-0.044 (0.034)	-1.28	0.205	[-0.111, 0.024]	13,165
2022	Framework	-0.026 (0.042)	-0.62	0.539	[-0.109, 0.057]	13,165
2023	Framework	-0.008 (0.051)	-0.16	0.873	[-0.109, 0.093]	13,165
2024	Framework	0.010 (0.061)	0.16	0.876	[-0.111, 0.130]	13,165
2025	Framework	0.027 (0.072)	0.38	0.703	[-0.113, 0.168]	13,165
2015	Any External Review	0.040 (0.075)	0.53	0.594	[-0.107, 0.188]	13,165
2017	Any External Review	0.033 (0.052)	0.64	0.521	[-0.068, 0.135]	13,165
2018	Any External Review	0.030 (0.041)	0.73	0.469	[-0.051, 0.111]	13,165
2019	Any External Review	0.027 (0.032)	0.82	0.412	[-0.037, 0.090]	13,165
2020	Any External Review	0.023 (0.027)	0.87	0.386	[-0.029, 0.075]	13,165
2021	Any External Review	0.020 (0.027)	0.75	0.457	[-0.032, 0.072]	13,165
2022	Any External Review	0.016 (0.032)	0.51	0.610	[-0.046, 0.079]	13,165
2023	Any External Review	0.013 (0.041)	0.32	0.752	[-0.067, 0.093]	13,165
2024	Any External Review	0.010 (0.051)	0.19	0.853	[-0.091, 0.110]	13,165
2025	Any External Review	0.006 (0.063)	0.10	0.922	[-0.117, 0.129]	13,165

Appendix A.5. Year-specific marginal effects: ICMA alignment, full sample

Year	Design feature	Marginal effect (SE)	t-stat	p-value	95% CI	N
2012	ICMA Alignment	0.137 (0.101)	1.36	0.176	[-0.061, 0.335]	21,841
2013	ICMA Alignment	0.112 (0.091)	1.24	0.218	[-0.065, 0.289]	21,841
2014	ICMA Alignment	0.087 (0.081)	1.08	0.282	[-0.071, 0.245]	21,841
2015	ICMA Alignment	0.062 (0.071)	0.87	0.386	[-0.077, 0.201]	21,841
2016	ICMA Alignment	0.037 (0.062)	0.59	0.557	[-0.086, 0.159]	21,841
2017	ICMA Alignment	0.012 (0.055)	0.21	0.832	[-0.096, 0.119]	21,841
2018	ICMA Alignment	-0.013 (0.049)	-0.27	0.785	[-0.110, 0.083]	21,841
2019	ICMA Alignment	-0.038 (0.046)	-0.84	0.401	[-0.128, 0.051]	21,841
2020	ICMA Alignment	-0.064 (0.045)	-1.41	0.161	[-0.152, 0.025]	21,841
2021	ICMA Alignment	-0.089* (0.048)	-1.86	0.065	[-0.182, 0.005]	21,841
2022	ICMA Alignment	-0.114** (0.053)	-2.16	0.032	[-0.217, -0.010]	21,841
2023	ICMA Alignment	-0.139** (0.060)	-2.32	0.021	[-0.256, -0.022]	21,841
2024	ICMA Alignment	-0.164** (0.068)	-2.41	0.017	[-0.297, -0.031]	21,841
2025	ICMA Alignment	-0.189** (0.077)	-2.45	0.016	[-0.340, -0.038]	21,841

Appendix A.6. Year-specific marginal effects: Framework and Any External Review, ICMA-aligned sample

Year	Design feature	Marginal effect (SE)	t-stat	p-value	95% CI	N
2014	Framework	-0.147 (0.233)	-0.63	0.529	[-0.605, 0.310]	6,962
2015	Framework	-0.131 (0.205)	-0.64	0.523	[-0.532, 0.270]	6,962
2016	Framework	-0.115 (0.177)	-0.65	0.518	[-0.462, 0.232]	6,962
2017	Framework	-0.098 (0.151)	-0.65	0.516	[-0.395, 0.198]	6,962
2018	Framework	-0.082 (0.128)	-0.64	0.523	[-0.333, 0.169]	6,962
2019	Framework	-0.066 (0.109)	-0.60	0.548	[-0.280, 0.149]	6,962
2020	Framework	-0.050 (0.098)	-0.51	0.613	[-0.241, 0.142]	6,962
2021	Framework	-0.033 (0.096)	-0.35	0.729	[-0.220, 0.154]	6,962
2022	Framework	-0.017 (0.104)	-0.16	0.871	[-0.220, 0.186]	6,962
2023	Framework	-0.001 (0.120)	-0.00	0.996	[-0.235, 0.234]	6,962
2024	Framework	0.016 (0.141)	0.11	0.911	[-0.261, 0.293]	6,962
2025	Framework	0.032 (0.166)	0.19	0.847	[-0.294, 0.358]	6,962
2014	Any External Review	-0.246 (0.170)	-1.45	0.150	[-0.579, 0.087]	6,962
2015	Any External Review	-0.243 (0.147)	-1.65	0.101	[-0.531, 0.046]	6,962
2016	Any External Review	-0.239* (0.126)	-1.90	0.059	[-0.485, 0.007]	6,962
2017	Any External Review	-0.236** (0.106)	-2.22	0.029	[-0.444, -0.027]	6,962
2018	Any External Review	-0.232** (0.090)	-2.57	0.011	[-0.409, -0.055]	6,962
2019	Any External Review	-0.228*** (0.080)	-2.86	0.005	[-0.385, -0.072]	6,962
2020	Any External Review	-0.225*** (0.077)	-2.91	0.004	[-0.376, -0.073]	6,962
2021	Any External Review	-0.221*** (0.083)	-2.66	0.009	[-0.385, -0.058]	6,962
2022	Any External Review	-0.218** (0.096)	-2.26	0.025	[-0.406, -0.029]	6,962
2023	Any External Review	-0.214* (0.114)	-1.88	0.062	[-0.437, 0.009]	6,962
2024	Any External Review	-0.211 (0.134)	-1.57	0.119	[-0.473, 0.052]	6,962
2025	Any External Review	-0.207 (0.156)	-1.33	0.188	[-0.513, 0.099]	6,962

Appendix A.7. Year-specific marginal effects: External review quality, ICMA-aligned sample

