FEDERAL RESERVE BANK
PHILADELPHIA

Working Papers
RESEARCH DEPARTMENT

Does Skin in the Game Align Incentives?
The Case of CRE CLOs

Daniel Broxterman
Florida State University

Larry Cordell
Federal Reserve Bank of Philadelphia (Retired)

Casey Dougal
Florida State University

Xingliang Ma
Federal Reserve Bank of Philadelphia Supervision, Regulation, and Credit Department

WP 25-43

PUBLISHED
December 2025

ISSN: 1962-5361

DOI: https://doi.org/10.21799/frbp.wp.2025.43

Does *Skin in the Game* Align Incentives? The Case of CRE CLOs*

Daniel Broxterman, Larry Cordell, Casey Dougal, Xingliang Ma

December 20, 2025

Abstract

This paper examines whether high levels of risk retention effectively align incentives in securitizations, using evidence from the $100+ billion commercial real estate collateralized loan obligation (CRE CLO) market. CRE CLO sponsors retain all equity and non–investment-grade tranches, far exceeding Dodd–Frank Act minimums. Despite this substantial retention, we find that security returns are driven in part by resolving distressed loans through par-value buyouts back to sponsor balance sheets, shifting losses outside the trust. Moreover, sponsors vertically integrated across servicing functions manage distressed loans in ways that reduce the likelihood of failing note protection tests that would divert cash flows away from retained interests. Although these actions bolster reported performance, they raise concerns about resilience if market stress deepens.

Keywords: CRE CLO, commercial real estate, securitization, shadow banking

*Broxterman: Florida State University, dbroxterman@fsu.edu; Cordell: Retired, Federal Reserve Bank of Philadelphia, larry.cordell@gmail.com; Dougal: Florida State University, cdougal@fsu.edu; and Ma: Federal Reserve Bank of Philadelphia, xingliang.ma@phil.frb.org

1. Introduction

The central challenges in securitization are to align incentives and ensure that information flows transparently from intermediaries to investors. Retention has historically been the primary safeguard for incentive alignment. By requiring that originators or sponsors hold a meaningful first-loss position, this "skin in the game" internalizes losses from misrepresentation or weak monitoring. Structures may also provide complementary credit support through note protection tests that divert interest payments and excess spread from retained positions to accelerate repayment of senior notes once performance triggers are breached. Information asymmetry is further reduced through mandated disclosure in offering documents and ongoing servicing reports, providing investors with periodic loan performance data and notice of material modifications.

Yet retention cannot eliminate conflicts of interest, and disclosure and reporting requirements do not guarantee transmission of full information. Of particular concern are affiliations between a retaining sponsor and the servicing entities, especially during distressed loan workouts, when the sponsor's interests may diverge from those of senior noteholders. While such ties can improve efficiency and information flow, they also create channels for conflicts that can affect both workout decisions and reporting practices.

The commercial real estate collateralized loan obligation (CRE CLO) market is an especially useful setting for studying how these incentive structures and governance frictions interact. Here retention levels substantially exceed regulatory minima, ensuring sponsors are meaningfully exposed to first-loss risk. Affiliations between sponsors and servicers are observable, as are the information environments in which they operate. And because servicing fees do not distort sponsor incentives, the effects of affiliation can be more cleanly identified. These institutional features make CRE CLOs a natural laboratory for examining how retention and sponsor–servicer affiliation affect governance and ultimately securitization performance.

This paper provides the first comprehensive empirical analysis of the CRE CLO market,

which surpassed $100 billion in issuance by 2021.[1] We examine both security-level returns and the performance of the underlying loan collateral. The study is especially timely: the transitional, short-term commercial real estate loans that make up CRE CLO collateral are now experiencing record-high delinquency and modification rates, while market participants have attracted scrutiny from both the financial press and short-focused hedge funds over potential conflicts of interest in servicing.

Our analysis shows that while CRE CLO equity and debt tranches have delivered outsized returns, these outcomes are supported by loan resolutions and servicing actions that defer loss recognition and preserve cash flows to retained interests. This raises questions about whether performance can be sustained if market stress deepens and distressed collateral must be resolved within securitization trusts.

Equity returns are especially pronounced. Using the public market equivalent (PME) approach of Kaplan and Schoar (2005) and Cordell et al. (2023), we find that CRE CLO equity tranches in completed deals outperformed the S&P 500 by an average of 24% between 2013 and 2025, far exceeding post-GFC BSL CLO equity performance. Managed deals earn higher PMEs than static deals, consistent with the value of active reinvestment flexibility (Fabozzi et al., 2021; Liebscher and Mahlmann, 2017). Among managed deals, the strongest results occur when sponsors are fully affiliated with both master and special servicing functions, consistent with their ability to influence collateral management and repurchase distressed loans out of pools at par. These findings indicate that spread arbitrage, rather than financing convenience alone, is a central driver of CRE CLO issuance. Importantly, however, equity returns are inflated by the migration of losses to sponsor balance sheets, raising concerns about durability under sustained stress.

Debt tranches also exhibit significantly positive excess returns, outperforming synthetic floating-rate corporate bond benchmarks and BSL CLO counterparts (Cordell et al., 2023).

[1]Research on CLOs in the financial economics literature has focused on the broadly syndicated loan (BSL) market; see Ivashina and Sun (2011); Shivdasani and Wang (2011); Becker and Ivashina (2015); Merrill et al. (2019); Elkamhi et al. (2020); Griffin and Nickerson (2023); and Cordell et al. (2023).

Yet this performance persists despite historically high delinquency and modification rates, which should have triggered appraisal reductions and failures of overcollateralization (OC) tests. Because OC test failures divert cash away from equity and suspend reinvestment privileges, sponsors have strong incentives to delay reappraisals and defer formal loss recognition. These incentives, if exhausted, could amplify losses once impairments are ultimately realized.

Finally, we show that affiliations among transaction parties significantly shape loan outcomes. Using a competing-risks hazard model, we find that sponsors vertically integrated with both their master and special servicers are associated with higher modification rates, more frequent par buyouts of distressed loans, and lower defaults relative to unaffiliated sponsors. These patterns suggest that affiliation reallocates distressed resolutions away from outright default and toward workouts that protect sponsors' retained positions. While this structure has supported performance to date, its capacity to absorb mounting stress remains uncertain.

The remainder of the paper is organized as follows. Section 2 reviews the literature on retention and affiliation in securitization. Section 3 describes the institutional features of the CRE CLO market and compares them with bank warehouse lines, commercial mortgage-backed securities (CMBS), and BSL CLOs, in turn. Section 4 details the construction of our dataset. Section 5 presents empirical results on security and loan performance. Section 6 concludes.

2. Skin in the Game

The rationale for skin in the game in securitization is firmly grounded in economic theory. Models of asymmetric information, beginning with Leland and Pyle (1977), show that tranching and retention mitigate adverse selection by enabling sponsors to signal quality through larger retained interests, thereby enhancing liquidity. Seminal work by DeMarzo and Duffie (1999) and DeMarzo (2005) demonstrate that retention allows sponsors to extract more

value from securitization than the cost of excluding some cash flow from marketable securities. Subsequent research refines the optimal form of retention: Cerasi and Rochet (2014), for instance, identify the minimum first-loss stake needed to preserve monitoring incentives, with the optimal amount varying over the business cycle, while Chemla and Hennessy (2014) show that the efficient level depends on the information content of market prices and may differ from what sponsors would choose privately.

Empirical findings on skin in the game in mortgage-backed securities are broadly consistent with the predictions from theory that retention mitigates adverse selection and moral hazard. The literature employs two main designs: cross-sectional analyses of variation in retention before the Dodd-Frank Act, and event studies that exploit the Act's implementation as an exogenous shock. Cross-sectional studies show that securitizations with larger equity tranches or greater retained positions experience lower delinquency rates, fewer downgrades, and, in residential mortgage-backed securities (RMBS), higher secondary-market prices conditional on credit ratings (Begley and Purnanandam, 2017; Ashcraft et al., 2019; Furfine and Zborowski, 2025). Event studies similarly find that mandated five-percent retention improves underwriting standards, borrower credit quality, and informational efficiency in tranche pricing, though in CMBS it also reduces issuance volumes (Furfine, 2020; Flynn Jr et al., 2020; Agarwal et al., 2024). Together, this evidence indicates that both voluntary and mandated retention enhances collateral quality and deal performance, albeit with some trade-offs for market activity.

A strand of literature has examined affiliation between securitization parties across multiple markets—RMBS, CMBS, and BSL CLOs—as both a mechanism for incentive alignment and a source of conflicts of interest across tranches and between sponsors and investors. Demiroglu and James (2012) study organizational ties between loan originators and either sponsors or servicers in non-agency RMBS, which they interpret as a proxy for risk retention. They find that affiliated transactions—particularly those backed by low-documentation (*Alt-A*) mortgages—experience substantially lower default and loss rates. Investors appear

to anticipate this ex ante: affiliated deals are issued at lower yields and require less subordination to achieve AAA ratings, consistent with affiliation signaling stronger screening incentives and higher expected loan performance. While these findings suggest that organizational ties mitigate adverse selection and moral hazard, subsequent research shows that affiliation may also create conflicts further down the capital stack.

The theory of the firm predicts that if ownership is concentrated, managers are more likely to undertake actions that transfer wealth from debt holders to equity holders when default risk is elevated (Jensen and Meckling, 1976; Myers, 1977). Huang and Nadauld (2019) extend this argument to pre-Dodd–Frank non-agency mortgage securitization by treating mortgage servicers as analogs to corporate managers, since servicing decisions directly affect trust cash flows. When servicers are affiliated with sponsors—who are assumed to most likely retain the equity tranche—they have incentives to favor equity holders at the expense of senior noteholders. Consistent with this view, equity tranches in affiliated deals remain entitled for interest payments significantly longer, driven by servicing practices such as delaying liquidations, aggressive loan modifications, and strategic payment advances. These findings imply wealth transfers from senior to subordinate tranches, though senior tranche yields at issuance do not appear to incorporate this risk.

Turning to CMBS, Wong (2018) examines conflicts of interest arising from ownership changes of special servicers that become part of vertically integrated financial institutions with affiliated buyers and service providers. Loans liquidated after such ownership changes suffer higher loss severities relative to non-affiliated servicers. The evidence points to self-dealing, with liquidations at lower prices and affiliated providers capturing a disproportionate share of transactions, consistent with fee extraction. These results highlight how affiliation in CMBS special servicing can generate conflicts that transfer value away from noteholders not affiliated with the controlling class.

In the BSL CLO market, Peristiani and Santos (2019) show that bank-affiliated managers—particularly when their parent bank is the arranger of a distressed loan—reduce exposures

well before default and continue selling afterward. Nonbank-affiliated managers, by contrast, do not exhibit systematic divestment. These results are consistent with affiliated managers benefiting from informational advantages through their parent bank's arranger role, though heightened risk aversion and reputational concerns may also contribute. While not emphasized in the paper, such trading behavior could also help affiliated CLOs avoid failing overcollateralization tests, thereby limiting reputational damage to the parent bank.

Relative to these other securitization markets, the institutional features of CRE CLOs permit sharper inference on the role of affiliation. In the RMBS setting, affiliation proxies for retention because sponsor holdings are unobserved (Demiroglu and James, 2012; Huang and Nadauld, 2019). By contrast, in the CRE CLO data, we observe both retention levels and affiliations, allowing clear assignment of deals as conflicted. For BSL CLOs, affiliation coincides with informational advantages from the parent bank's arranger role (Peristiani and Santos, 2019). CRE CLOs, however, are structured as single-seller transactions in which the loan originators also serve as deal sponsors, ensuring a common information environment across offerings. In CMBS, the evidence centers on self-dealing conflicts in special servicing through discounted affiliated-party purchases, steering business to affiliates, and fee discrimination in liquidation services (Wong, 2018). In CRE CLOs, by contrast, loan buyouts are made by the sponsor at par, and a sponsor with an affiliated special servicer captures the equity excess spread, so its overall income is unaffected by the level of servicing or workout fees charged within the structure. These institutional features exclude competing explanations raised in the prior literature, enabling a dispositive test of whether affiliation itself allows conflicts of interest to affect loan outcomes.

3. Institutional Features of CRE CLOs

CRE CLOs are securitization vehicles backed by pools of floating-rate, interest-only loans originated to finance transitional commercial real estate and multifamily properties. These

loans have an initial three-year term to maturity and include two one-year extension options conditioned on the satisfaction of performance covenants. Borrowers are real estate investors executing business plans that generally involve renovation, lease-up, or repositioning, with the intent to either refinance into long-term, fixed-rate debt or sell the asset upon cash flow stabilization.

The loans are originated by nonbank lenders—primarily private debt funds and publicly listed commercial mortgage REITs—and initially funded by draws on warehouse lines of credit. These warehouse lines are provided by third-party lenders who hold a security interest in the underlying loans. To transfer a loan into a CRE CLO, the warehouse draw is repaid using proceeds from the securitization.

Historically, banks dominated bridge lending, balancing flexible servicing post-closing with conservative underwriting at origination. In the years following the Global Financial Crisis, however, nonbank lenders have expanded rapidly across credit markets and gained share in commercial real estate finance by offering more borrower-friendly terms. Relying on CRE CLOs as a funding vehicle, these lenders have provided higher leverage and more limited recourse, positioning themselves as an attractive substitute to traditional bank credit.[2]

Each CRE CLO is structured as a bankruptcy-remote special purpose vehicle (SPV) that issues multiple tranches of debt securities with differing levels of payment priority, along with a residual equity tranche in the form of preferred shares; all tranches are backed by the same underlying loan pool. Investment-grade tranches are offered to qualified institutional buyers, while the sponsor retains all subordinate debt and equity interests—funded through a combination of credit facilities and the sponsor's equity capital. By holding the first-loss position, the sponsor preserves both economic exposure ("skin in the game") and control rights over the transaction.[3]

[2]Regarding recourse, bank loans typically require a "warm-body" payment guarantee, whereby the sponsor who controls the borrower entity is personally liable for the full loan balance in the event of default. By contrast, CRE CLO loans are generally non-recourse to the sponsor, except under limited circumstances. These commonly include guaranties related to completion of physical improvements and obligations to replenish interest reserves that fall below a threshold.