Year	Design feature	Marginal effect (SE)	t-stat	p-value	95% CI	N
2014	External Review Only	0.092 (0.114)	0.80	0.424	[-0.132, 0.315]	7,130
2015	External Review Only	0.058 (0.096)	0.61	0.543	[-0.129, 0.246]	7,130
2016	External Review Only	0.025 (0.080)	0.31	0.754	[-0.131, 0.181]	7,130
2017	External Review Only	-0.008 (0.068)	-0.12	0.902	[-0.141, 0.124]	7,130
2018	External Review Only	-0.042 (0.063)	-0.66	0.508	[-0.165, 0.081]	7,130
2019	External Review Only	-0.075 (0.066)	-1.14	0.258	[-0.204, 0.054]	7,130
2020	External Review Only	-0.108 (0.076)	-1.42	0.159	[-0.258, 0.042]	7,130
2021	External Review Only	-0.142 (0.092)	-1.54	0.125	[-0.321, 0.038]	7,130
2022	External Review Only	-0.175 (0.110)	-1.59	0.114	[-0.390, 0.040]	7,130
2023	External Review Only	-0.208 (0.130)	-1.61	0.111	[-0.462, 0.046]	7,130
2024	External Review Only	-0.241 (0.150)	-1.61	0.111	[-0.536, 0.053]	7,130
2025	External Review Only	-0.275 (0.172)	-1.60	0.112	[-0.611, 0.062]	7,130
2014	CBI Certification	-0.281* (0.166)	-1.69	0.093	[-0.607, 0.044]	7,130
2015	CBI Certification	-0.269* (0.144)	-1.87	0.064	[-0.551, 0.013]	7,130
2016	CBI Certification	-0.257** (0.123)	-2.09	0.039	[-0.498, -0.016]	7,130
2017	CBI Certification	-0.245** (0.105)	-2.34	0.021	[-0.450, -0.040]	7,130
2018	CBI Certification	-0.233** (0.090)	-2.60	0.011	[-0.408, -0.057]	7,130
2019	CBI Certification	-0.221*** (0.080)	-2.75	0.007	[-0.378, -0.063]	7,130
2020	CBI Certification	-0.209*** (0.079)	-2.65	0.009	[-0.363, -0.054]	7,130
2021	CBI Certification	-0.196** (0.085)	-2.30	0.023	[-0.364, -0.029]	7,130
2022	CBI Certification	-0.184* (0.098)	-1.87	0.064	[-0.377, 0.009]	7,130
2023	CBI Certification	-0.172 (0.116)	-1.49	0.140	[-0.399, 0.055]	7,130
2024	CBI Certification	-0.160 (0.136)	-1.18	0.241	[-0.426, 0.106]	7,130
2025	CBI Certification	-0.148 (0.158)	-0.94	0.350	[-0.457, 0.161]	7,130

Appendix A.8. Year-specific marginal effects: Framework and Any External Review, full sample

Year	Design feature	Marginal effect (SE)	t-stat	p-value	95% CI	N
2012	Framework	-0.036 (0.096)	-0.37	0.711	[-0.225, 0.153]	21,672
2013	Framework	-0.032 (0.086)	-0.38	0.706	[-0.201, 0.136]	21,672
2014	Framework	-0.029 (0.076)	-0.38	0.701	[-0.177, 0.119]	21,672
2015	Framework	-0.026 (0.066)	-0.39	0.695	[-0.154, 0.103]	21,672
2016	Framework	-0.022 (0.056)	-0.40	0.690	[-0.132, 0.087]	21,672
2017	Framework	-0.019 (0.047)	-0.41	0.686	[-0.111, 0.073]	21,672
2018	Framework	-0.016 (0.039)	-0.40	0.689	[-0.092, 0.061]	21,672
2019	Framework	-0.012 (0.033)	-0.37	0.710	[-0.077, 0.053]	21,672
2020	Framework	-0.009 (0.030)	-0.30	0.767	[-0.068, 0.050]	21,672
2021	Framework	-0.006 (0.031)	-0.18	0.857	[-0.067, 0.056]	21,672
2022	Framework	-0.002 (0.036)	-0.06	0.949	[-0.073, 0.068]	21,672
2023	Framework	0.001 (0.043)	0.02	0.981	[-0.083, 0.085]	21,672
2024	Framework	0.004 (0.052)	0.08	0.933	[-0.097, 0.105]	21,672
2025	Framework	0.008 (0.061)	0.13	0.899	[-0.112, 0.127]	21,672
2012	Any External Review	-0.006 (0.117)	-0.05	0.959	[-0.235, 0.222]	21,672
2013	Any External Review	-0.015 (0.104)	-0.15	0.883	[-0.219, 0.189]	21,672
2014	Any External Review	-0.025 (0.092)	-0.27	0.789	[-0.205, 0.155]	21,672
2015	Any External Review	-0.034 (0.080)	-0.43	0.671	[-0.191, 0.123]	21,672
2016	Any External Review	-0.043 (0.068)	-0.63	0.528	[-0.177, 0.091]	21,672
2017	Any External Review	-0.053 (0.058)	-0.91	0.363	[-0.166, 0.060]	21,672
2018	Any External Review	-0.062 (0.048)	-1.29	0.199	[-0.156, 0.032]	21,672
2019	Any External Review	-0.071* (0.040)	-1.76	0.080	[-0.151, 0.008]	21,672
2020	Any External Review	-0.081** (0.036)	-2.22	0.028	[-0.152, -0.009]	21,672
2021	Any External Review	-0.090** (0.037)	-2.46	0.015	[-0.161, -0.018]	21,672
2022	Any External Review	-0.099** (0.041)	-2.40	0.017	[-0.180, -0.018]	21,672
2023	Any External Review	-0.108** (0.049)	-2.21	0.029	[-0.205, -0.012]	21,672
2024	Any External Review	-0.118** (0.059)	-2.00	0.047	[-0.233, -0.002]	21,672
2025	Any External Review	-0.127* (0.070)	-1.82	0.071	[-0.264, 0.010]	21,672

Appendix A.9. Year-specific marginal effects: External review quality, full sample

Year	Design feature	Marginal effect (SE)	t-stat	p-value	95% CI	N
2012	External Review Only	0.060 (0.144)	0.42	0.678	[-0.223, 0.343]	21,841
2013	External Review Only	0.046 (0.128)	0.36	0.719	[-0.205, 0.297]	21,841
2014	External Review Only	0.032 (0.112)	0.29	0.774	[-0.187, 0.251]	21,841
2015	External Review Only	0.018 (0.096)	0.19	0.849	[-0.170, 0.206]	21,841
2016	External Review Only	0.004 (0.080)	0.05	0.957	[-0.153, 0.162]	21,841
2017	External Review Only	-0.010 (0.065)	-0.15	0.883	[-0.138, 0.119]	21,841
2018	External Review Only	-0.024 (0.052)	-0.45	0.650	[-0.125, 0.078]	21,841
2019	External Review Only	-0.038 (0.041)	-0.92	0.359	[-0.118, 0.043]	21,841
2020	External Review Only	-0.052 (0.035)	-1.48	0.142	[-0.120, 0.017]	21,841
2021	External Review Only	-0.065* (0.037)	-1.79	0.076	[-0.137, 0.006]	21,841
2022	External Review Only	-0.079* (0.045)	-1.76	0.080	[-0.168, 0.009]	21,841
2023	External Review Only	-0.093 (0.057)	-1.62	0.106	[-0.206, 0.019]	21,841
2024	External Review Only	-0.107 (0.072)	-1.50	0.136	[-0.248, 0.033]	21,841
2025	External Review Only	-0.121 (0.087)	-1.40	0.165	[-0.292, 0.049]	21,841
2012	CBI Certification	-0.117 (0.163)	-0.72	0.475	[-0.435, 0.202]	21,841
2013	CBI Certification	-0.127 (0.144)	-0.88	0.378	[-0.410, 0.155]	21,841
2014	CBI Certification	-0.138 (0.126)	-1.10	0.274	[-0.385, 0.108]	21,841
2015	CBI Certification	-0.149 (0.108)	-1.38	0.169	[-0.360, 0.063]	21,841
2016	CBI Certification	-0.160* (0.091)	-1.77	0.079	[-0.337, 0.018]	21,841
2017	CBI Certification	-0.171** (0.074)	-2.30	0.022	[-0.316, -0.025]	21,841
2018	CBI Certification	-0.181*** (0.059)	-3.06	0.003	[-0.297, -0.065]	21,841
2019	CBI Certification	-0.192*** (0.048)	-4.02	<0.001	[-0.286, -0.099]	21,841
2020	CBI Certification	-0.203*** (0.042)	-4.80	<0.001	[-0.286, -0.120]	21,841
2021	CBI Certification	-0.214*** (0.045)	-4.73	<0.001	[-0.302, -0.125]	21,841
2022	CBI Certification	-0.225*** (0.055)	-4.07	<0.001	[-0.333, -0.117]	21,841
2023	CBI Certification	-0.235*** (0.069)	-3.41	<0.001	[-0.371, -0.100]	21,841
2024	CBI Certification	-0.246*** (0.085)	-2.89	0.004	[-0.413, -0.079]	21,841
2025	CBI Certification	-0.257** (0.102)	-2.51	0.013	[-0.458, -0.056]	21,841

Appendix A.10. Year-specific marginal effects: External review quality, non-ICMA sample

Year	Design feature	Marginal effect (SE)	t-stat	p-value	95% CI	N
2015	External Review Only	0.038 (0.070)	0.54	0.589	[-0.100, 0.176]	13,167
2017	External Review Only	0.034 (0.050)	0.69	0.494	[-0.064, 0.133]	13,167
2018	External Review Only	0.033 (0.041)	0.79	0.433	[-0.049, 0.114]	13,167
2019	External Review Only	0.031 (0.035)	0.89	0.375	[-0.037, 0.099]	13,167
2020	External Review Only	0.029 (0.031)	0.94	0.350	[-0.032, 0.089]	13,167
2021	External Review Only	0.027 (0.031)	0.86	0.390	[-0.034, 0.089]	13,167
2022	External Review Only	0.025 (0.036)	0.70	0.484	[-0.045, 0.096]	13,167
2023	External Review Only	0.023 (0.043)	0.54	0.591	[-0.062, 0.109]	13,167
2024	External Review Only	0.022 (0.052)	0.41	0.681	[-0.081, 0.124]	13,167
2025	External Review Only	0.020 (0.062)	0.32	0.752	[-0.103, 0.142]	13,167
2015	CBI Certification	0.804*** (0.135)	5.94	<0.001	[0.539, 1.070]	13,167
2017	CBI Certification	0.653*** (0.076)	8.56	<0.001	[0.503, 0.802]	13,167
2018	CBI Certification	0.577*** (0.079)	7.32	<0.001	[0.423, 0.731]	13,167
2019	CBI Certification	0.501*** (0.105)	4.77	<0.001	[0.295, 0.707]	13,167
2020	CBI Certification	0.425*** (0.142)	2.99	0.003	[0.146, 0.704]	13,167
2021	CBI Certification	0.350* (0.184)	1.90	0.060	[-0.012, 0.711]	13,167
2022	CBI Certification	0.274 (0.228)	1.20	0.233	[-0.174, 0.721]	13,167
2023	CBI Certification	0.198 (0.273)	0.72	0.470	[-0.337, 0.733]	13,167
2024	CBI Certification	0.122 (0.319)	0.38	0.702	[-0.503, 0.747]	13,167
2025	CBI Certification	0.046 (0.365)	0.13	0.899	[-0.668, 0.761]	13,167

Appendix B

Appendix B.1 CRE-logit issuer dynamics summary

Proxy Group	History proxy	Non-ICMA-aligned sample			Full sample				
		Management of Proceeds	Process for Project Evaluation and Selection	Reporting	ICMA Alignment	Framework	Any External Review	External Review Only	CBI Certification
Within-issuer coefficients									
Prior adoption	Feature ever used	-1.030 (2.483)	**-3.369**** (1.611)	**-4.389***** (1.584)	0.031 (0.554)	-0.256 (0.416)	**-1.584**** (0.710)	**-2.155***** (0.785)	**-4.340**** (2.159)
Prior intensity	Count previous uses	-1.030 (2.483)	**-3.028**** (1.411)	**-3.522***** (0.686)	0.032 (0.249)	-0.264 (0.273)	-0.524 (0.474)	0.016 (0.277)	**-2.516*** (1.519)
	Share previous deals	—	**-7.251*** (3.882)	—	0.505 (1.435)	1.275 (1.149)	-0.725 (1.700)	-3.380 (2.210)	—
Inactivity	Gap since last use (days)	—	—	—	0.000 (0.001)	0.000 (0.001)	-0.000 (0.001)	0.001 (0.001)	-0.001 (0.002)
	Gap since last use (deals)	—	—	—	0.342 (1.091)	-0.111 (0.310)	0.708 (0.532)	**0.408**** (0.175)	—
Recency	Uses in last 3 deals (sum)	—	—	—	0.289 (0.419)	**0.672*** (0.351)	-0.784 (0.616)	-0.666 (0.507)	—
	Uses in last 3 deals (share)	—	—	—	0.867 (1.257)	**2.016*** (1.053)	-2.352 (1.847)	-1.999 (1.520)	—
Between-issuer coefficients									
Prior adoption	Feature ever used	**11.017***** (2.601)	**6.438***** (2.366)	**9.073***** (2.650)	**5.670***** (0.654)	**3.777***** (0.495)	**7.432***** (0.990)	**6.418***** (1.035)	**17.317**** (8.118)
Prior intensity	Count previous uses	**11.017***** (2.601)	**5.415**** (2.284)	**5.974***** (0.965)	**1.528***** (0.342)	**0.732***** (0.166)	**2.389***** (0.564)	**1.374*** (0.724)	**3.708***** (1.278)
	Share previous deals	—	3.397 (2.471)	—	**6.050***** (0.810)	**3.704***** (0.518)	**6.845***** (1.351)	**5.281***** (1.013)	—
Inactivity	Gap since last use (days)	—	—	—	-0.001 (0.001)	-0.001 (0.001)	-0.006 (0.004)	-0.005 (0.004)	-0.008 (0.015)
	Gap since last use (deals)	—	—	—	**-5.877**** (2.505)	**-1.453***** (0.336)	**-5.819***** (1.284)	**-4.032***** (0.936)	—
Recency	Uses in last 3 deals (sum)	—	—	—	**2.173***** (0.396)	**1.365***** (0.211)	**3.999**** (1.615)	**3.544***** (1.373)	—
	Uses in last 3 deals (share)	—	—	—	**6.518***** (1.187)	**4.095***** (0.633)	**11.998**** (4.846)	**10.633***** (4.120)	—

Note: The table summarizes the correlated random effects logit models for issuer-side continuation. Each cell reports the coefficient on the indicated issuer-history proxy from a separate CRE-logit model. Within-issuer coefficients capture deviations of the issuer's own history from its issuer-level mean; between-issuer coefficients capture the issuer-level mean of the same history proxy. Coefficients are logit-index coefficients and should not be interpreted as marginal effects. The models include deal-level controls and issue-year fixed effects; standard errors are clustered by issuer. Deal-level controls include maturity, Log Issue Size, Tranche Rating, Callable, Sinkable, Bank qualified, Treasury Yield, and tax-status indicators. Putable is excluded because it is almost always zero and provides no stable deal-level variation. Dashes indicate specifications that are not estimated or not reported because of sparse outcomes, collinearity, or non-estimable models. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Appendix B.2. CRE Logit Core Management of Proceeds