[3]While the issuer is formally the SPV that sells the securities, and the sponsor is the entity that organizes

CRE CLOs may be issued with static or managed pools. In static deals, the loan collateral is fully identified at closing and remains fixed during the life of the transaction, apart from regular borrower payoffs. Managed deals allow a collateral manager to actively acquire and dispose of loans during a specified reinvestment period of two to three years subject to portfolio eligibility criteria.[4] These criteria include constraints on property types, maximum loan-to-value (LTV) ratios, minimum debt service coverage (DSCR) ratios, and individual loan size. The reinvestment period is followed by an amortization period where no new loans can be purchased and the deal pays down.[5]

3.1. CRE CLOs vs Warehouse Lines of Credit

As described in CREFC (2025), CRE CLOs offer several advantages to nonbank lenders over retaining loans on warehouse lines of credit. Warehouse facilities are typically subject to mark-to-market accounting and maximum dwell times, both of which can trigger forced loan sales during periods of market volatility. In contrast, CRE CLOs provide closed-end, matched-term financing that eliminates margin-call risk and reduces exposure to fire-sale dynamics.

CRE CLOs permit higher advance rates. While warehouse lines generally require 20–35% equity from the loan originator, CRE CLO sponsors—who originate the underlying loans—retain about 18% of the capital structure on average through subordinate debt and equity tranches. Thus, 20% represents a minimum equity contribution in warehouse lending but serves as the maximum retained interest in a typical CRE CLO.[6]

Lastly, managed CRE CLOs give lenders substantially greater flexibility in choosing

the transaction and transfers the assets, throughout this paper the terms "sponsor" and "issuer" are used interchangeably, without loss of clarity, because the issuer has no economic role independent of the sponsor.

[4]Moody's (2025) claims reinvestment periods can go as long as five years.

[5]Preferred equity holders have the option to redeem shares and close deals after a specified date. This differs from standard securities language that allows for a "closing call" only after the collateral pools have been paid down to specified levels.

[6]Readers may be aware that warehouse lines for residential lenders allow considerably higher advance rates (97%–100%). This reflects the short dwell times (often under 30 days) and low execution risk associated with home loans eligible for sale to Fannie Mae, Freddie Mac and Ginnie Mae (collectively called "the Agencies").

assets than a typical warehouse line. Although new collateral in a CRE CLO must still meet defined eligibility standards, warehouse structures typically require explicit consent from the warehouse provider for each loan.

3.2. CRE CLOs vs CMBS

Although both commercial mortgage-backed securities (CMBS) and CRE CLOs provide investors with exposure to commercial real estate debt, they differ significantly in collateral characteristics and structure. CMBS loans are typically secured by stabilized properties and underwritten based on normalized in-place income and occupancy. CRE CLO loans are backed by transitional properties and underwritten to projected pro forma performance, introducing execution risk tied to the sponsor's ability to carry out the business plan and obtain takeout financing (Moody's, 2025).

CMBS transactions are static: the collateral pool is fully identified within a few months of closing and generally cannot be altered thereafter. By contrast, CRE CLOs may be issued on static or managed pools, though most are actively managed. Even nominally static CRE CLOs commonly include a limited replenishment feature that allows the sponsor to substitute collateral when loans repay within a defined post-closing window.

The allocation of first-loss risk also differs. CMBS structures do not include a residual equity class and third-party B-piece buyers acquire the junior-most debt tranches, committing capital prior to final pool composition and exercising veto rights over collateral selection. These positions are sized to meet regulator risk-retention minimums. In CRE CLOs, the sponsor retains the transaction equity and all below-investment-grade tranches, resulting in substantially greater economic exposure to credit losses.

The treatment of excess spread further distinguishes the two structures. In CMBS, excess spread is directed to a separately offered interest-only class within the waterfall. In CRE CLOs, excess spread accrues to the equity tranche, tying the sponsor's return directly to the ongoing performance of the collateral pool.

Many of the structural differences between CRE CLOs and CMBS transactions arise from the interaction of product design with legal and tax considerations. Under the Internal Revenue Code, a vehicle that issues multiple classes of debt is generally treated as a separate taxable corporation unless it qualifies for a statutory exemption. CMBS transactions rely on the Real Estate Mortgage Investment Conduit (REMIC) regime, which provides pass-through treatment but imposes strict limitations: REMICs may not acquire assets more than three months after closing, and significant loan modifications are treated as loan exchanges that can jeopardize REMIC status. These restrictions make REMICs poorly suited for actively managed or transitional mortgage pools that require flexible servicing.

As explained by Schwartz et al. (2018), CRE CLOs instead are commonly issued through Qualified REIT Subsidiaries (QRSs), which preserve pass-through treatment while allowing reinvestments and loan modifications without adverse tax consequences. The main drawback is that a QRS structure requires the sponsor to retain all non–investment-grade securities.[7] Because investment-grade attachment points in CRE CLOs are typically well above 5%, the resulting exposure substantially exceeds the Dodd-Frank risk-retention requirement, making the QRS constraint a binding determinant on the overall advance rate of the transaction.

These institutional differences may affect credit outcomes. Consistent with the constraints imposed by the REMIC regime described above, Glancy et al. (2022) document that CMBS servicers face strict limits on loan modifications. As a result, CMBS loans exhibit significantly lower modification rates and higher delinquency rates than comparable bank-originated loans. In the analysis that follows, we show that CRE CLOs engage in more active credit-risk management, a pattern facilitated in part by the flexibility of the QRS framework, which allows modifications and reinvestments without jeopardizing tax status.

CRE CLOs also incorporate note-protection mechanisms not present in CMBS: the Interest Coverage (IC) Test and the Overcollateralization (OC) Test, also known as the Par

[7]To obtain a credit rating, the sponsor must secure a tax opinion that the issuer will not incur entity-level taxation. According to Schwartz et al. (2018), counsel will not opine that below-investment-grade tranches are "debt" for tax purposes, because of the possibility of non–repayment. Any tranche that might be treated as equity must be wholly owned by the REIT parent and thus cannot be sold to third-party investors.

Value Test. The IC Test evaluates whether interest income from the collateral is sufficient to cover interest due on the notes, while the OC Test assesses whether the collateral balance is adequate to support outstanding debt. If either test fails, cash flows are redirected from the retained tranches to senior noteholders until compliance is restored, substantially reducing the sponsor's returns.[8]

The loan servicing framework is broadly similar across CMBS and CRE CLO structures: servicers handle performing loans, and special servicers manage workouts in accordance with the servicing agreement.[9] In managed CRE CLOs, however, the collateral manager plays an additional and distinct role. Beyond directing loan acquisitions and sales, the collateral manager may approve certain categories of loan modifications outside the standard servicing framework. This contrasts with CMBS, which are static and do not include a collateral manager. Moreover, because collateral in CRE CLOs is generally originated by a single lender-servicer pair, there is typically no need for a master servicer to coordinate across multiple primary servicers, as is required in conduit CMBS.

Servicer affiliations also differ across markets. In CMBS, special servicers are typically unaffiliated with the sponsor. In CRE CLOs, approximately half of deals involve a sponsor-affiliated special servicer, and in about a quarter of cases, the same entity performs both master and special servicing, compared with just 4% of post-crisis conduit CMBS deals (An et al., 2023).

3.3. CRE CLOs vs BSL CLOs

CRE CLOs have adopted the same securitization structure as the broadly syndicated loan (BSL) CLO market, but the vehicles differ fundamentally in their liquidity, underlying

[8]The IC Test compares expected collateral interest—including servicer advances—to interest due on non-retained notes. The OC Test compares the collateral balance, net of appraisal reduction amounts, with the balance of non-retained notes. A common threshold for both tests is 120%. See Armstrong et al. (2023) for details.

[9]The servicer administers payments and may advance principal and interest on delinquent loans when such advances are deemed recoverable (Ambrose et al., 2016). The special servicer manages distressed loans, including decisions regarding modifications, foreclosures, and asset dispositions. Distress is typically defined as 60 days delinquent or when other events materially impair recovery prospects.

collateral, and market concentrations. BSL CLOs invest in senior secured, floating-rate loans to large corporate borrowers, typically firms with earnings exceeding $100 million. These loans have maturities of five to seven years.[10] BSL CLOs are highly diversified by design, limiting exposure to any single industry to 15% and any single borrower to 2% of the pool (Cordell et al., 2023). In contrast, CRE CLOs securitize shorter-term transitional real estate loans with a heavy concentration in multifamily properties.[11] According to Moody's (2025), the average rating of a BSL CLO loan is B2 (that is, rated B). CRE CLO loans are not rated, but if they were, Moody's would give them an average rating of CCC+.

The liquidity of the underlying assets differs significantly. BSL CLO borrowers often have revolving facilities through which they can draw on available liquidity, along with lending relationships with flexible lending terms (Moody's, 2025). Their loans trade actively in secondary markets with daily bid prices published by S&P Global. CRE CLOs fund CRE mortgages that direct lenders originate. These are illiquid and rarely traded; reinvestment activity typically involves negotiated loan sales rather than open-market transactions. As we will show, CRE loans removed from CRE CLO pools are generally paid off at par, even in cases of impairment. Alternatively, distressed BSL CLO loans are sold at their market values. In both structures, loan sales can also occur when the deal is refinanced into a new CLO.

The affiliations between key parties also differ. In CRE CLOs, the sponsor originates loans and is always affiliated with the collateral manager. Leveraged loans are syndications issued by large banks, with their collateral managers generally not affiliated with the bank arrangers (Benmelech et al., 2012).[12] BSL CLOs are open-market vehicles in which collateral

[10]Some CLOs invest in middle-market (MM) loans to smaller firms, but this represents a small portion of the overall market. Moody's (2025) does a comparison of MM CLOs and CRE CLOs.

[11]Multifamily loans make up 64% by balance of all CRE CLO loans in our sample with 16% office, 6% hotels, and the remaining 14% spread across at least seven different industries. More recently, the share of office has all but disappeared, with the multifamily share now around 75%.

[12]Looking at the period from 2007 to 2011, Peristiani and Santos (2019) claim that around a quarter of CLOs in their sample had affiliations with banks. While this may have been true during this period, today BSL CLO collateral managers are generally not affiliated with their issuing banks. From the near-comprehensive list of 289 BSL CLO collateral managers studied in Cordell et al. (2023), only 17 had a parent bank holding company.

managers acquire loans through participations or purchases in the open market.

Despite these differences, capital structures are broadly similar (see Figure 1). Average leverage is comparable—90% in CRE CLOs and 89% in BSL CLOs. AAA tranches in CRE CLOs are a slightly smaller share of the capital structure (58%) than BSL CLOs (61%). However, BB/B-rated tranches in CRE CLOs have greater subordination (9% vs. 5%) and are typically retained by the sponsor. In BSL CLOs, banks retain only the senior-most tranches (DeMarco et al., 2020).

3.4. Rating Agency Considerations and Concentrations

In evaluating CRE CLOs, investors rely on rating agencies for assessments of the likelihood that a tranche will pay as scheduled. This analysis extends beyond loan performance to the capabilities of transaction parties and the incentive effects embedded in the structure. However, several important credit enhancements fall outside agency models. Sponsors may purchase defaulted loans out of the pool at par to resolve them on their balance sheets, and they may exercise optional redemption rights that limit extension risk. This external credit support can materially affect performance even though it is not warranted and thus not considered in the rating methodology.

CRE CLO ratings exhibit distinct patterns of rating agency concentrations. As shown in Table 6, Moody's has rated 189 out of 198 deals, almost exclusively at the AAA level. In contrast, S&P—one of the two dominant rating agencies in the BSL CLO market—has rated only a single AAA tranche, and Fitch has participated in just 18 transactions.

By contrast, roughly 95% of non-AAA bonds are rated by one of two smaller agencies—DBRS/Morningstar or KBRA—with the vast majority receiving a rating of the non-AAA tranches from only one of the two. Together, the three major agencies—Moody's, S&P, and Fitch—contribute just 8% of non-AAA ratings.

The ratings distributions described above likely reflect a combination of regulatory requirements and sponsor incentives. US banking regulations require two ratings for securities

purchased by banks, and since bank participation in CLOs is generally limited to AAA tranches, Moody's plays a dominant role at the top of the capital stack but has limited involvement in lower-rated tranches. We will examine this in more detail in our empirical analysis below.

3.5. Loan Modifications and Portfolio Management

The transitional loans underlying CRE CLO securitizations are exposed to execution risk in addition to broader macroeconomic shocks. As a result, these loans are expected to exhibit greater performance volatility than loans secured by stabilized properties. In this market, servicers and collateral managers typically address distressed loans through in-structure modifications or by removing impaired loans from the collateral pool.

The law firm Dechert, LLP distinguishes three categories of loan modifications in CRE CLOs: servicing standard modifications, and two types of non-servicing standard modifications, administrative modifications and criteria-based modifications (Armstrong et al., 2023). Servicing standard modifications are undertaken by the special servicer, who is contractually obligated to act in the best interest of the noteholders as a whole by maximizing timely recoveries on a net present value basis. These modifications may include interest rate adjustments, maturity extensions, and the forgiveness, deferral or capitalization of interest provided such actions comply with the servicing standard.

In managed transactions, the collateral manager may direct certain loan modifications outside the servicing standard framework. Administrative modifications involve changes to non-credit-related operational terms, such as fees, performance covenants, and reserve requirements (excluding tax and insurance escrows). Criteria-based modifications are less routine and may include economically substantive changes such as interest rate reductions, maturity extensions, or provisions allowing borrower sponsors to incur additional mezzanine debt or issue preferred equity.

Although these modifications fall outside the servicing standard, they are subject to the

collateral manager standard. Under this standard, the collateral manager must act without regard to conflicts of interest and manage the loans in a manner consistent with how it would manage assets for itself or other clients, and in line with other prudent managers of similar assets. Moreover, these modifications are limited to loans that are not credit-impaired—specifically, loans that are not in default, that are not in special servicing, and where foreclosure is not reasonably foreseeable. When the collateral manager directs such a modification, the special servicer is required to execute it, provided it concurs that the change qualifies as either an administrative or criteria-based modification.

Dechert, LLP explains that defaulted and modified loans are discounted substantially in Par Value (PV) Test calculations (Armstrong et al., 2023). A loan is deemed defaulted once it is 60 or 90 days delinquent. Whether a loan is considered "modified" for test purposes depends on carve outs for administrative and criteria-based modifications. When the OC test fails, interest payments are redirected from the sponsor's retained interests to pay down senior notes. The potential adverse impact on sponsor returns creates strong incentives for sponsors to delay recognition of both defaulted and credit-impaired assets.

To avoid triggering interest diversion associated with an OC test failure, collateral managers may direct the sponsor to sell, rather than modify, a distressed loan. These "credit risk sales" are typically negotiated with affiliated entities and financed using back leverage, rather than executed through competitive market auctions. Although such transactions raise concerns about conflicts of interest, they allow impaired assets to be returned to the sponsor's balance sheet, where modification is not restricted by securitization covenants. Once modified, a loan can be seasoned on balance sheet and potentially resecuritized at a later date.

Discussions with market participants indicate that investors expect collateral managers to sell distressed loans from CRE CLO pools in order to avoid test failures and credit losses. However, this strategy introduces counterparty risk, as it relies on the sponsor's ability to repurchase impaired loans at par using distressed-loan warehouse facilities during periods of

market stress.[13]

4. CRE CLO Deal and Loan Trends

4.1. Data

Our analyses draw on three primary data sources: Intex, Green Street, and Trepp. Intex is a leading provider of structured finance data, sourcing data directly from deal trustees, the third-party financial institutions responsible for enforcing the indenture governing each securitization. We rely on Intex for detailed records of cash distributions for each CRE CLO bond and equity tranche.

We supplement our Intex data with information from Green Street, which provides the most comprehensive source of CRE CLO issuance data and a full array of deal- and tranche-level characteristics. These include balances and spreads on all security tranches and rating agency ratings for all rating agencies; weighted average loan-to-value and debt service coverage ratios; weighted average maturities, loan counts, and the distribution of holdings across ten property sectors.[14] Green Street also identifies key transaction parties—sponsors, collateral managers, and master and special servicers—and provides commentary on important aspects of each deal. Crucially, Green Street reports issue prices for investment-grade bonds, which we use for our return analysis.

For loan-level analysis, we rely on data from Trepp, which provides a full panel covering every loan held in CRE CLO pools. Data sets include detailed characteristics of the borrower, loan, and property, along with performance indicators such as delinquency status, transfers to special servicing, modifications, and resolutions. Many variables overlap with those in Intex and Green Street, allowing for cross-validation of values and imputation of missing

[13]According to CRED iQ (May 2024), nonperforming loan back leverage is typically structured at 50%-75% of acquisition cost, with pricing starting at SOFR + 400 basis points (Haas, 2024).

[14]Property types include office, hotel, multifamily, retail, industrial, self-storage, mixed-use, healthcare, mobile home, and other.

data when needed.

We merge data from all three sources at the deal level using Bloomberg tickers, which are consistently available across datasets. This yields a near comprehensive dataset covering the universe of CRE CLO deals issued between 2013 and 2024.

4.2. Deal Evolution

Table 1 summarizes our CRE CLO deal and security sample, reporting issuance volumes and counts, the number of deals and securities with nonmissing values, and counts of completed deals and fully paid-off securities by issuing vintage from 2013 through 2024.

The CRE CLO market expanded gradually during the early 2010s, surpassing $10 billion in annual issuance for the first time in 2018, reaching $18 billion in 2019. Issuance declined in 2020 amid COVID-19 disruptions but rebounded sharply in 2021, with 51 transactions totaling $45 billion. Activity fell to $29 billion in 2022 as financial conditions tightened following the Federal Reserve's rate-hiking cycle, which began in March and included seven increases over the year. A more severe contraction followed in 2023 and 2024, when annual issuance fell to just 10 deals per year and dollar volume dropped below $10 billion. In total, our sample includes 198 CRE CLO deals totaling $143 billion.

As shown in Table 2, average deal size increased markedly over the sample period, rising from $255 million in 2013 to more than $1 billion by 2021. This trend is noteworthy given findings in Furfine (2014) that loan performance tends to deteriorate in more complex securitizations.[15]

Of the 198 deals in our sample, 107 are managed transactions totaling $88 billion, and 91 are static deals totaling $54 billion. The share of managed deals increases over time, peaking at 74% of annual issuance in 2021 and 72% in 2022, before fluctuating in the final two years. The shift toward managed structures is not surprising. In static deals, the prioritization of

[15]For managed CRE CLOs, the number of loans reported at deal closing may not reliably indicate structural complexity, as managers may accumulate additional assets during the post-closing ramp-up period. Loans acquired during the ramp-up period are funded by reserves that are capitalized at closing and included in total issuance, even if they are not reported in the initial pool.

principal payments causes the weighted average spread to widen over time, increasing the likelihood that the sponsor will exercise its optional redemption rights and return the loans to a warehouse line. Managed CRE CLOs, by extending the life of the transaction, reduce the sponsor's expected financing costs, as noted by CREFC (2025).

Sponsors typically retain the equity tranche along with all non–investment-grade bonds. By holding the first-loss position, they maintain control rights over the transaction. As shown in Table 2, subordination levels for the BBB- tranche vary across vintages but have a weighted average of 17.9%, well above the 5% minimum required under Dodd-Frank risk retention rules (see Furfine and Zborowski (2025)). In effect, while investment-grade investors provide over 80% of deal capital, control over key decisions remains with the sponsor and its affiliates, subject to the constraints of the servicing agreement and reputational considerations.

A primary objective of our research is to examine how affiliations among key transaction parties—sponsors, collateral managers, and servicers—affect loan performance in CRE CLOs. As detailed in Section 3, sponsors originate the securitizations and contribute most or all the underlying loan collateral. In managed transactions, the collateral manager directs loan acquisitions and dispositions during the reinvestment period and pay downs after the reinvestment period ends. Servicers administer performing loans, while special servicers manage workouts. However, in managed CRE CLOs, the collateral manager is authorized to direct certain loan modifications.

To identify affiliations among transaction parties, we rely primarily on data from Green Street. Because the relevant entities are reported in free-text fields, we begin by standardizing entity names to enable reliable matching. When names differ across sources, we manually verify affiliations using internet searches on artificial intelligence tools such as Google Gemini. Once confirmed, we normalize entity names to ensure consistent identification in our matching algorithm.

Our normalization process, described in Appendix A, proceeds in three steps. First, we standardize entity names and, for managed transactions, verify that the sponsor is affiliated

with the collateral manager.[16] We then classify each transaction into one of three mutually exclusive affiliation categories. In cases of *full affiliation*, the sponsor is affiliated with both the master servicer and special servicer. *Partial affiliation* applies when the sponsor is affiliated with the special servicer but not the servicer. (We do not observe any transactions in which the sponsor is affiliated with the master servicer but not the special servicer.)

Unaffiliated refers to deals in which the sponsor is unaffiliated with either servicing party. In these cases, the independence of the special servicer is preserved, allowing it to serve as a check on the collateral manager. As described in Section 3.5, the prospectus requires the special servicer to confirm whether any manager-directed modification qualifies as administrative or criteria-based, a safeguard that has force only when the special servicer operates independently.

The distribution of sponsor-servicer affiliations by vintage is reported in Table 2, with aggregate statistics for the full sample shown in Table 3. We observe substantial intertemporal variation in affiliation patterns, providing sufficient heterogeneity for empirical analysis. Across the entire sample, full affiliation occurs in 20% of transactions (24% of managed deals and 15% of static deals). Partial affiliation is observed in 24% of transactions (28% of managed deals and 19% of static deals). The remaining 56% of transactions (51% of managed deals and 60% of static deals) are where the sponsor is unaffiliated with either servicer. Thus, relative to static deals, managed deals display a substantially higher incidence of affiliated servicing relationships.

4.3. Loan Evolution

Table 4 summarizes our CRE CLO loan sample, reporting origination totals by dollar volume and loan count, along with weighted average characteristics by vintage from 2013 through 2024. Loan origination volumes naturally track deal issuance, peaking in 2021 with 1,818 loans totaling $46.4 billion. Average loan size has increased over time, with recent vintages

[16] We find that the sponsor is affiliated with the collateral manager in all managed deals—a key structural distinction from BSL CLOs, in which the manager is typically independent.

ranging from approximately $40 million to $50 million.

CRE CLO loans feature floating interest rates calculated as a spread over a benchmark index: initially the 30-day London Interbank Offer Rate (LIBOR), and, in later vintages, the 30-day Secured Overnight Financing Rate (SOFR). Spreads are determined by prevailing market conditions and the risk-return profile of individual loans. Unadjusted spreads—i.e., contractual spreads that do not control for loan-specific risk—are negatively correlated with origination volume, likely reflecting heightened lender competition and strong demand for CRE CLO bonds during periods of elevated issuance. In particular, spreads declined during the expansionary phase, falling from a peak of 5.3% in 2016 to a low of 3.1% in 2020. They subsequently widened as signs of performance deterioration emerged late in the sample period, although they tightened again in 2024.

Collateral composition has shifted over time. The share of multifamily loans has steadily increased, reaching a peak of 82.5% in 2022. In contrast, exposure to the office sector—which accounted for approximately one quarter of originations until 2020—declined sharply following the pandemic, falling to single-digit levels in subsequent years. This decline reflects structural changes in office demand that have reduced occupancy rates and undermined investor confidence in the sector (Gupta et al., 2022).

The predominant loan purpose in our sample has been acquisition rather than refinance, indicating that CRE CLOs have primarily financed value-add strategies such as renovation and repositioning. This pattern shifted markedly in 2024, when the share of refinance loans rose to 68.2%, up from 37.9% the previous year. Rather than reflecting typical refinancings of construction loans to fund the lease-up period, this increase likely signals a rise in bridge-to-bridge refinancings. Many multifamily loans originated during the low-interest-rate, compressed-cap-rate period are now reaching final maturity without achieving their expected stabilization income and are ineligible for a standard permanent agency takeout.[17]

[17] "Agency takeout" refers to the refinancing of a bridge loan on a multifamily property with a CMBS loan backed by Fannie Mae, Freddie Mac, or Ginnie Mae.

4.4. Underwriting Evolution

4.4.1. Financial Risk Ratios

Table 5 summarizes the underwriting characteristics of our CRE CLO loan sample, reporting weighted averages on key metrics by vintage from 2013 through 2024. Credit risk in commercial mortgage underwriting is primarily assessed using three financial ratios: the loan-to-value (LTV) ratio, the debt service coverage ratio (DSCR), and the debt yield ratio (DYR). For transitional properties, underwriters commonly evaluate both "as-is" and "stabilized" values of these metrics. As-is ratios reflect current income and occupancy, while stabilized ratios incorporate projected performance improvements from the appraisal report. DSCR and DYR may be calculated using underwritten net operating income (NOI) or net cash flow (NCF), where NCF equals NOI less capital expenditures.[18]

Table 5 reports two LTV measures, as-is and stabilized, along with four DSCR and DYR variants, reflecting denominator combinations of as-is versus stabilized and NOI versus NCF. Over the sample period, average as-is and stabilized LTVs were 76% and 65%, respectively, where a 75% LTV is a typical maximum for permanent financing. Although stabilized LTVs declined over time, this trend was largely driven by increasingly optimistic assumptions about expected appreciation and rent growth, as shown toward the bottom of the table. The associated increase in exposure to business plan execution risk was most pronounced in the 2019–2022 vintages, which reflected the most aggressive underwriting of rent growth and price appreciation. These same years also saw a notable concentration of highly leveraged loans, with 18% underwritten with as-is LTVs between 80% and 89%, and 8% with as-is LTVs of 90% or higher.

Average as-is and stabilized NCF DSCRs were 1.08 and 1.67, respectively. Given that a property with a DSCR only marginally above unity is nearly insolvent and limited capacity to

[18]LTV is calculated by dividing loan balance, including future funding commitments, by property value. It represents the equity cushion available to absorb losses in default. DSCR is defined as underwritten NCF or NOI divided by annual contractual debt service, and measures a property's cash-flow cushion. DYR is calculated by dividing underwritten NCF or NOI by loan amount, and measures a lender's cash-on-cash return in the event of foreclosure.

absorb income shocks, these values underscore the extent to which CRE CLO underwriting has relied on forward-looking assumptions about property performance. A primary risk in this segment is that actual cash flows may fall short of pro forma projections.

While DSCR remains a key indicator of term default risk, it is less informative for assessing maturity default risk, the likelihood that a property will neither sell nor qualify for take-out financing at loan maturity. This limitation is especially relevant for interest-only loans originated at low rates, where current DSCR may exceed what could be supported under a higher-rate, fully amortizing permanent loan. In this context, the Debt Yield Ratio (DYR) has become increasingly important in CRE CLO underwriting. Unlike DSCR, DYR is unaffected by interest rate or amortization assumptions, providing a more stable, asset-level measure of income relative to loan amount and a more reliable indicator of refinance risk.

In our sample, the average as-is and stabilized DYRs were 7.16 and 12.43, respectively. Loans with DYR values below 8.00 are generally considered at higher risk of maturity default. As with LTV, the large projected increases in DYR during the peak issuance years reflect a high degree of optimism regarding the anticipated lift in property performance.

4.4.2. Loan Structure

Bridge lenders employ a range of structural features to mitigate risks associated with the contingencies that may arise during execution of a transitional business plan. In addition to construction or renovation completion guarantees, the most prominent credit enhancements include interest rate caps, interest reserves, and cash management mechanisms.

An interest rate cap is a derivative contract that pays the borrower when a reference rate exceeds a specified strike. Lenders typically require that borrowers with floating-rate loans purchase a cap with a strike calibrated to ensure that, based on in-place net cash flow, debt service coverage remains above a minimum threshold in a rising rate environment. This structure limits the lender's exposure to interest rate volatility and reduces the likelihood

of default. But the caps are purchased only for the first 36 months of the loan term. If borrowers exercise their option to extend the loan term, they must repurchase interest rate caps for an additional 12-month term.

A key challenge in extending maturing loans today is the prohibitively high cost of purchasing a replacement cap with, for example, a 2% strike, when 30-day SOFR is in the 4% to 5% range. In many cases, the cost of the cap alone renders extension economically infeasible absent modification to the cap requirements specified in the loan agreement.

Interest reserves are typically required when property-level income is expected to fall short of debt service obligations during renovation or lease-up. These reserves are funded at origination, sized to cover projected shortfalls over a defined period—commonly three to six months, and often include provisions requiring replenishment if drawn. The obligation to replenish the reserve is typically a recourse obligation of the sponsor under an interest reserve replenishment guaranty.

While our data do not consistently distinguish interest reserves from other reserve types, we observe notable trends in total reserve balances. Table 5 shows that, as a percentage of loan amount, reserve funding increased during the early years of CRE CLO issuance, declined from 2015 to 2020—potentially reflecting a loosening of underwriting standards—and rose again in the final two years of our sample, coinciding with growing loan performance concerns.

Cash management structures, such as lockboxes and cash sweeps, are also employed to capture rental income and control fund disbursement. A lockbox is a borrower-held deposit account over which the servicer assumes control through a deposit account control agreement. Income is deposited and disbursed according to a predefined waterfall. Lockboxes mitigate diversion risk by limiting borrower access to funds required for property operations and debt service.

In our data, lockboxes are classified as hard, soft, or springing. A hard lockbox traps excess cash after waterfall distributions, with the servicer determining whether to release

funds to the borrower or retain them as reserves. A soft lockbox routes income through the waterfall but allows excess cash to flow directly to the borrower outside lender control. A springing hard lockbox functions as a soft lockbox until a trigger event causes it to convert into a hard structure, redirecting excess cash to a lender-controlled account. Hard lockboxes offer the strongest protection for lenders but impose greater costs and operational constraints on borrowers. Their prevalence in CRE CLOs declined from 58.2% in 2018 to 16.0% in 2022, as indicated in Table 5, mirroring broader trends in the relaxation of credit enhancements described in this section.