VARIABLES	(1) Ever Used	(2) Prior Use Count
Within history proxy	-1.030	-1.030
	(2.483)	(2.483)
Between history proxy	11.017***	11.017***
	(2.601)	(2.601)
Tax Exempt	-1.052	-1.052
	(1.764)	(1.764)
Taxable	-	-
Maturity	-0.079	-0.079
	(0.124)	(0.124)
Log Issue Size	0.706**	0.706**
	(0.308)	(0.308)
Bond Rating	0.129	0.129
	(0.171)	(0.171)
Callable	-2.805***	-2.805***
	(0.835)	(0.835)
Sinkable	0.528	0.528
	(1.442)	(1.442)
Bank Qualified	1.858	1.858
	(2.028)	(2.028)
Treasury Yield	1.471**	1.471**
	(0.678)	(0.678)
Constant	-19.803***	-19.803***
	(6.720)	(6.720)
Sample	Non-ICMA	Non-ICMA
Observations	434	434
Issuers/Clusters	352	352
Issue-Year FE	Yes	Yes
Issuer FE	No	No
SE Clustering	Issuer	Issuer

Note: The table reports correlated random effects logit models for subsequent use of the indicated design feature. Each specification enters one issuer-history proxy at a time and decomposes it into within-issuer and between-issuer components. The models include deal-level controls and issue-year fixed effects. Standard errors are clustered by issuer and reported in parentheses. Coefficients are logit-index coefficients. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Appendix B.3. CRE Logit Core Process for Project Evaluation and Selection

VARIABLES	(1) Ever Used	(2) Prior Use Count	(3) Prior Use Share
Within history proxy	-3.369**	-3.028**	-7.251*
	(1.611)	(1.411)	(3.882)
Between history proxy	6.438***	5.415**	3.397
	(2.366)	(2.284)	(2.471)
Tax Exempt	-0.363	-0.305	
	(2.034)	(2.020)	
Taxable	-0.245	-0.218	
	(2.066)	(2.054)	
Maturity	-0.057	-0.054	0.056
	(0.036)	(0.036)	(0.112)
Log Issue Size	0.010	0.021	0.261
	(0.150)	(0.149)	(0.364)
Bond Rating	0.352***	0.349***	0.216
	(0.106)	(0.102)	(0.244)
Callable	1.254*	1.211*	-0.160
	(0.690)	(0.672)	(1.326)
Sinkable	-0.514	-0.480	-1.088
	(0.389)	(0.388)	(1.039)
Bank Qualified	0.898*	0.869*	2.347
	(0.518)	(0.516)	(2.386)
Treasury Yield	-0.083	-0.071	-0.398
	(0.418)	(0.420)	(1.050)
Constant	-6.226*	-6.373*	-7.686
	(3.724)	(3.688)	(7.356)
Sample	Non-ICMA	Non-ICMA	Non-ICMA
Observations	850	850	174
Issuers/Clusters	653	653	93
Issue-Year FE	Yes	Yes	Yes
Issuer FE	No (RE)	No (RE)	No (RE)
SE Clustering	Issuer	Issuer	Issuer

Issuer-clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Appendix B.4. CRE Logit Core Reporting

	(1)	(2)
VARIABLES	Ever Used	Prior Use Count
Within history proxy	-4.389***	-3.522***
	(1.584)	(0.686)
Between history proxy	9.073***	5.974***
	(2.650)	(0.965)
Tax Exempt	-4.195***	-3.440***
	(1.583)	(1.165)
Taxable	-2.528	-1.969
	(1.618)	(1.308)
Maturity	0.005	0.004
	(0.045)	(0.053)
Log Issue Size	0.365	0.303*
	(0.230)	(0.184)
Bond Rating	0.105	0.084
	(0.159)	(0.131)
Callable	-1.016	-0.886
	(0.966)	(0.950)
Sinkable	0.384	-0.017
	(0.686)	(0.623)
Bank Qualified	0.899	0.578
	(0.945)	(0.984)
Treasury Yield	0.095	0.175
	(0.697)	(0.808)
Constant	-7.169	-5.444
	(6.546)	(5.848)
Sample	Non-ICMA	Non-ICMA
Observations	770	770
Issuers/Clusters	600	600
Issue-Year FE	Yes	Yes
Issuer FE	No (RE)	No (RE)
SE Clustering	Issuer	Issuer

Issuer-clustered standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.10

Appendix B.5. CRE Logit ICMA Alignment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	Ever Used	Prior Use Count	Prior Use Share	Gap since last use (deals)	Gap since last use (days)	Recent use count	Recent use share
Within history proxy	0.031	0.032	0.505	0.342	0.000	0.289	0.867
	(0.554)	(0.249)	(1.435)	(1.091)	(0.001)	(0.419)	(1.257)
Between history proxy	5.670***	1.528***	6.050***	-5.877**	-0.001	2.173***	6.518***
	(0.654)	(0.342)	(0.810)	(2.505)	(0.001)	(0.396)	(1.187)
Tax Exempt	-1.788**	-1.951**	1.445**	1.348	1.358	1.225	1.225
	(0.716)	(0.799)	(0.695)	(1.074)	(1.595)	(1.329)	(1.329)
Taxable	-3.002***	-3.353***					
	(0.792)	(0.851)					
Maturity	0.045	0.053*	-0.049	-0.112	-0.159*	-0.019	-0.019
	(0.030)	(0.031)	(0.045)	(0.110)	(0.085)	(0.057)	(0.057)
Log Issue Size	0.495***	0.679***	0.484***	0.836*	0.997***	0.317	0.317
	(0.097)	(0.102)	(0.124)	(0.485)	(0.309)	(0.223)	(0.223)
Bond Rating	0.017	-0.008	0.067	0.198	0.412	0.022	0.022
	(0.067)	(0.073)	(0.144)	(0.230)	(0.458)	(0.203)	(0.203)
Callable	-0.594	-0.687*	-0.023	0.744	0.894	-0.431	-0.431
	(0.382)	(0.416)	(0.651)	(1.088)	(1.157)	(1.004)	(1.004)
Sinkable	-0.081	0.050	0.180	-0.505	-0.859	0.699	0.699
	(0.245)	(0.284)	(0.402)	(0.632)	(0.846)	(0.768)	(0.768)
Bank Qualified	-0.720*	-0.882*					
	(0.382)	(0.456)					
Treasury Yield	0.327	0.205	0.344	0.301	0.288	0.745	0.745
	(0.289)	(0.313)	(0.481)	(1.174)	(1.017)	(0.653)	(0.653)
Constant	-12.445***	-15.686***	-13.972***	-10.059	-18.054**	-13.219**	-13.219**
	(2.532)	(2.737)	(3.323)	(8.311)	(7.873)	(6.176)	(6.176)
Sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample
Observations	1,386	1,386	508	259	259	262	262
Issuers/Clusters	862	862	165	83	83	66	66
Issue-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Issuer FE	No (RE)	No (RE)	No (RE)	No (RE)	No (RE)	No (RE)	No (RE)
SE Clustering	Issuer	Issuer	Issuer	Issuer	Issuer	Issuer	Issuer

Issuer-clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Appendix B.6. CRE Logit Recommended: Framework

VARIABLES	(1) Ever Used	(2) Prior Use Count	(3) Prior Use Share	(4) Gap since last use (deals)	(5) Gap since last use (days)	(6) Recent use count	(7) Recent use share
Within history proxy	-0.256	-0.264	1.275	-0.111	0.000	0.672*	2.016*
	(0.416)	(0.273)	(1.149)	(0.310)	(0.001)	(0.351)	(1.053)
Between history proxy	3.777***	0.732***	3.704***	-1.453***	-0.001	1.365***	4.095***
	(0.495)	(0.166)	(0.518)	(0.336)	(0.001)	(0.211)	(0.633)
Tax Exempt	-1.717**	-1.846**	-0.305	-0.268	-0.671	-0.362	-0.362
	(0.756)	(0.754)	(1.213)	(1.002)	(1.352)	(0.947)	(0.947)
Taxable	-2.587***	-2.663***	-0.590	-0.654	-0.859		
	(0.787)	(0.778)	(1.239)	(1.118)	(1.459)		
Maturity	0.027	0.035	-0.033	-0.088**	-0.085*	0.028	0.028
	(0.025)	(0.024)	(0.036)	(0.040)	(0.051)	(0.042)	(0.042)
Log Issue Size	0.477***	0.625***	0.356***	0.303*	0.198	0.304**	0.304**
	(0.083)	(0.095)	(0.110)	(0.159)	(0.189)	(0.120)	(0.120)
Bond Rating	-0.046	-0.108*	0.002	0.089	0.097	-0.185*	-0.185*
	(0.059)	(0.061)	(0.095)	(0.119)	(0.148)	(0.095)	(0.095)
Callable	-0.707**	-0.669**	0.088	0.450	0.402	0.049	0.049
	(0.331)	(0.338)	(0.448)	(0.594)	(0.686)	(0.778)	(0.778)
Sinkable	0.105	0.134	0.113	-0.076	-0.045	-0.200	-0.200
	(0.225)	(0.237)	(0.309)	(0.424)	(0.494)	(0.333)	(0.333)
Bank Qualified	-1.081**	-1.076**	-1.099	0.378	1.365		
	(0.461)	(0.497)	(0.969)	(1.313)	(1.613)		
Treasury Yield	0.450*	0.411	0.673*	0.378	0.667	1.267**	1.267**
	(0.270)	(0.276)	(0.389)	(0.527)	(0.619)	(0.578)	(0.578)
Constant	-11.314***	-13.555***	-9.972***	-1.353	-0.185	-13.641***	-13.641***
	(2.122)	(2.412)	(2.881)	(4.257)	(4.310)	(3.700)	(3.700)
Sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample
Observations	1,382	1,382	543	322	322	258	258
Issuers/Clusters	860	860	185	95	95	66	66
Issue-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Issuer FE	No (RE)	No (RE)	No (RE)	No (RE)	No (RE)	No (RE)	No (RE)
SE Clustering	Issuer	Issuer	Issuer	Issuer	Issuer	Issuer	Issuer

Issuer-clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Appendix B.7. CRE Logit Recommended: Any External Review

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	Ever Used	Prior Use Count	Prior Use Share	Gap since last use (deals)	Gap since last use (days)	Recent use count	Recent use share
Within history proxy	-1.584**	-0.524	-0.725	0.708	-0.000	-0.784	-2.352
	(0.710)	(0.474)	(1.700)	(0.532)	(0.001)	(0.616)	(1.847)
Between history proxy	7.432***	2.389***	6.845***	-5.819***	-0.006	3.999**	11.998**
	(0.990)	(0.564)	(1.351)	(1.284)	(0.004)	(1.615)	(4.846)
Tax Exempt	-0.755	-0.659	-3.836	-0.614	-1.909	-2.143	-2.143
	(0.870)	(0.832)	(2.696)	(1.171)	(3.059)	(1.730)	(1.730)
Taxable	-1.092	-1.064	-3.787				
	(0.930)	(0.897)	(2.832)				
Maturity	0.018	0.029	-0.097*	-0.072	-0.211	-0.005	-0.005
	(0.032)	(0.030)	(0.057)	(0.057)	(0.206)	(0.106)	(0.106)
Log Issue Size	0.443***	0.510***	0.591***	0.892***	1.735**	0.756	0.756
	(0.118)	(0.122)	(0.204)	(0.286)	(0.789)	(0.553)	(0.553)
Bond Rating	0.159**	0.147**	0.255	-0.046	0.180	0.525	0.525
	(0.074)	(0.071)	(0.170)	(0.184)	(0.507)	(0.510)	(0.510)
Callable	-0.149	-0.082	1.473	2.555***	5.007**	0.500	0.500
	(0.490)	(0.491)	(1.141)	(0.739)	(2.420)	(1.612)	(1.612)
Sinkable	-0.309	-0.308	0.209	-0.681	-0.039	1.174	1.174
	(0.278)	(0.277)	(0.560)	(0.663)	(1.573)	(1.265)	(1.265)
Bank Qualified	1.141***	1.212***	-0.768	-1.921	-3.679		
	(0.405)	(0.392)	(1.666)	(1.291)	(3.230)		
Treasury Yield	0.333	0.179	0.464	-0.020	0.116	2.992**	2.992**
	(0.329)	(0.325)	(0.609)	(1.273)	(2.391)	(1.417)	(1.417)
Constant	-13.641***	-14.608***	-15.079***	-9.665	-29.320	-34.929*	-34.929*
	(2.958)	(3.069)	(5.468)	(7.006)	(20.419)	(18.082)	(18.082)
Sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample
Observations	1,386	1,386	528	191	191	262	262
Issuers/Clusters	862	862	184	62	62	66	66
Issue-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Issuer FE	No (RE)	No (RE)	No (RE)	No (RE)	No (RE)	No (RE)	No (RE)
SE Clustering	Issuer	Issuer	Issuer	Issuer	Issuer	Issuer	Issuer

Issuer-clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Appendix B.8.CRE Logit External Review Only