5. Empirical Results

5.1. Deal Performance

In this section, we evaluate the performance of CRE CLO securities by computing internal rates of return (IRRs) on both CRE CLO bond and equity tranches and their public market equivalents (PMEs), following Kaplan and Schoar (2005) and Cordell et al. (2023). We gather from Intex a panel of all cash distributions on CRE CLO tranches. Because these securities are not actively traded, we restrict the analysis to completed securities, defined as tranches that have been fully repaid or liquidated with realized losses, so that all cash flows are observed.

For the investment-grade bonds, we obtain purchase prices from Green Street. Reported prices are almost uniformly at par: the mean was 99.87% with a standard deviation of 0.77%, and no price exceeds 100. This pricing pattern is consistent with the view of investment-grade investors that their bonds are highly likely to pay off at par. Prices for non–investment-grade bonds are not reported; because these securities are entirely sponsor-retained, we assume prices of 100 for all of these.

The resulting sample contains 896 securities from 112 completed deals, just over half of the 198 transactions in our overall dataset (Table 1).

Table 7, Panel A, reports internal rates of return (IRRs) for all securities, computed as the discount rate that equates the present value of cash distributions with the initial investment. Reported IRRs are averages of annualized monthly returns. Across deals completed from 2013 to 2024, average IRRs range from 3.32% for AAA tranches to 23.55% for equity. As shown in the table, these returns compare favorably with those of BSL CLOs in Cordell et al. (2023) over the post-GFC period and with investment-grade floating-rate SASB CMBS in An et al. (2023).

The relative-value pickup of CRE CLO tranches over comparable BSL CLO and SASB CMBS securities may partly reflect differences in liquidity across these markets. In addition, as discussed in Section 3.4, rating models exclude the external credit support provided by CRE CLO sponsors, so stronger performance is not surprising for tranches other than AAA and AA, which experienced no losses in any of the three asset classes over their respective periods of analysis.

Equity tranches in CRE CLO IRRs generated an average IRR of 23.55%, an extraordinary return relative to the 10.92% average for BSL CLO equity. These findings suggest that spread arbitrage is a primary economic driver of CRE CLO issuance, consistent with theoretical models of financial intermediation and extending beyond the industry narrative that emphasizes financing convenience. A primary driver of the high returns on CRE CLO equity is that distressed loans are bought out of pools at par, such that writedowns are primarily realized *outside* the CRE CLO trust, an issue we examine in detail below.

Table 7 Panel B reports PME estimates in the same format as Panel A to compare against our benchmarks. For each security, we discount the cash flow stream using the realized returns of a benchmark portfolio and sum the present values. We then compute the ratio of this sum to the size of the initial investment. The result is a total return profitability index that measures the present value for each dollar invested over the sample period. A PME greater than one indicates that investors earned more in present value terms than what they paid, while a PME less than one indicates the opposite.

We use two benchmarks for our PMEs. For CRE CLO debt tranches, we benchmark them against corporate bond indices with the same credit rating. Because corporate bonds are long-term fixed-rate instruments and CRE CLO bonds are floating rate, we need to convert these fixed rate indexes to floating. Intercontinental Exchange (ICE) provides synthetic nonfinancial floating rate corporate indexes for AAA through BBB indexes and nonfinancial floating-rate high-yield indexes for BB and BB/B rated securities. Because there is no B rated index, we use the BB/B rated index to proxy for B rated securities. The indexes are excess returns vs. a risk-matched basket of interest-rate swaps. We compute benchmark indices for each rating category by value-weighting the synthetic floating-rate returns of individual bonds. See An et al. (2023) for a detailed discussion.

The results of our CRE CLO sample debt tranches show that PMEs are significantly above one for every rating category and significantly higher than BSL CLOs and SASB CMBS for most rating categories. All are significant at the 1% level. Again, the superior performance of the AAA and AA bonds is notable given that all three asset classes did not suffer losses in these securities over the estimated sample period.

Finally, for our equity tranches, we benchmark them against the S&P 500 Index, a common equity performance benchmark (Kaplan and Schoar, 2005). The value of 1.23 implies that the CRE CLOs outperformed the S&P 500 by 23% over the 2013-2025 timeframe; this is also highly significant. This is also significantly higher than the post-GFC PME value for BSL CLOs of 0.97.

In Table 8, we segment our equity returns by managed and static deals and by affiliation type to analyze CRE CLO equity performance for different levels of corporate affiliations. All CRE CLO equity PMEs are significantly greater than 1 at the 5% level or more. Managed CRE CLOs achieved higher average PMEs of 32% versus 16% for static deals, consistent with studies showing that managed deals can take advantage of opportunistic selling and buying (Liebscher and Mahlmann, 2017; Fabozzi et al., 2021; Cordell et al., 2023). Among managed deals, those involving full affiliation—where the sponsor, collateral manager, servicer, and

special servicer are all affiliated—earned returns 39% greater than the S&P 500 over the 2013-2025 period, but also exhibited the greatest standard deviation, suggesting greater risk.

Further examining PMEs in Table 8 Panel B, we see that managed deals involving partial affiliation—where the sponsors were unaffiliated with the servicer but affiliated with the special servicer—actually underperformed those with no servicer affiliations, suggesting the role of the master servicer in overseeing loan resolutions is important. In the next section, we will show that these sponsors did fewer modifications and had higher defaults than the full affiliation group, which likely weighed on relative performance.

In contrast, static deals with full affiliation generated the lowest total relative PMEs of 12%, suggesting that their lower relative performance may reflect the inability to buy out distressed loans from pools and replace them with new loans. Given the small number of observations, the differences among these groups are not significant.

A major beneficiary of recognizing losses outside trusts were the rating agencies. As shown in Table A11, rating agency downgrades were minimal. According to a Bank of America report in August 2025, of 1,170 bonds rated by rating agencies between March 2020 and August 2025, only 30 were ever downgraded, less than 3% of all bonds. This contrasts significantly with rating agency downgrades found in CMBS transactions reported in An et al. (2023), where a higher percentage of the AAA bonds received downgrades over a similar time period.

Another potential indicator of CRE CLO performance at the deal level is the number of deals that fail either the Interest Coverage (IC) or Overcollateralization (OC) tests. Despite sharply higher short-term interest rates and record high delinquency rates on CRE CLOs, a July 2025 report from Bank of America identified only three deals that failed their IC tests, one that failed its OC test, and one that failed both. Over the life of the CRE CLO market, historical data from Trepp record eight deals that failed an IC test, seven that failed an OC test, and six that failed both.

The seemingly low incidence of IC test failures may appear counterintuitive given that most transactions are currently reporting average debt service coverage ratios below one at prevailing interest rates. However, the IC test only requires that interest income from the collateral pool covers interest due on the offered notes; that is, interest obligations on retained tranches are excluded from the calculation. Moreover, reported DSCRs omit cash flows from in-the-money interest rate caps and borrower-funded interest reserves. Thus, while low coverage ratios indicate mounting credit stress–particularly, heightened risk of maturity default–they do not necessarily trigger IC test failures under standard deal covenants.

More concerning is the limited number of OC test failures. For example, in Arbor's AR-CLO 2021-FL4 transaction, 42 of the 59 loans, representing 77.5% of the $1,662.05 million collateral pool, had undergone modifications as of June 2025. However, only five appraisal reductions had been applied, totaling just $18.5 million. Assuming a one-to-one correspondence between collateral and security balances and a sponsor retention of 18%, a rough estimate of the OC Test statistic is narrowly above the 1.20 threshold: $(\$1{,}662.05 - 18.5)/(\$1{,}662.05 \times 0.82) = 1.21$.

A concern is that sponsors like Arbor may be exercising discretion to delay reappraisals of modified collateral. Since failure of the OC test diverts interest payments from retained interests to pay down senior tranches and suspends reinvestment privileges until compliance is restored, sponsors have strong incentives to defer formal recognition of collateral deterioration.

Indeed, back-of-the-envelope estimates suggest that actual impairments could be an order of magnitude larger. If all modified loans in the Arbor deal were reappraised, cumulative appraisal reductions could plausibly exceed $275 million. Such a write-down would almost certainly cause the deal to breach the OC test and redirect income away from the sponsor's retained interests.[19]

[19]For modified loans, the OC test adjusts the collateral balance by subtracting cumulative appraisal reduction amounts (ARAs), defined as the portion of a loan's balance exceeding 90% of the most recent appraised value. With a weighted average coupon of 7.81% and WADSCR of 0.67, implied net operating income is $86.95 million. Applying a 6% cap rate yields a portfolio value of $1,449.13 million. Multiplying

5.2. Loan Performance

The US commercial real estate market is under substantial stress from three major shocks. First, structural shifts in office demand—driven by the widespread adoption of remote and hybrid work models and the digitization of workplace functions—have contributed to record-high vacancy rates (Gupta et al., 2022; Brookfield, 2024; Cushman & Wakefield, 2025). Some 16% of CRE CLO issuance has been for office properties. Second, an unprecedented wave of multifamily construction has raised concerns about oversupply amid declining occupancy. Third, the sharp rise in interest rates during 2021–2022 has increased debt service burdens and depressed property values.

Reflecting these headwinds, delinquency rates for CRE CLO loans have increased sharply for both static and managed deals, from 0.63% and 1.20%, respectively in 2019, to 12.64% and 8.41% in 2024, as shown in Table 9. The difference in delinquency rates between deal types likely reflects differential modification propensity. While 21.32% of outstanding loans in static deals had undergone at least one modification by 2024, the share rises to 31.01% for managed deals.

An important indicator of CRE loan stress is the contemporaneous debt service coverage ratio. As of 2024, half of loans in static deals and two-thirds in managed deals report current DSCRs below unity, indicating that property-level net operating income is insufficient to cover the full uncapped interest payments. While these floating-rate loans require interest rate caps that augment cash flows when benchmark rates exceed the strike, this protection is limited in duration. Caps are required only to cover the initial three-year loan term, leaving borrowers exposed to substantially higher hedging costs if they need to exercise any of the two one-year extension options available.[20]

Although cap payments may enable borrowers to meet contractual interest payment re-

by 77.5% produces a valuation of $1,123.08 million for modified loans; 90% of that is $1,010.77 million. Compared with the $1,288.09 million modified loan balance, the implied ARA is $277.32 million.

[20]For example, An et al. (2023) find that interest rate caps on floating rate single asset, single borrower (SASB) CMBS rose from a few basis points to 81 bps, around 13% of NOIs during their sample period.

quirements, the high share of sub-unity DSCRs signals elevated default risk. First, borrowers with such low debt coverage are unlikely to obtain takeout financing or dispose of properties at valuations sufficient to clear the existing debt. Second, these reported DSCRs will become the true DSCRs when their rate caps expire.

5.3. A Competing Risk Model of Outcomes

Table 10 summarizes first event occurrence for 8,116 CRE CLO loans across four mutually exclusive loan events: Payoff, Buyout, Modification, and Default. Here we define a Payoff as the loan being repaid in full without any signs of distress. This includes payoffs at maturity and prepayments. In contrast to conduit CMBS, where prepayment is tightly constrained, CRE CLO collateral consists of transitional, floating–rate bridge loans that can be prepaid early without penalty. Consistent with sponsors executing value–add business plans, Payoff is both the modal and the only unambiguously favorable resolution (33% of observed outcomes).

The remaining outcomes: Buyout, Modification, and Default, signal distress or deviation from underwriting and together account for 50.8% of the sample; 16% of loans remain active and are treated as right–censored in our duration analysis.[21] Buyout signifies that a loan is repaid, either at maturity or before, but flagged as distressed at the point of repayment. Modification means a loan's payment terms have been modified and the loan has been flagged as distressed, while Default indicates when a loan is 90 or more days delinquent.

We estimate covariate effects on the timing and incidence of a loan's first event using a competing-risks design. We model our four mutually exclusive events so that once one occurs the loan exits the risk sets for the others. To do this we use the Fine–Gray subdistribution hazard model (Fine and Gray, 1999) to quantify how covariates shift the accumulation of each outcome's cumulative incidence while accommodating competing events and right-

[21] We flag a loan as distressed if it meets any of these conditions: 90+ days delinquent, foreclosure, REO, borrower bankruptcy, realized losses, transfer to special servicing, servicer workout, DSCR < 1.0, debt yield < 6.0, LTV $> 100\%$, appraisal reduction event, placement on servicer watch list, or discontinued servicer advances.

censoring.[22] In the Fine–Gray model the subdistribution hazard for event type k at time t conditional on the covariate vector X is

$$h_k^*(t \mid X) \;=\; h_{0k}^*(t)\, \exp\!\big(X^\top \beta_k\big), \tag{1}$$

where $h_{0k}^*(t)$ is an unspecified baseline subdistribution hazard. Unlike a cause-specific hazard, $h_k^*(t \mid X)$ is evaluated in a risk set that keeps observations that have already experienced a *different* competing event, weighted by the inverse of their probability of remaining uncensored. We obtain $\widehat{\beta}_k$ by maximizing the Fine–Gray weighted partial likelihood. With $\widehat{\beta}_k$ fixed, we recover $h_{0k}^*(t)$ nonparametrically and integrate it to form the cumulative incidence function (CIF),

$$F_k(t \mid X) \;=\; 1 - \exp\!\Big[-\int_0^t h_{0k}^*(u)\, \exp\!\big(X^\top \widehat{\beta}_k\big)\, du\Big]. \tag{2}$$

Thus, $F_k(t \mid X)$ gives the probability that a performing loan's first exit by time t is to k rather than to any other event. For example, the Default CIF answers: *What is the probability that a performing loan's first transition out of the active state is to default rather than to modification, buyout, or payoff?* This first-event perspective is well suited to questions about servicer workload, note-protection triggers, and early cash-flow timing, but it can diverge from ultimate outcomes if a meaningful share of modified or defaulted loans later payoff. We examine this possibility in Table 12, but find only 10 to 12 percent of loans payoff after realizing a default or modification, minimizing this concern.

Table 11 presents sub-distribution hazard ratio (SHR) estimates, i.e., $\exp(\widehat{\beta}_k)$, from our competing-risk regressions. Estimates greater than one indicate a higher sub-distribution hazard for the specified outcome, i.e., a faster increase in its cumulative incidence accounting for competing events; estimates less than one indicate a slower increase. Of particular importance is the role of sponsor–servicer affiliation on loan outcomes. To examine this, we define *Partial affiliation* to equal one when the sponsor is also the special servicer, and

[22] Ciochetti et al. (2002) provide an early application of these methods to longer-duration CRE mortgage loans.