VARIABLES	(1) Ever Used	(2) Prior Use Count	(3) Prior Use Share	(4) Gap since last use (deals)	(5) Gap since last use (days)	(6) Recent use count	(7) Recent use share
Within history proxy	-2.155***	0.016	-3.380	0.408**	0.001	-0.666	-1.999
	(0.785)	(0.277)	(2.210)	(0.175)	(0.001)	(0.507)	(1.520)
Between history proxy	6.418***	1.374*	5.281***	-4.032***	-0.005	3.544**	10.633**
	(1.035)	(0.724)	(1.013)	(0.936)	(0.004)	(1.373)	(4.120)
Tax Exempt	-1.422	-1.300*	-4.621*	-0.429	-1.030	-2.712*	-2.712*
	(0.881)	(0.781)	(2.591)	(0.997)	(1.445)	(1.438)	(1.438)
Taxable	-1.770*	-1.824**	-4.267				
	(0.929)	(0.839)	(2.601)				
Maturity	0.020	0.017	-0.039	0.018	-0.018	-0.041	-0.041
	(0.027)	(0.027)	(0.042)	(0.050)	(0.126)	(0.078)	(0.078)
Log Issue Size	0.346***	0.418***	0.432***	1.061***	1.494***	0.519**	0.519**
	(0.120)	(0.119)	(0.158)	(0.301)	(0.531)	(0.252)	(0.252)
Bond Rating	0.117*	0.104	0.023	-0.075	-0.800**	0.072	0.072
	(0.070)	(0.067)	(0.147)	(0.110)	(0.379)	(0.244)	(0.244)
Callable	-0.306	-0.256	1.143	1.860**	3.495***	-0.043	-0.043
	(0.470)	(0.454)	(0.955)	(0.827)	(1.339)	(1.265)	(1.265)
Sinkable	-0.102	0.012	0.438	-0.520	0.416	1.631	1.631
	(0.264)	(0.259)	(0.458)	(0.760)	(1.267)	(1.049)	(1.049)
Bank Qualified	1.302***	1.309***	0.151	0.496	1.364		
	(0.440)	(0.416)	(1.467)	(1.710)	(3.752)		
Treasury Yield	0.190	0.191	0.280	-0.709	-0.766	1.811	1.811
	(0.349)	(0.336)	(0.572)	(0.822)	(1.404)	(1.515)	(1.515)
Constant	-10.934***	-11.744***	-8.806**	-11.869**	-21.757**	-20.742**	-20.742**
	(2.960)	(2.887)	(4.264)	(5.148)	(10.629)	(10.236)	(10.236)
Sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample
Observations	1,386	1,386	497	140	140	247	247
Issuers/Clusters	862	862	183	51	51	66	66
Issue-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Issuer FE	No (RE)	No (RE)	No (RE)	No (RE)	No (RE)	No (RE)	No (RE)
SE Clustering	Issuer	Issuer	Issuer	Issuer	Issuer	Issuer	Issuer

Issuer-clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Appendix B.9. CRE Logit CBI Certification

VARIABLES	(1) Ever Used	(2) Prior Use Count	(3) Gap since last use (days)
Within history proxy	-4.340**	-2.516*	-0.001
	(2.159)	(1.519)	(0.002)
Between history proxy	17.317**	3.708***	-0.008
	(8.118)	(1.278)	(0.015)
Tax Exempt	-1.449	-1.027	
	(1.195)	(0.653)	
Taxable			
Maturity	0.038	0.049	0.227
	(0.069)	(0.040)	(0.161)
Log Issue Size	0.555	0.629***	-0.695
	(0.415)	(0.212)	(1.986)
Bond Rating	0.283	0.088	-0.191
	(0.358)	(0.130)	(0.660)
Callable	0.437	0.073	
	(1.628)	(1.011)	
Sinkable	-0.654	-0.660	-0.292
	(0.872)	(0.626)	(7.372)
Bank Qualified			
Treasury Yield	1.005	0.333	-1.378
	(1.297)	(0.744)	(10.984)
Constant	-28.540*	-19.270***	
	(15.385)	(5.274)	
Sample	Full sample	Full sample	Full sample
Observations	991	991	68
Issuers/Clusters	553	553	19
Issue-Year FE	Yes	Yes	Yes
Issuer FE	No (RE)	No (RE)	No (RE)
SE Clustering	Issuer	Issuer	Issuer

Issuer-clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Appendix C

Appendix C.1. Pooled logit benchmark for issuer dynamics

Proxy Group	History proxy	Non-ICMA-aligned sample			Full sample				
		Management of Proceeds	**Process for Project Evaluation and Selection**	**Reporting**	**ICMA Alignment**	**Framework**	**Any External Review**	**External Review Only**	**CBI Certification**
Prior adoption	Feature ever used	**4.618**** (1.993)	**1.145*** (0.646)	**2.689*** (1.474)	**2.534***** (0.273)	**1.487***** (0.270)	**2.337***** (0.318)	**1.520***** (0.331)	**4.480***** (0.579)
Prior intensity	Count previous uses	**4.618**** (1.993)	**1.056*** (0.564)	**1.416***** (0.345)	**0.756***** (0.232)	**0.195**** (0.080)	**0.955***** (0.186)	**0.629**** (0.278)	**1.065***** (0.334)
	Share previous deals	—	**1.863*** (0.991)	**5.373***** (1.522)	**4.366***** (0.379)	**2.969***** (0.287)	**4.551***** (0.415)	**3.675***** (0.457)	**9.046***** (0.827)
Inactivity	Gap since last use (days)	—	—	—	**-0.0007**** (0.0003)	**-0.0007***** (0.0002)	**-0.0016**** (0.0006)	**-0.0014**** (0.0006)	-0.0033 (0.0021)
	Gap since last use (deals)	—	—	—	**-1.699***** (0.302)	**-0.735***** (0.196)	**-1.725***** (0.497)	**-1.101***** (0.326)	**-2.876***** (0.908)
Recency	Uses in last 3 deals (sum)	—	—	—	**1.660***** (0.207)	**1.153***** (0.171)	**2.080***** (0.321)	**1.531***** (0.349)	**3.651***** (0.843)
	Uses in last 3 deals (share)	—	—	—	**4.979***** (0.621)	**3.458***** (0.513)	**6.240***** (0.964)	**4.593***** (1.048)	**10.953***** (2.529)

Note: The table reports pooled-logit benchmark models for issuer-side continuation. Each cell reports the coefficient on the indicated issuer-history proxy from a separate pooled-logit model. Coefficients are logit-index coefficients and should not be interpreted as marginal effects. The models use the same issuer-history proxies, deal-level controls, issue-year fixed effects, and issuer-clustered standard errors as the CRE-logit models, but they do not decompose persistence into within-issuer and between-issuer components. Dashes indicate specifications that are not estimated or not reported because of sparse outcomes, collinearity, or non-estimable models. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. The pooled-logit reference effects plotted in Figure 6 are estimated on the corresponding CRE estimation samples to keep the within, between, and pooled average marginal effects comparable within each design feature. Deal-level controls include maturity, Log Issue Size, Tranche Rating, Callable, Sinkable, Bank qualified, Treasury Yield, and tax-status indicators. Putable is excluded because it is almost always zero and provides no stable deal-level variation.

Appendix C.2 – Pooled Logit Core Management of Proceeds

VARIABLES	(1) Ever Used	(2) Prior Use Count
History proxy	4.618**	4.618**
	(1.993)	(1.993)
Maturity	-0.101	-0.101
	(0.156)	(0.156)
Log Issue Size	0.470**	0.470**
	(0.218)	(0.218)
Bond Rating	0.034	0.034
	(0.161)	(0.161)
Callable	-2.492***	-2.492***
	(0.727)	(0.727)
Sinkable	0.804	0.804
	(1.519)	(1.519)
Bank Qualified	0.616	0.616
	(1.681)	(1.681)
Treasury Yield	1.370***	1.370***
	(0.532)	(0.532)
Constant	-15.300***	-15.300***
	(4.980)	(4.980)
Sample	Non-ICMA	Non-ICMA
Observations	434	434
Issuers/Clusters	352	352
Issue-Year FE	Yes	Yes
Issuer FE	No	No
SE Clustering	Issuer	Issuer

Note: The table reports pooled-logit benchmark models for subsequent use of the indicated design feature. Each specification enters one issuer-history proxy at a time. The models include deal-level controls and issue-year fixed effects. Standard errors are clustered by issuer and reported in parentheses. Coefficients are logit-index coefficients. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Appendix C.3 – Pooled Logit Core Process for Project Evaluation and Selection

VARIABLES	(1) Ever Used	(2) Prior Use Count	(3) Prior Use Share
History proxy	1.145*	1.056*	1.863*
	(0.646)	(0.564)	(0.991)
Maturity	-0.045	-0.045	0.043
	(0.028)	(0.028)	(0.058)
Log Issue Size	0.063	0.064	0.178
	(0.096)	(0.096)	(0.219)
Bond Rating	0.244***	0.244***	0.176
	(0.060)	(0.060)	(0.152)
Callable	0.849*	0.854*	-0.895
	(0.498)	(0.497)	(1.013)
Sinkable	-0.275	-0.279	-0.295
	(0.250)	(0.249)	(0.712)
Bank Qualified	0.651**	0.650**	1.146
	(0.329)	(0.330)	(0.982)
Treasury Yield	-0.065	-0.071	-0.357
	(0.308)	(0.305)	(0.761)
Constant	-5.689**	-5.723**	-3.908
	(2.407)	(2.406)	(4.464)
Sample	Non-ICMA	Non-ICMA	Non-ICMA
Observations	850	850	174
Issuers/Clusters	653	653	93
Issue-Year FE	Yes	Yes	Yes
Issuer FE	No	No	No
SE Clustering	Issuer	Issuer	Issuer

Issuer-clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Appendix C.4 – Pooled Logit Core Reporting

VARIABLES	(1) Ever Used	(2) Prior Use Count	(3) Prior Use Share
History proxy	2.689*	1.416***	5.373***
	(1.474)	(0.345)	(1.522)
Maturity	0.061	0.065*	0.130**
	(0.040)	(0.038)	(0.059)
Log Issue Size	0.179	0.210	-0.502*
	(0.167)	(0.169)	(0.289)
Bond Rating	-0.037	-0.046	-0.125
	(0.117)	(0.123)	(0.176)
Callable	-0.836	-0.829	-2.163
	(0.849)	(0.842)	(1.552)
Sinkable	0.323	0.315	1.530
	(0.636)	(0.621)	(1.267)
Bank Qualified	0.703	0.752	0.520
	(0.723)	(0.751)	(1.094)
Treasury Yield	-0.224	-0.217	-1.326
	(0.631)	(0.630)	(0.895)
Constant	-2.490	-3.211	10.747*
	(4.673)	(4.795)	(5.828)
Sample	Non-ICMA sample (D4=0)	Non-ICMA sample (D4=0)	Non-ICMA sample (D4=0)
Observations	770	770	186
Issuers/Clusters	600	600	92
Issue-Year FE	Yes	Yes	Yes
Issuer FE	No	No	No
SE Clustering	Issuer	Issuer	Issuer

Issuer-clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Appendix C.5 – Pooled Logit ICMA Alignment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	Ever Used	Prior Use Count	Prior Use Share	Gap since last use (deals)	Gap since last use (days)	Recent use count	Recent use share
History proxy	2.534***	0.756***	4.366***	-1.699***	-0.001**	1.660***	4.979***
	(0.273)	(0.232)	(0.379)	(0.302)	(0.000)	(0.207)	(0.621)
Maturity	0.040*	0.047**	-0.029	-0.096**	-0.093**	-0.016	-0.016
	(0.023)	(0.020)	(0.038)	(0.045)	(0.046)	(0.049)	(0.049)
Log Issue Size	0.444***	0.437***	0.370***	0.642***	0.644***	0.400**	0.400**
	(0.071)	(0.070)	(0.091)	(0.167)	(0.175)	(0.170)	(0.170)
Bond Rating	0.029	0.002	0.007	0.153	0.198	0.059	0.059
	(0.048)	(0.045)	(0.112)	(0.152)	(0.159)	(0.155)	(0.155)
Callable	-0.254	-0.313	-0.084	0.489	0.416	-0.282	-0.282
	(0.277)	(0.264)	(0.525)	(0.633)	(0.652)	(0.690)	(0.690)
Sinkable	-0.057	0.013	-0.008	-0.696	-0.871*	0.510	0.510
	(0.190)	(0.190)	(0.316)	(0.529)	(0.513)	(0.599)	(0.599)
Bank Qualified	-0.636**	-0.728**	-	-	-	-	-
	(0.321)	(0.317)					
Treasury Yield	0.289	0.200	0.204	0.454	0.319	0.652	0.652
	(0.236)	(0.220)	(0.389)	(0.700)	(0.653)	(0.640)	(0.640)
Constant	-9.884***	-9.557***	-10.190***	-10.668***	-11.436***	-14.460***	-14.460***
	(1.858)	(1.830)	(2.463)	(4.072)	(4.058)	(4.543)	(4.543)
Sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample
Observations	1,442	1,442	508	259	259	262	262
Issuers/Clusters	897	897	165	83	83	66	66
Issue-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Issuer FE	No	No	No	No	No	No	No
SE Clustering	Issuer	Issuer	Issuer	Issuer	Issuer	Issuer	Issuer

Issuer-clustered standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.10

Appendix C.6 – Pooled Logit Recommended: Framework

VARIABLES	(1) Ever Used	(2) Prior Use Count	(3) Prior Use Share	(4) Gap since last use (deals)	(5) Gap since last use (days)	(6) Recent use count	(7) Recent use share
History proxy	1.487***	0.195**	2.969***	-0.735***	-0.001***	1.153***	3.458***
	(0.270)	(0.080)	(0.287)	(0.196)	(0.000)	(0.171)	(0.513)
Maturity	0.030	0.032*	-0.005	-0.042	-0.017	0.037	0.037
	(0.018)	(0.017)	(0.030)	(0.032)	(0.033)	(0.040)	(0.040)
Log Issue Size	0.411***	0.455***	0.234**	0.216*	0.151	0.336***	0.336***
	(0.059)	(0.064)	(0.093)	(0.111)	(0.142)	(0.119)	(0.119)
Bond Rating	-0.053	-0.105**	-0.081	0.035	0.006	-0.178*	-0.178*
	(0.043)	(0.044)	(0.084)	(0.083)	(0.097)	(0.097)	(0.097)
Callable	-0.257	-0.312	0.036	0.367	0.318	0.103	0.103
	(0.254)	(0.251)	(0.395)	(0.508)	(0.482)	(0.746)	(0.746)
Sinkable	0.028	0.095	0.027	-0.265	-0.185	-0.285	-0.285
	(0.181)	(0.177)	(0.263)	(0.341)	(0.362)	(0.327)	(0.327)
Bank Qualified	-0.932**	-0.994**	-1.378*	-0.555	-0.227	-	-
	(0.392)	(0.399)	(0.720)	(0.834)	(0.758)		
Treasury Yield	0.331	0.362*	0.595*	0.445	0.350	1.299**	1.299**
	(0.208)	(0.204)	(0.326)	(0.460)	(0.403)	(0.565)	(0.565)
Constant	-8.249***	-8.833***	-7.994***	-3.963	-2.980	-14.391***	-14.391***
	(1.562)	(1.630)	(2.545)	(2.860)	(3.192)	(3.561)	(3.561)
Sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample
Observations	1,438	1,438	543	322	322	258	258
Issuers/Clusters	895	895	185	95	95	66	66
Issue-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Issuer FE	No	No	No	No	No	No	No
SE Clustering	Issuer	Issuer	Issuer	Issuer	Issuer	Issuer	Issuer