Full affiliation to equal one when the sponsor is both the special servicer and the master servicer.[23]

Estimates of SHRs reported in Table 11 generally indicate that affiliation primarily reallocates first events away from defaults and toward payoffs in both managed and static deals. Modification incidence is also particularly higher in affiliated managed deals. For example, among managed deals where the sponsor is both the master and special servicer, payoff and modification are significantly higher (SHR = 2.772, SHR = 1.395, respectively), buyout is not significantly different (SHR = 0.998), and defaults are significantly lower (SHR = 0.201). When the sponsor is only the special servicer, we find that modifications and payoffs are more likely (SHR = 1.277, SHR = 1.417, respectively), while defaults are less likely (SHR = 0.799). Among static deals we find similar results for payoffs and defaults, but insignificant results for modifications.

The model–implied CIFs (Figures 2–4) reinforce these interpretations. Figure 2 shows that managed pools exhibit more active credit management than static pools: the Modification and Buyout CIFs rise earlier and more rapidly, while the Default CIF remains comparatively flat over most horizons. In affiliation splits reported in Figures 3 and 4, Full affiliation managed pools display higher Payoff and lower Default CIFs throughout the window, while the Buyout curves are closely bunched and the Modification curve for Full-affiliation loans sits only modestly above those for Partial and Unaffiliated. In static pools, the Payoff (Default) CIF under Full affiliation lies above (below) the Unaffiliated curve, with Buyout and Modification curves more tightly clustered, echoing the weaker point estimates in Table 11.

Other control variables included in our Table 11 specifications also yield economically intuitive patterns. Balloon–maturity indicators dominate timing: defaults in static deals bunch near long balloon dates, while in managed deals the approach of a 36–month balloon coincides with more frequent modifications, consistent with collateral managers resolving

[23]There is no instance where the sponsor is the master servicer but not the special servicer.

incipient distress ahead of contractual maturity. Loan size adds a complementary dimension: in managed pools, larger balances are less likely to exit via clean Payoff, while in static pools larger loans are more likely to be worked out via modification rather than to default. Property–type effects (relative to industrial) track sectoral fundamentals: hospitality loans show the highest modification propensity, reflecting pandemic–era revenue shocks, while office and mixed–use loans exhibit elevated default and modification risks in the wake of work–from–home policies. Market conditions move in expected directions: increases in the Green Street national commercial property price index (CPPI) from loan origination to time t, which signal rising asset values, are associated with fewer defaults and modifications and more payoffs; higher LTVs are associated with lower payoff incidence and no statistically reliable increase in default. Finally, rating–agency coverage and concentration measures provide additional structure: in managed pools, deals rated by newer agencies are associated with more modifications and fewer buyouts, and greater property–type concentration (HHI Property Type) is linked to more modifications and fewer payoffs, consistent with servicers prioritizing higher-risk, concentrated loans for early intervention.

In Table A7 we report robustness tests of our competing risk specifications and find similar estimates weighting loan observations by loan amount, excluding loans from Arbor Realty Trust deals, estimating the specifications using only multifamily loans, and dropping loans from the sample that have missing DSCR or debt yield (DY) on the date of the first event. This last robustness test we perform to limit the possibility that our distress loan flag, and subsequently results, are driven by missing data. We exclude Arbor Realty Trust deals because these loans represent a large, concentrated cluster of loans in our sample that exhibit a disproportionately high incidence of modifications and workout activity relative to the rest of the sample and feature collateral/underwriting profiles that place them at the high-risk end of the distribution. Removing Arbor loans thus prevents a single, perhaps anomalous, sponsor's outlier practices from dominating the competing-risk estimates.

In Table A9 we examine the role of good versus bad states on master and special servicer

behavior in affiliated loans. We do this by interacting our affiliation indicators with a "bad loans" indicator that equals one when the percentage of loans with a distressed loan flag within a deal exceeds the sample average of 31%. Overall, we find that affiliation's effect is highly state-dependent. Restricting the sample to managed deals, we find that in "normal" states ($\mathbf{1}$[Bad Loans] = 0), Full affiliation is associated with a substantially higher payoff subhazard (SHR = 2.314) and a lower buyout subhazard (SHR = 0.548); effects on modification and default are negative but not precisely estimated. Partial affiliation also raises the payoff subhazard (SHR = 1.453) with little movement elsewhere. By contrast, when a deal's contemporaneous share of "bad loans" is above average ($\mathbf{1}$[Bad Loans] = 1), the baseline shifts sharply toward distress (Payoff ≈ 0, Buyout = 27.105, Modification = 16.909, Default = 16.370), and the affiliation interactions indicate a pivot in how affiliated servicers resolve that distress. For Full affiliation, the interaction terms imply (i) a compressed payoff incidence (SHR = $2.314 \times 0.490 = 1.13$), (ii) a flip from fewer to more buyouts (SHR = $0.548 \times 3.163 = 1.73$), (iii) a marked increase in modification (SHR = $0.425 \times 3.820 = 1.62$), and (iv) a pronounced reduction in default (combined SHR = $0.625 \times 0.342 = 0.21$). Partial affiliation shows the same qualitative re-allocation: the payoff incidence compresses (SHR = 1.11), modification rises (to SHR = 1.56), and default is lower (SHR = 0.79), but magnitudes are smaller and buyouts remain roughly unchanged (SHR = 1.00). In short, when deals tip into periods with many troubled loans, full affiliation shifts first exits decisively away from outright default and toward active workout channels like modification or buyout.

Across event distributions and competing-risk estimates, CRE CLO loan outcomes reflect active management, heterogeneous collateral risk, and state-contingent servicer behavior. Payoff is the modal and only unambiguously favorable first exit, but roughly half of loans experience a distressed first event. We find sponsor–servicer affiliation does not simply "lower default", but rather reallocates first exits: in normal times toward payoffs, and in bad times toward modification and buyout while substantially suppressing default.

In sum, servicer affiliation in CRE CLOs appears less about eliminating credit risk than

about controlling its path and timing. In our results, affiliation reallocates first exits: raising payoffs in "normal" states and, when portfolios tip into stress, steering loans away from outright default toward active workouts (modification, and where feasible, par take-outs), which helps preserve OC/IC compliance and protect the sponsor's retained position. This matches the market setup: sponsors retain a large first-loss position, are vertically integrated (sponsor–collateral manager–servicer/special servicer), and use flexible QRS vehicles that permit par buyouts of impaired loans for off-trust resolution. These features support strong equity PMEs while relocating loss recognition to the sponsor's balance sheet. The practical implication is that affiliation functions as an operational hedge for the securitization: it buys time and smooths trust-level outcomes so long as the sponsor can finance par take-outs and modifications. If market stress deepens or appraisal reductions catch up, those same mechanisms may have limited headroom, and losses deferred from the trust could reappear with greater severity.

6. Conclusions

The commercial lending market has undergone significant transformation over the past decade, with a notable shift from traditional bank financing toward greater participation by nonbank financial institutions.[24] As credit markets become increasingly securitized, CLOs are positioned to play a growing role in financial intermediation by channeling long-term capital into tradable credit assets. Their structural stability and adaptability make them particularly suitable for this role, as argued by Diamond et al. (2024).

However, to date, the CLO structure has been deployed at scale outside of the leveraged

[24]Recent research attributes the rise of shadow banking entities to a combination of regulatory arbitrage and technological innovation (e.g., Buchak et al. (2018)). Though not our focus, nonbank CRE CLO lenders may indeed benefit from more efficient, technology-enabled operations and less binding regulatory constraints, allowing them to offer more competitive pricing or even take on greater credit risk. Another important driver of the sector's post-GFC emergence likely stems from market-driven differences in funding costs within a persistently low-rate environment. As interest rates approach the zero bound, the traditional funding advantage of banks—access to low-cost deposits—erodes, narrowing the cost differential that has historically favored depository lenders.

loan market in only one major structured product: commercial real estate collateralized loan obligations, or CRE CLOs. Despite extensive academic research on traditional CLOs, CRE CLOs have never been studied in the financial economics literature. This paper provides the first large-sample empirical analysis of this important segment of the securitization market—historically the domain of depository institutions—documenting the characteristics and performance of both the underlying loans and the issued securities.

CRE CLOs have thus far delivered strong security performance for sponsors and external investors, even relative to CMBS and corporate CLOs. These findings suggest that spread arbitrage, and not just financing convenience, has been a primary economic driver of CRE CLO issuance. Yet, a more fundamental factor is structural: distressed loans are bought out of pools at par and resolved *outside* the trust, which preserves collateral values but makes true performance difficult to observe. This practice may not be sustainable if distress deepens further in this market, and it explains the coexistence of high default and modification rates with extraordinarily low realized loss rates. Equally concerning is the low failure rate for overcollaterization tests. Because failure of the OC test diverts cash flows from the equity to the senior notes and suspends reinvestment privileges, sponsors have strong incentives to defer formal recognition of collateral deterioration.

A central finding of this study is the effect of sponsor-servicer relationships on resolution outcomes. In managed deals where the special servicer is sponsor-affiliated, modification and buyout rates are significantly higher—and default rates significantly lower—than in unaffiliated deals. This pattern suggests that vertically integrated sponsors may be better equipped, or more incentivized, to manage distressed loans in ways that preserve apparent collateral performance and maintain compliance with structural triggers. However, by prioritizing the retention of control and cash flow over transparent and timely loss recognition, such strategies may work against the interests of senior bondholders, who hold the majority of outstanding securities.

Our results suggest several potential reforms aimed at improving transparency and re-

silience in CRE CLOs. First, conflict-of-interest safeguards should be strengthened. Skin in the game does not cure all ills. When the special servicer is sponsor-affiliated, the operating advisor in static deals or advisory committee in managed deals should be granted broader consent rights over conflicted transactions, given the lack of an independent check on the collateral manager. Second, servicers should more clearly disclose interest rate cap premiums, ensuring that coverage metrics reflect actual cash flows. Third, greater clarity is needed in defining loan modifications, defaults, and appraisal reduction triggers, since current practices leave sponsors with wide discretion to avoid classification events. Finally, deal documentation should more clearly specify permissible forms of loan modification, and any waivers of structural protections—such as rate-cap requirements or due-on-encumbrance clauses—should be explicitly disclosed, especially where such waivers permit the addition of mezzanine debt to cover interest shortfalls.

These agency dynamics are not merely theoretical: they are unfolding in real time. Many CRE CLOs—particularly those originated during the 2021–2022 issuance peak—remain active, and the ultimate resolution of their distressed loans is still pending. This paper highlights the need for further research on optimal resolution strategies, agency conflicts between security sponsors and bond investors, and the evolving role of securitization in the commercial real estate credit cycle.

References

Agarwal, S., B. W. Ambrose, Y. Yildirim, and J. Zhang (2024). Risk retention rules and the issuance of commercial mortgage backed securities. *Journal of Real Estate Finance & Economics 68*, 684–714.

Ambrose, B. W., A. B. Sanders, and A. Yavas (2016). Servicers and mortgage-backed securities default: Theory and evidence. *Real Estate Economics 44*(2), 462–489.

An, X., L. Cordell, and N. Smith (2023). CMBS market evolution and emerging risks. Working Paper 23-27, Federal Reserve Bank of Philadelphia. Available at SSRN 4639474.

Armstrong, M. J., S. McQueen, E.-M. Smith, L. Swihart, and J. Ludwig-Eagan (2023, May). Loan modifications and pool management in a CRE CLO. Research report, Dechert LLP.

Ashcraft, A. B., K. Gooriah, and A. Kermani (2019). Does skin-in-the-game affect security performance? *Journal of Financial Economics 134*(2), 333–354.

Becker, B. and V. Ivashina (2015). Reaching for yield in the bond market. *Journal of Finance 70*(5), 1863–1901.

Begley, T. A. and A. Purnanandam (2017). Design of financial securities: Empirical evidence from private-label RMBS deals. *The Review of Financial Studies 30*(1), 120–161.

Benmelech, E., J. Dlugosz, and V. Ivashina (2012). Securitization without adverse selection: The case of CLOs. *Journal of Financial Economics 106*(1), 91–113.

Brookfield (2024). The misunderstood U.S. office market. Retrieved from `https://www.brookfield.com/news-insights/insights/misunderstood-us-office-market`.

Buchak, G., G. Matvos, T. Piskorski, and A. Seru (2018). Fintech, regulatory arbitrage, and the rise of shadow banks. *Journal of Financial Economics 130*(3), 453–483.

Cerasi, V. and J.-C. Rochet (2014). Rethinking the regulatory treatment of securitization. *Journal of Financial Stability 10*, 20–31.

Chemla, G. and C. A. Hennessy (2014). Skin in the game and moral hazard. *Journal of Finance 69*(4), 1597–1641.

Ciochetti, B., Y. Deng, B. Gao, and R. Yao (2002). The termination of commercial mortgage contracts through prepayment and default: A proportional hazard approach with competing risks. *Real Estate Economics 30*(4), 595–633.

Cordell, L., M. R. Roberts, and M. Schwert (2023). CLO performance. *The Journal of Finance 78*(3), 1235–1278.

CREFC (2025). CRE Finance Council CRE CLO e-primer 2021 edition. `https://www.crefc.org/ItemDetail?iProductCode=CRECLOEPRIMER25&Category=LMS&WebsiteKey=d358bd5a-42a6-4d2c-a6a8-f0865c824aa1`.

Cushman & Wakefield (2025). U.S. office marketbeat report. Retrieved from `https://www.cushmanwakefield.com/en/united-states/insights/us-marketbeats/us-office-marketbeat-reports`.

DeMarco, L., E. Liu, and T. Schmidt-Esenhohr (2020, June). Who owns U.S. CLO securities? An update by tranche. FEDS Notes, Board of Governors of the Federal Reserve System.

DeMarzo, P. M. (2005). The pooling and tranching of securities: A model of informed intermediation. *Review of Financial Studies 18*(1), 1–35.

DeMarzo, P. M. and D. Duffie (1999). A liquidity-based model of security design. *Econometrica 67*(1), 65–99.

Demiroglu, C. and C. James (2012). How important is having skin in the game? Originator–sponsor affiliation and losses on mortgage-backed securities. *The Review of Financial Studies 25*(11), 3217–3258.

Diamond, W., L. Falasconi, and C. C. Xu (2024). Collateralized loan obligations as fire-sale insulation. Working paper.

Elkamhi, R., R. Li, and Y. Nozawa (2020). A benchmark for collateralized loan obligations. Working paper, University of Toronto.

Fabozzi, F. J., S. Klingler, P. Molgaard, and M. S. Nielsen (2021). Active loan trading. *Journal of Financial Intermediation 46*, 100868.

Fine, J. P. and R. J. Gray (1999). A proportional hazards model for the subdistribution of a competing risk. *Journal of the American Statistical Association 94*(446), 496–509.