Issuer-clustered standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.10

Appendix C.7 – Pooled Logit Recommended: Any External Review

VARIABLES	(1) Ever Used	(2) Prior Use Count	(3) Prior Use Share	(4) Gap since last use (deals)	(5) Gap since last use (days)	(6) Recent use count	(7) Recent use share
History proxy	2.337***	0.955***	4.551***	-1.725***	-0.002**	2.080***	6.240***
	(0.318)	(0.186)	(0.415)	(0.497)	(0.001)	(0.321)	(0.964)
Maturity	0.013	0.024	-0.057	-0.081*	-0.061	0.001	0.001
	(0.020)	(0.018)	(0.036)	(0.048)	(0.046)	(0.060)	(0.060)
Log Issue Size	0.399***	0.357***	0.407***	0.771***	0.876***	0.529**	0.529**
	(0.066)	(0.063)	(0.116)	(0.217)	(0.215)	(0.240)	(0.240)
Bond Rating	0.142***	0.120***	0.181*	0.136	0.290	0.347*	0.347*
	(0.049)	(0.046)	(0.107)	(0.159)	(0.194)	(0.203)	(0.203)
Callable	0.048	-0.010	0.867	1.930***	1.418**	-0.419	-0.419
	(0.304)	(0.294)	(0.678)	(0.591)	(0.605)	(0.987)	(0.987)
Sinkable	-0.138	-0.123	0.116	-0.412	-0.272	0.890	0.890
	(0.179)	(0.177)	(0.380)	(0.532)	(0.450)	(0.826)	(0.826)
Bank Qualified	0.937***	0.837***	-1.607	-1.396	-1.859	-	-
	(0.250)	(0.241)	(1.168)	(1.413)	(1.298)		
Treasury Yield	0.172	0.099	0.133	0.011	-0.631	1.183*	1.183*
	(0.229)	(0.210)	(0.452)	(0.775)	(0.834)	(0.674)	(0.674)
Constant	-10.600***	-9.509***	-9.749***	-12.198***	-12.682***	-20.142***	-20.142***
	(1.694)	(1.612)	(3.265)	(4.502)	(4.362)	(4.614)	(4.614)
Sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample
Observations	1,386	1,386	528	191	191	262	262
Issuers/Clusters	862	862	184	62	62	66	66
Issue-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Issuer FE	No	No	No	No	No	No	No
SE Clustering	Issuer	Issuer	Issuer	Issuer	Issuer	Issuer	Issuer

Issuer-clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Appendix C.8 – Pooled Logit External Review Only

VARIABLES	(1) Ever Used	(2) Prior Use Count	(3) Prior Use Share	(4) Gap since last use (deals)	(5) Gap since last use (days)	(6) Recent use count	(7) Recent use share
History proxy	1.520***	0.629**	3.675***	-1.101***	-0.001**	1.531***	4.593***
	(0.331)	(0.278)	(0.457)	(0.326)	(0.001)	(0.349)	(1.048)
Maturity	0.005	0.018	-0.032	-0.049	-0.065**	-0.033	-0.033
	(0.021)	(0.018)	(0.031)	(0.037)	(0.033)	(0.053)	(0.053)
Log Issue Size	0.286***	0.239***	0.355***	0.710***	0.571***	0.498***	0.498***
	(0.065)	(0.058)	(0.095)	(0.175)	(0.158)	(0.170)	(0.170)
Bond Rating	0.113**	0.082*	0.122	0.003	0.018	0.227*	0.227*
	(0.047)	(0.046)	(0.083)	(0.113)	(0.134)	(0.117)	(0.117)
Callable	-0.144	-0.221	0.749	0.681	0.395	-0.356	-0.356
	(0.299)	(0.282)	(0.543)	(0.689)	(0.683)	(0.835)	(0.835)
Sinkable	-0.058	-0.004	0.229	0.060	0.274	0.693	0.693
	(0.183)	(0.180)	(0.344)	(0.509)	(0.474)	(0.653)	(0.653)
Bank Qualified	0.867***	0.794***	-0.694	-0.491	-1.073	-	-
	(0.245)	(0.241)	(1.030)	(1.432)	(1.317)		
Treasury Yield	0.076	0.035	0.090	-0.831	-1.104*	0.876	0.876
	(0.222)	(0.216)	(0.422)	(0.649)	(0.570)	(0.641)	(0.641)
Constant	-6.839***	-5.864***	-7.635***	-8.518**	-5.643	-14.877***	-14.877***
	(1.636)	(1.541)	(2.669)	(3.711)	(3.474)	(3.231)	(3.231)
Sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample
Observations	1,386	1,386	497	140	140	247	247
Issuers/Clusters	862	862	183	51	51	66	66
Issue-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Issuer FE	No	No	No	No	No	No	No
SE Clustering	Issuer	Issuer	Issuer	Issuer	Issuer	Issuer	Issuer

Issuer-clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Appendix C.9 – Pooled Logit CBI Certification

VARIABLES	(1) Ever Used	(2) Prior Use Count	(3) Prior Use Share	(4) Gap since last use (deals)	(5) Gap since last use (days)	(6) Recent use count	(7) Recent use share
History proxy	4.480***	1.065***	9.046***	-2.876***	-0.003	3.651***	10.953***
	(0.579)	(0.334)	(0.827)	(0.908)	(0.002)	(0.843)	(2.529)
Maturity	0.047	0.004	-0.100**	-0.056	0.186	0.062	0.062
	(0.035)	(0.030)	(0.045)	(0.110)	(0.150)	(0.080)	(0.080)
Log Issue Size	0.374**	0.492***	0.015	-0.455	-0.696	-0.119	-0.119
	(0.145)	(0.109)	(0.239)	(0.414)	(0.514)	(0.251)	(0.251)
Bond Rating	0.012	0.050	0.176	-0.228	-0.163	0.346	0.346
	(0.102)	(0.074)	(0.162)	(0.298)	(0.175)	(0.361)	(0.361)
Callable	0.590	0.577	-0.011	21.117***	21.223***	4.913***	4.913***
	(0.689)	(0.681)	(1.731)	(2.482)	(2.938)	(1.446)	(1.446)
Sinkable	0.279	-0.012	-0.427	-0.775	0.064	-0.648	-0.648
	(0.336)	(0.341)	(0.681)	(1.290)	(1.197)	(2.100)	(2.100)
Bank Qualified	-	-	-	-	-	-	-
Treasury Yield	0.236	0.299	1.318	1.546	-0.575	2.070*	2.070*
	(0.614)	(0.494)	(1.006)	(1.159)	(1.384)	(1.186)	(1.186)
Constant	-14.859***	-16.666***	-14.357**	-13.833	-4.678	-23.653***	-23.653***
	(3.873)	(3.498)	(6.592)	(9.686)	(11.203)	(8.353)	(8.353)
Sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample
Observations	991	991	467	68	68	262	262
Issuers/Clusters	553	553	158	19	19	66	66
Issue-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Issuer FE	No	No	No	No	No	No	No
SE Clustering	Issuer	Issuer	Issuer	Issuer	Issuer	Issuer	Issuer

Issuer-clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10