Flynn Jr, S. J., A. C. Ghent, and A. Tchistyi (2020). Informational efficiency in securitization after Dodd–Frank. *The Review of Financial Studies 33*(11), 5131–5172.

Furfine, C. (2020). The impact of risk retention regulation on the underwriting of securitized mortgages. *Journal of Financial Services Research 58*(2), 91–114.

Furfine, C. and B. Zborowski (2025). Signaling through security design: Evidence from commercial mortgage-backed securities. Working paper, available at SSRN 5209905.

Furfine, C. H. (2014). Complexity and loan performance: Evidence from the securitization of commercial mortgages. *The Review of Corporate Finance Studies 2*(2), 154–187.

Glancy, D., R. J. Kurtzman, and L. Loewenstein (2022). Loan modifications and the commercial real estate market. Finance and Economics Discussion Series 2022-050, Board of Governors of the Federal Reserve System.

Griffin, J. M. and J. Nickerson (2023, June). Are CLO collateral and tranche ratings disconnected? *The Review of Financial Studies 36*(6), 2319–2360.

Gupta, A., V. Mittal, and S. Van Nieuwerburgh (2022). Work from home and the office real estate apocalypse. NBER Working Paper 30526, National Bureau of Economic Research.

Haas, M. (2024, May). CRE CLOs: Structural considerations when analyzing distress & searching for opportunity using CRED iQ analytics. Blog post.

Huang, Y. and T. D. Nadauld (2019). A direct test of agency theories of debt: Evidence from residential mortgage-backed securities. *Management Science 65*(4), 1792–1809.

Ivashina, V. and Z. Sun (2011). Institutional demand pressure and the cost of corporate loans. *Journal of Financial Economics 99*(3), 500–522.

Jensen, M. C. and W. H. Meckling (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics 3*(4), 305–360.

Kaplan, S. N. and A. Schoar (2005). Private equity performance: Returns, persistence, and capital flows. *Journal of Finance 60*(4), 1791–1823.

Leland, H. E. and D. H. Pyle (1977). Informational asymmetries, financial structure, and financial intermediation. *The Journal of Finance 32*(2), 371–387.

Liebscher, R. and T. Mahlmann (2017). Are professional investment managers skilled? Evidence from syndicated loan portfolios. *Management Science 63*(6), 1892–1918.

Merrill, C. B., T. D. Nadauld, and P. E. Strahan (2019). Final demand for structured finance securities. *Management Science 65*(1), 390–412.

Moody's (2025, July). CLO use grows for CRE and MM lenders; collateral differs but structures similar. Moody's Sector In-Depth report.

Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of Financial Economics 5*(2), 147–175.

Peristiani, S. and J. A. C. Santos (2019, July). CLO trading and collateral manager bank affiliation. *Journal of Financial Intermediation 39*, 47–58.

Schwartz, J., G. Silverstein, and D. Ng (2018). The taxation of commercial real estate collateralized loan obligations. Insight report, Cadwalader, Wickersham & Taft LLP. Daily Tax Report (BNA).

Shivdasani, A. and Y. Wang (2011). Did structured credit fuel the LBO boom? *Journal of Finance 66*(4), 1291–1328.

Wong, M. (2018). CMBS and conflicts of interest: Evidence from ownership changes for servicers. *Journal of Finance 73*(5), 2425–2458.

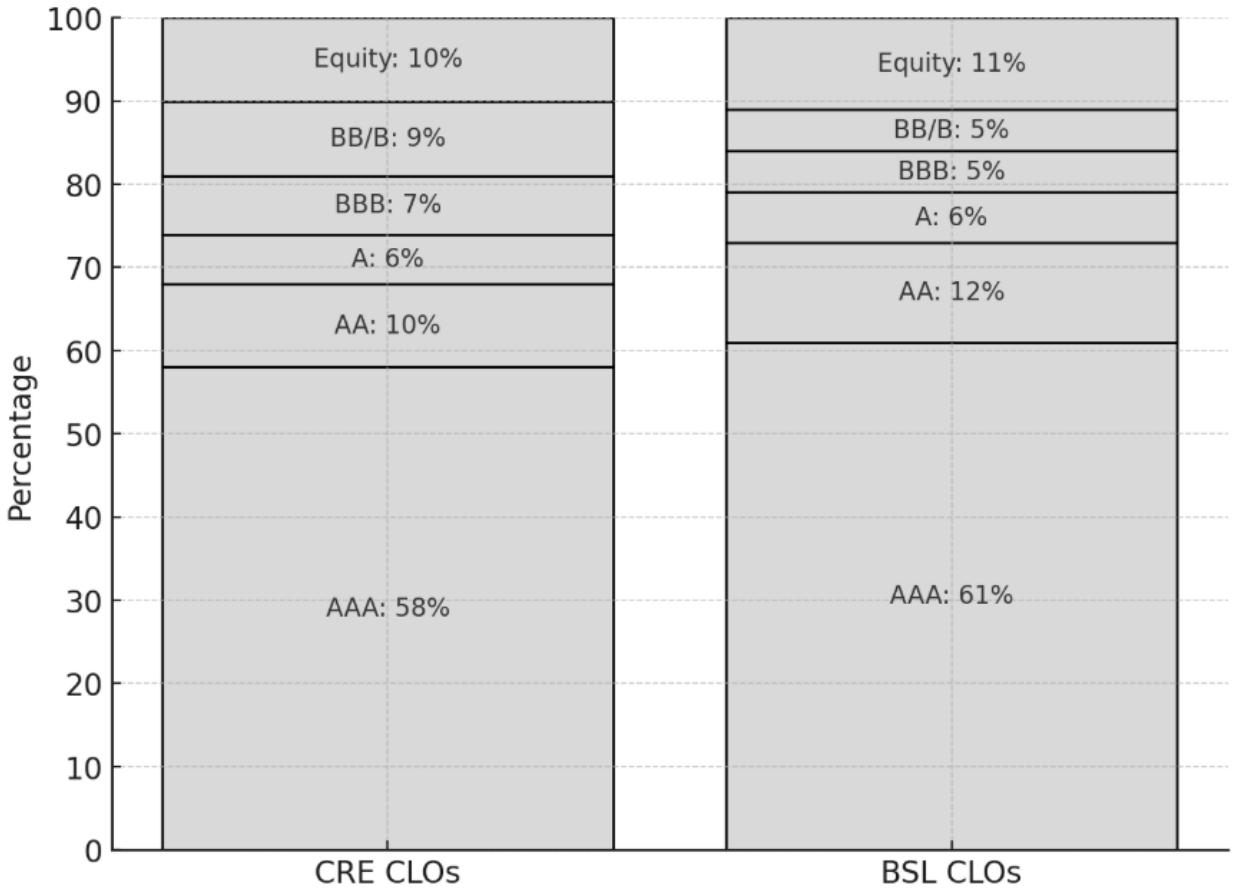
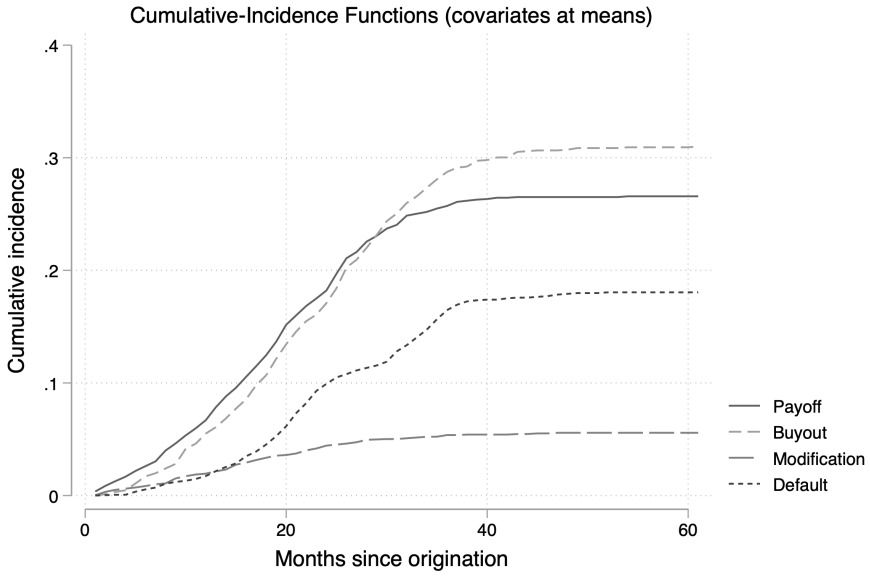


Fig. 1. **CRE and BSL CLO capital structures.** This figure presents the liability side of the balance sheets of CRE CLOs and broadly syndicated loan (BSL) CLOs. The capital structure is presented as the principal value-weighted share of liabilities by rating category at issuance. We pool the BB and B categories because they have relatively small shares. Data for CRE CLOs are from Green Street; data for BSL CLOs are from Cordell, Roberts and Schwert (2023).

Panel A. Static Deals



Panel B. Managed Deals

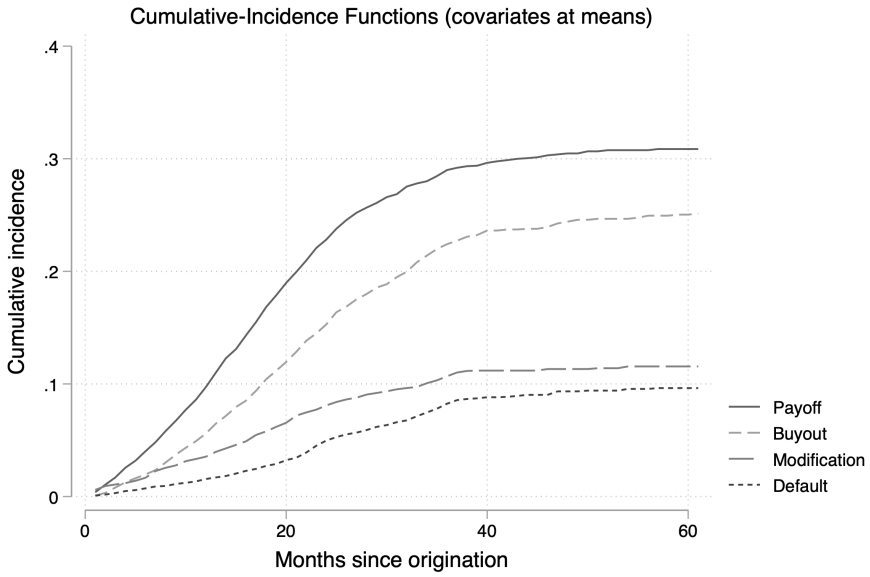


Fig. 2. **Cumulative Incidence Function by Deal Type.** This figure presents cumulative incidence functions (CIFs) based on our estimates in Table 11 for each of our four outcomes (Payoff, Buyout, Modification and Default) for both static and managed deals. Data source: Intex.

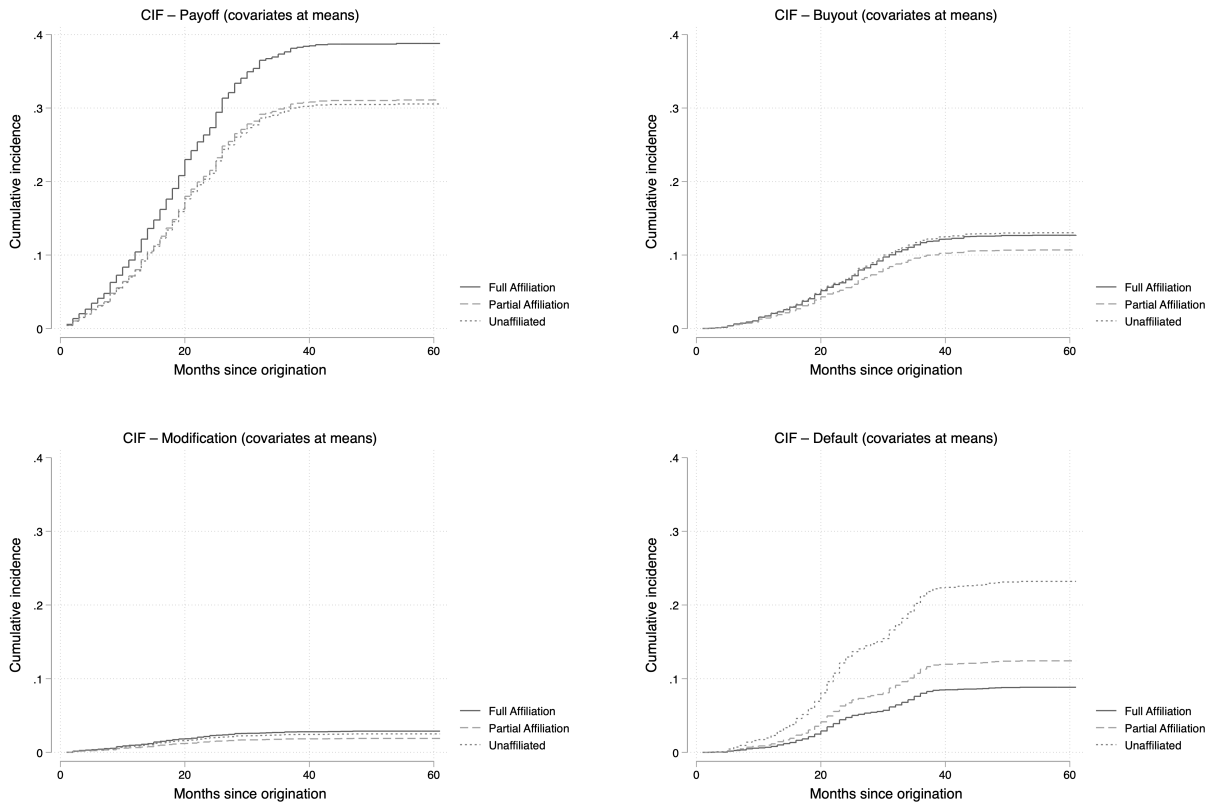


Fig. 3. **Static Deal Cumulative Incidence Functions by Affiliation.** This figure presents cumulative incidence functions (CIFs) for loans in static deals, conditional on affiliations between the sponsor and their servicers. Full affiliation indicates sponsors who are affiliated with both their servicers and special servicers, who manage delinquent accounts. Partial affiliation indicates sponsors who are affiliated with their special servicers only. Unaffiliated indicates no affiliation with either servicer. CIFs are derived from estimates in Table 11. Data source: Trepp.

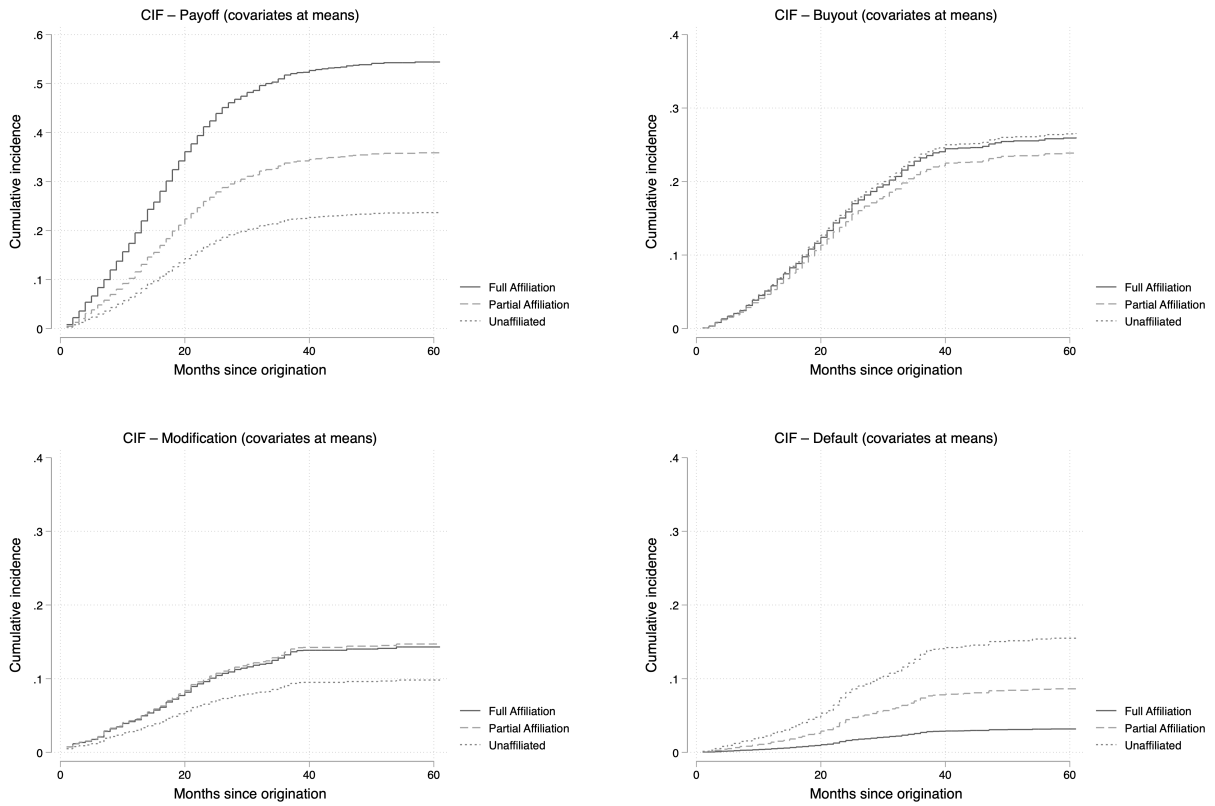


Fig. 4. **Managed Deal Cumulative Incidence Functions by Affiliation.** This figure presents cumulative incidence functions (CIFs) for loans in managed deals, conditional on affiliations between the sponsor/collateral managers and their servicers. All sponsors are affiliated with their collateral managers. Full affiliation indicates sponsors who are affiliated with both their servicers and special servicers, who manage delinquent accounts. Partial affiliation indicates sponsors who are affiliated with their special servicers only. Unaffiliated indicates no affiliation with either servicer. CIFs are derived from estimates in Table 11. Data source: Trepp.

Table 1: Counts and Characteristics of Deals and Securities Sample

This table summarizes deal and security counts and dollar issuance amounts by vintage for the full CRE CLO sample. Mean deal and security sizes are at issuance. "Nonmissing" indicates deals matched with Intex. "Completed deals" are fully repaid debt and equity tranches. "Paid off securities" are fully paid individual securities. Data sources: Green Street (full sample), Intex (nonmissing counts).

Panel A: Deal Characteristics

Vintage	Deal Count	Issuance Amount ($ Mil.)	Mean Deal Size ($ Mil.)	Nonmissing Deals	Completed Deals
2013–14	7	1,899	271	7	7
2015–16	12	4,439	370	10	10
2017	15	6,616	441	12	14
2018	24	13,365	557	24	22
2019	28	18,922	676	25	24
2020	12	8,312	693	13	8
2021	51	45,437	891	43	17
2022	29	29,301	1,010	31	9
2023	10	6,670	667	10	2
2024	10	7,822	782	10	0
Total	198	142,783	721	185	113

Panel B: Bond and Equity Tranche Characteristics

Ratings	Bond/Equity Count	Issuance Amount ($ Mil.)	Mean Security Size ($ Mil.)	Nonmissing / Paid Off Securities
AAA	360	89,056	247.38	213
AA	185	7,896	42.68	106
A	187	8,509	45.50	107
BBB	327	11,808	36.11	161
BB	195	6,601	33.85	100
B	177	4,454	25.16	97
Equity	199	14,011	70.41	113
Total	1,642	142,783		896

Table 2: CRE CLO Deal Characteristics by Vintage

This table presents deal-level summary statistics for CRE CLOs by securitization year. *Total Deal Volume ($ B)* and *Total Deal Volume (#)* reflect the annual aggregate issuance amount and number of deals. *Loans Per Deal* and *Pool Size ($ M)* describe the average composition of each deal by number of loans and total balance. *Cutoff LTV* is the loan-balance-weighted average loan-to-value ratio at securitization. *Effective LTV* is the average risk-adjusted loan-to-value ratio for the lowest non-retained tranche, calculated by reducing the deal's overall LTV by the lowest non-retained tranche's credit enhancement. *AAA Spread* and *BBB- Spread* are the average coupon spreads for the highest and lowest rated tranches, respectively. *Managed (%)* and *Static (%)* indicate whether deals allow post-securitization collateral management or maintain a fixed loan pool. *State HHI* and *Asset Class HHI* are Herfindahl-Hirschman Index measures of concentration which range from zero to one. *LTV Bimodal Coeff.* is a measure of the bi-modality of loan LTVs within deals. *New Issuer (%)* reports the share of deals sponsored by issuers entering the CRE CLO market for the first time. *Full Affiliation (%)* denotes deals where the issuer also serves as both servicer and special servicer; *Partial Affiliation (%)* includes deals where the issuer serves as the special servicer only; and *No Affiliation (%)* refers to deals without any issuer involvement in servicing. *AAA Subordination (%)* and *BBB- Subordination (%)* reflect the average tranche-level credit enhancement for the respective rating levels. All annual averages are weighted by securitized deal balance. Data sources: Trepp and Green Street.

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Total Deal Volume ($ B)	0.4	1.5	3.6	0.9	6.6	14.0	18.3	8.4	45.4	29.3	6.7	7.8
Total Deal Volume (#)	2	5	9	3	15	25	27	12	51	29	10	10
Loans Per Deal	22.0	16.7	26.1	21.5	25.9	27.2	32.0	29.7	32.2	30.8	24.2	24.5
Pool Size ($ M)	255.1	309.1	427.4	290.3	516.3	663.7	755.8	847.1	1,043.3	1,164.9	711.8	892.0
Cutoff LTV	.	69.7	68.0	70.1	66.6	64.9	65.9	63.5	67.7	68.7	62.2	61.7
Effective LTV	.	60.8	63.9	70.1	61.0	57.3	60.6	58.2	61.3	62.8	56.6	56.0
AAA Spread	175.0	139.1	182.4	191.6	123.8	130.9	142.8	203.1	143.0	238.0	305.3	223.4
BBB- Spread	.	348.7	436.1	588.0	358.9	283.4	275.9	350.4	321.7	423.9	599.4	518.3
Managed (%)	30.5	0.0	22.8	37.7	35.4	57.5	63.4	27.3	74.4	72.0	36.1	69.0
Static (%)	69.5	100.0	77.2	62.3	64.6	42.5	36.6	72.7	25.6	28.0	63.9	31.0
State HHI	0.2	0.1	0.2	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.2	0.2
Asset Class HHI	0.3	0.3	0.3	0.4	0.4	0.3	0.4	0.6	0.6	0.8	0.6	0.7
LTV Bimodal Coeff.	0.3	0.2	0.3	0.3	0.3	0.4	0.3	0.4	0.3	0.4	0.2	0.3
New Issuer (%)	100.0	47.2	52.3	32.4	49.5	81.2	35.6	0.0	19.9	6.4	10.1	0.0
AAA Sub. (%)	31.4	43.0	42.1	38.5	38.7	42.0	37.0	37.4	37.7	36.9	34.8	32.8
BBB- Sub. (%)	15.1	25.4	22.6	18.6	18.7	21.4	17.3	16.9	17.4	17.8	15.6	13.7
Master Servicer—Special-Servicer Affiliation (%)												
Full	30.5	28.5	38.8	67.6	32.8	15.8	17.5	9.5	19.8	12.8	9.2	5.4
Partial	69.5	71.5	18.3	0.0	5.3	9.7	12.7	17.0	21.3	31.0	22.1	57.9
Unaffiliated	0.0	0.0	42.9	32.4	61.9	74.5	69.8	73.5	58.9	56.2	68.7	36.7

Table 3: CRE CLO Affiliations with Issuers

This table summarizes issuer affiliations with the major agents in CRE CLO transactions. The issuer of the securitization is the entity that typically provides all, or most, of the collateral for the deal and typically owns the equity and noninvestment grade securities. The collateral manager manages the buying and selling of loans throughout the life of the deal for managed deals. Managed deals allow for the buying and selling of loans throughout the life of the deal; static deals do not have collateral managers. The master servicer processes loan payments, services performing loans, and advances payments on nonperforming loans, among other duties. The special servicer services nonperforming loans, such as handling workouts, modifications, and liquidations, among other duties. Data source is Green Street.

Affiliation	Collateral Manager	Master Servicer	Special Servicer	All Deals	Share All (%)	Managed Deals	Share Managed (%)	Static Deals	Share Static (%)
Full	Y	Y	Y	40	20	26	24	14	15
Partial	Y	N	Y	47	24	30	28	17	19
Unaffiliated	Y	N	N	111	56	51	48	60	66
Totals				198		107		91	

Table 4: CRE CLO Loan Pool Characteristics by Vintage

This table reports loan-level summary statistics by CRE CLO origination vintage. *Total Volume ($ B)* is the total annual loan origination volume, and *Total Volume (#)* is the number of loans. *Avg Loan Size ($ M)* is the average size of originated loans. *Pari Passu (%)* shows the percentage of loans syndicated across multiple deals. *Avg Spread (%)* is the average loan spread in basis points, winsorized at the 1% level. Loan purpose shares (*Purchase*, *Refinance*, *Missing*) and asset class shares (*Multifamily*, *Office*, *Retail*, etc.) are reported as percentages. Geographic distributions report regional (*Northeast*, *Midwest*, etc.) shares. All percentages are weighted by loan size. Data source: Trepp.

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Total Volume ($ B)	0.5	1.4	3.6	0.9	6.6	14.2	18.1	8.3	46.4	30.3	6.7	7.5
Total Volume (#)	47	85	241	73	406	746	907	384	1,818	942	239	240
Avg Loan Size ($ M)	12.9	25.8	23.1	16.8	24.9	33.8	35.7	35.6	40.9	50.4	40.1	46.6
Pari Passu (%)	0.0	0.0	0.0	0.0	0.0	6.5	6.3	7.0	4.8	5.2	5.2	0.0
Avg Spread (%)	5.0	4.7	5.1	5.3	4.6	4.2	3.5	3.1	3.6	3.7	4.1	3.6
Loan Purpose (%)												
Purchase	41.8	62.6	60.1	33.8	60.6	49.5	51.1	60.6	55.0	65.7	61.4	28.3
Refinance	32.9	37.4	26.2	26.4	34.0	43.8	42.3	33.8	33.9	26.3	37.9	68.2
Missing	25.3	0.0	13.7	39.8	4.8	6.6	6.7	5.6	11.1	8.0	0.6	3.5
Asset Class (%)												
Multifamily	28.9	37.0	36.7	46.4	44.4	39.1	49.0	56.1	70.0	82.5	73.5	76.8
Office	10.1	29.0	25.8	20.8	27.0	23.6	24.7	24.2	13.4	5.4	3.5	1.4
Retail	24.7	12.0	13.4	12.5	9.3	7.1	5.0	0.8	1.5	1.6	1.6	1.2
Industrial	5.9	11.1	1.5	3.6	2.3	4.8	3.0	3.2	3.3	2.1	9.7	6.4
Hospitality	3.3	1.6	9.5	3.4	5.7	12.3	9.4	5.4	4.0	4.2	6.9	4.3
Mixed-use	12.1	9.3	4.4	2.7	4.6	6.9	5.3	6.1	3.7	2.7	1.9	2.6
Other	2.4	0.0	3.3	1.6	1.8	4.1	1.9	2.2	3.8	1.6	2.2	7.0
Missing	12.7	0.0	5.4	8.9	4.8	2.2	1.8	1.9	0.3	0.0	0.6	0.2
Region (%)												
Northeast	5.3	11.4	8.0	15.9	13.7	24.2	15.5	14.9	14.5	17.0	14.9	21.6
Southeast	16.3	27.4	24.5	38.4	25.3	24.7	25.7	26.4	32.4	28.9	40.4	29.8
Southwest	24.2	19.8	24.1	11.7	18.1	14.6	24.8	16.9	23.7	27.2	19.5	19.0
Midwest	8.0	11.4	9.2	6.7	11.8	11.2	9.4	12.1	8.9	7.4	2.7	5.8
West	28.7	19.6	18.8	18.4	24.9	16.7	21.1	23.5	17.7	17.5	19.1	21.0

Table 5: CRE CLO Loan Underwriting Characteristics by Vintage
This table reports loan underwriting characteristics by CRE CLO origination year. The *As-Is* and *Stabilized* panels include average loan-to-value (LTV), debt service coverage ratios (DSCR) based on net operating income (NOI) and net cash flow (NCF), debt yields, and property occupancy, as reported at origination and under stabilized assumptions. These variables are winsorized at the 1% level. The *Loan Structure* panel summarizes lockbox provisions (*Hard*, *Soft*, *Springing*) and reserve amounts as a percentage of loan face value, including total reserves, tenant improvement/leasing commissions (TI/LC), capital replacement, and other reserves. The table further includes the expected rent growth and appreciation, and average implied coupon rates derived from stabilized NOI and DSCR. Due to the degree of missing data at securitization, values have been backfilled at most 6-months. Additionally, reserve variables are set equal to zero if missing. Data source: Trepp.

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
As-Is												
LTV	63.4	77.3	66.0	66.6	65.8	63.0	65.6	63.5	67.2	66.9	62.1	60.8
DSCR (NCF)	1.5	1.7	1.8	2.4	1.3	1.1	1.0	1.0	1.1	1.1	0.3	0.8
DSCR (NOI)	1.6	1.8	1.8	2.4	1.4	1.2	1.1	1.2	1.2	1.1	0.6	0.9
Debt Yield (NCF)	7.3	6.8	5.9	7.4	8.7	7.5	6.3	13.7	6.7	5.1	4.1	10.5
Debt Yield (NOI)	7.8	7.1	6.1	7.4	9.3	9.2	7.0	15.0	7.0	5.5	5.7	11.3
Occupancy	89.4	83.2	83.5	68.9	86.6	80.1	81.1	81.1	83.4	84.7	77.4	82.1
Stabilized												
LTV	70.2	69.7	68.3	71.8	66.4	64.6	65.9	63.7	65.3	63.8	62.2	61.1
DSCR (NCF)	1.6	1.8	1.7	1.4	1.5	1.5	1.5	1.8	1.9	1.7	1.2	1.3
DSCR (NOI)	1.7	1.9	1.9	1.7	1.8	1.6	1.6	1.9	2.0	1.7	1.2	1.4
Debt Yield (NCF)	9.2	10.3	10.4	10.7	17.2	14.5	11.5	21.7	11.7	11.4	12.4	15.5
Debt Yield (NOI)	10.2	10.9	11.7	11.6	18.9	15.6	12.4	24.1	12.1	11.7	12.9	15.9
Occupancy	88.1	85.2	85.6	88.7	86.1	86.3	89.9	91.1	91.9	92.5	91.3	92.9
Lock Box (%)												
Hard	42.2	43.3	41.1	14.8	37.6	50.7	40.1	40.4	22.9	13.6	13.3	5.1
Soft	18.5	56.7	37.7	53.1	37.9	25.3	27.4	28.5	27.7	27.1	13.6	13.2
Springing	0.0	0.0	14.3	20.4	12.0	12.4	20.0	24.8	21.0	32.1	30.9	43.9
Missing	39.3	0.0	5.9	8.9	12.4	11.0	11.3	5.6	27.2	19.9	37.5	35.8
Reserves-to-Assets												
Total	2.7	4.2	4.2	7.3	4.0	3.5	3.0	2.7	2.3	1.8	2.0	1.4
TI/LC	0.9	0.9	1.3	1.7	0.8	0.5	0.5	0.3	0.2	0.1	0.2	0.1
Replacement	0.2	0.3	0.5	0.7	0.8	0.5	0.4	0.3	0.1	0.1	0.2	0.2
Other	1.3	2.7	1.8	4.1	1.8	2.1	2.0	2.1	1.9	1.5	1.5	1.1
Exp Appreciation	6.1	10.9	0.0	0.0	3.5	0.0	0.0	0.0	4.2	7.1	0.0	0.9
Exp Rent Growth	5.4	12.8	0.0	0.0	2.8	-0.0	-0.1	1.2	13.9	6.3	0.0	0.9
Exit Cap Rate	7.3	7.5	6.6	6.8	6.5	6.5	6.3	5.7	5.3	4.8	5.2	6.0
Implied Rate (%)	4.7	4.2	4.1	.	8.4	8.8	6.9	10.9	4.7	5.8	9.8	10.7

Table 6: Rating Agency Ratings of CRE CLO Deals and Bonds 2013–2024
This table reports counts of how many of the deals each rating agency participated in and which bonds are rated by the five agencies that rated CRE CLOs between 2013 and 2024. Percentages are not value-weighted. Data source: Green Street.

	Total	Moody's	S&P	Fitch	Rated by Top Three	% Top Three	DBRS	% DBRS	KBRA	% KBRA
Deal Counts	198	189	1	18	197	99.5	120	60.6	67	33.8
Bond Counts										
AAA	360	192	1	28	211	58.6	226	62.8	123	34.2
AA	184	1	0	12	13	7.1	114	62.0	65	35.3
A	181	2	0	12	15	8.3	116	64.1	66	36.5
BBB	326	10	0	16	26	8.0	209	64.1	96	29.4
BB	194	0	0	9	9	4.6	122	62.9	63	32.5
B	176	3	0	7	9	5.1	108	61.4	61	34.7

Table 7: Loan Performance Summary Statistics by Year

This table reports statistics on the performance of the CLO equity tranches and CLO debt tranches by initial rating category. Panel A presents internal rates of return (IRRs); Panel B presents public-market equivalents (PMEs) versus corporate bonds (Debt) and the S&P 500 (Equity). CRE CLO tranche returns are compared with mean returns on broadly syndicated loan (BSL) CLOs from Cordell et al. (2023), and—with the exception of equity—floating-rate Single-Asset Single-Borrower (SASB) CMBS bond returns from An et al. (2023). We construct t-tests of the null hypothesis that the PMEs equal one. *,**,*** denote p-values less than 0.10, 0.05, 0.01, respectively. WAL is the weighted-average-life of the bonds. Data sources: Intex, ICE, and Green Street.

Panel A. Internal Rates of Return (%)

	CRE CLOs									BSL CLOs	SASB CMBS
Ratings	N	WAL	Mean	SD	P10	P25	P50	P75	P90	Mean	Mean
AAA	213	35.87	3.32	1.78	1.83	2.30	2.76	3.72	6.01	2.38	2.54
AA	106	36.75	4.07	1.81	2.56	2.97	3.51	4.55	7.23	2.44	2.53
A	107	38.09	5.02	3.10	3.25	3.56	4.18	5.17	8.98	2.99	2.58
BBB	161	39.21	5.14	5.05	3.49	4.19	5.19	6.24	9.53	3.92	2.62
BB	100	38.00	6.33	6.30	5.02	5.61	6.75	8.08	10.52	6.25	NA
B	97	38.21	8.14	5.43	5.98	6.83	8.70	9.94	11.14	NA	NA
Equity	112	38.91	23.55	15.69	5.98	15.16	22.09	31.73	41.78	10.92	NA
Total	896	37.71									

Panel B. Public-Market Equivalents (%)

	CRE CLOs								BSL CLOs	SASB CMBS
Ratings	N	Mean	SD	P10	P25	P50	P75	P90	Mean	Mean
AAA	213	1.06***	0.07	0.99	1.01	1.05	1.10	1.15	1.02	1.00
AA	106	1.09***	0.06	1.02	1.04	1.07	1.13	1.19	1.06	1.01
A	107	1.11***	0.08	1.04	1.07	1.10	1.15	1.20	1.09	1.02
BBB	161	1.11***	0.11	1.02	1.07	1.12	1.17	1.21	1.10	1.02
BB	100	1.09***	0.13	1.00	1.05	1.11	1.16	1.19	1.05	NA
B	97	1.16***	0.12	1.04	1.12	1.17	1.22	1.27	1.13	NA
Equity	112	1.23***	0.33	0.85	1.01	1.23	1.45	1.62	0.97	NA
Total	896									

Table 8: Equity Tranche Performance of Completed CLO Deals
This table reports statistics on the performance of CLO equity tranches for managed and static deals, as well as by the level of affiliation between the CLO and its servicers. Panel A shows internal rates of return (IRRs); Panel B shows public-market equivalents (PMEs) versus the S&P500. Only equity tranches that have paid off or liquidated are included. We construct t-tests of the null hypothesis that the PMEs equal one. *,**,*** denote p-values less than 0.10, 0.05, 0.01, respectively. Data sources: Intex, ICE, and Green Street.

Panel A. Internal Rates of Return (%)

Deal Type / Affiliation	N	Mean	SD	P10	P25	P50	P75	P90
Deal structure								
Managed	51	25.20	17.88	11.24	18.63	25.57	33.75	44.03
Static	61	22.16	13.60	5.98	12.85	20.75	30.90	38.64
Managed affiliations								
Full	16	26.15	28.81	-20.54	21.35	30.49	45.05	51.19
Partial	11	22.84	14.74	5.60	11.67	18.03	41.78	42.65
Unaffiliated	24	25.65	7.46	16.26	20.44	24.39	30.93	34.79
Static affiliations								
Full	12	17.62	12.26	4.95	5.66	17.09	28.52	31.55
Partial	10	25.28	16.24	12.32	12.85	18.52	31.63	51.24
Unaffiliated	39	22.76	13.29	8.33	15.16	21.40	31.32	38.64

Panel B. Public-Market Equivalents (%)

Deal Type / Affiliation	N	Mean	SD	P10	P25	P50	P75	P90
Deal structure								
Managed	51	1.32***	0.40	0.91	1.05	1.31	1.57	1.79
Static	61	1.16***	0.26	0.85	0.94	1.18	1.30	1.49
Managed affiliations								
Full	16	1.39**	0.54	0.43	1.19	1.43	1.73	2.06
Partial	11	1.27*	0.43	0.91	0.95	1.05	1.62	1.86
Unaffiliated	24	1.29***	0.26	0.95	1.08	1.27	1.46	1.61
Static affiliations								
Full	12	1.12*	0.22	0.86	0.90	1.14	1.29	1.37
Partial	10	1.15**	0.20	0.84	1.08	1.18	1.29	1.41
Unaffiliated	39	1.18***	0.28	0.82	0.98	1.21	1.34	1.57

Table 9: Loan Performance Summary Statistics by Year

This table presents annual loan-balance-weighted-average percentages for CRE CLO loans, separated into two panels. Panel A reports results for static deals and Panel B for managed deals. *Delinquent* indicates the loan was ≥ 30 days delinquent. *Special Servicing* includes loans transferred to special servicers. *Maturity Default* and *Payment Default* indicate the special-servicing transfer was triggered by a balloon maturity or missed payment, respectively. *Distress* is defined as either a delinquency in special servicing or a loan modification. *Modification* captures loans with any evidence of a contractual change. $DSCR < 1$ and $DSCR < 0$ reflect net operating income below debt-service thresholds. Data source: Trepp.

Panel A. Static Deals

	Loan Origination Year									
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Delinquent	0.00	0.49	0.68	0.51	0.63	4.37	2.46	1.64	5.60	12.64
Special Servicing	0.35	0.72	1.79	1.26	1.26	3.22	2.03	1.61	5.59	12.28
Maturity Def.	.	.	.	5.23	18.97	16.11	24.67	58.87	27.35	30.31
Payment Def.	.	.	.	76.70	68.53	68.23	54.30	46.84	49.43	45.77
Distress	0.00	1.09	1.87	2.88	3.60	11.77	13.63	13.43	17.22	27.02
Modification	0.00	0.61	1.33	2.58	3.37	10.77	12.96	12.80	13.79	21.32
DSCR < 1	5.12	13.01	11.16	14.37	24.94	25.56	23.44	21.24	43.95	53.12
DSCR < 0	1.18	3.19	2.14	2.10	3.33	3.89	6.02	5.87	6.28	4.82

Panel B. Managed Deals

	Loan Origination Year									
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Delinquent	0.00	0.00	0.00	0.00	1.20	3.36	1.03	1.06	3.85	8.41
Special Servicing	0.00	0.00	0.00	0.30	0.17	1.06	0.72	0.88	4.52	8.96
Maturity Def.	.	.	.	.	.	.	.	.	28.15	.
Payment Def.	.	.	.	.	.	.	.	.	69.98	.
Distress	0.60	0.00	0.00	0.68	1.27	11.83	9.17	7.58	19.17	34.31
Modification	0.60	0.00	0.00	0.68	1.21	11.42	8.77	7.38	17.40	31.01
DSCR < 1	0.00	0.00	6.48	9.77	19.44	32.98	22.68	27.35	57.27	66.81
DSCR < 0	0.00	0.00	2.28	1.96	3.57	8.04	6.48	4.31	5.03	6.08

Table 10: Event Counts and Shares by Affiliation Group

This table reports the number and percentage of loans by event type across affiliation groups, separately for static and managed CRE CLO deals. *Limited* indicates that the deal issuer is affiliated with the collateral manager but unaffiliated with either the master or special servicer. *Partial* means the issuer is affiliated with the collateral manager and the special servicer. *Full* indicates issuer affiliation with the collateral manager and both the master and special servicer. The competing events are: *Payoff*, in which a loan is repaid in full before maturity without distress; *Buyout*, in which a loan is repaid early but flagged as distressed; *Modification*, in which a distressed loan undergoes modification of the loan terms; *Default*, in which a distressed loan is neither prepaid nor modified and defaults; *Active*, where loans are still active, representing our censored subgroup. A loan is flagged as distressed if it meets any of the following conditions: 90+ days delinquent, foreclosure, REO, borrower bankruptcy, realized losses, transfer to special servicing, servicer workout, DSCR < 1.0, debt yield < 6.0, LTV $> 100\%$, appraisal reduction event, placement on a servicer watch list, or discontinued servicer advances. Data sources: Trepp and Green Street.

	All	Static Deals			Managed Deals		
	Full Sample	Unaffiliated	Partial	Full	Unaffiliated	Partial	Full
Payoff	2,679	531	158	108	615	957	310
	33.01	27.04	48.02	26.41	27.14	51.62	23.96
Buyout	2,055	612	113	107	501	443	279
	25.32	31.16	34.35	26.16	22.11	23.89	21.56
Modification	939	153	29	24	294	231	208
	11.57	7.79	8.81	5.87	12.97	12.46	16.07
Default	1,130	411	28	67	417	58	149
	13.92	20.93	8.51	16.38	18.40	3.13	11.51
Active	1,313	257	1	103	439	165	348
	16.18	13.09	0.30	25.18	19.37	8.90	26.89
Total	8,116	1,964	329	409	2,266	1,854	1,294
	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table 11: Probability of Loan Events

This table reports subdistribution hazard ratio (SHR) estimates from Fine-Gray competing risks models predicting the likelihood of different loan outcomes in CRE CLOs, reported separately for static and managed deals. The competing events are: *Payoff*, in which a loan is repaid in full without distress; *Buyout*, in which a loan is repaid but flagged as distressed; *Modification*, in which a loan's payment terms have been modified and flagged as distressed; and *Default*, in which a loan is 90 or more days delinquent. The reference category includes active loans that have not experienced any of these events. A loan is flagged as a buyout if it meets any of these conditions when removed from the pool: 90+ days delinquent, foreclosure, REO, borrower bankruptcy, realized losses, transfer to special servicing, servicer workout, DSCR < 1.0, debt yield < 6.0, LTV $> 100\%$, appraisal reduction event, placement on servicer watch list, or discontinued servicer advances. *Ch CPPI* is the percentage change in the Green Street national commercial property price index from loan origination to time t. *HHI* is the Herfindahl-Hirschman Index scaled to between 0 and 1. t-statistics based on standard errors clustered at the loan level are shown in parentheses. Statistical significance is denoted as follows: $^{*} < 0.10$, $^{**} < 0.05$, $^{***} < 0.01$. Data sources: Trepp and Green Street.

	Static Deals				Managed Deals			
	Payoff	Buyout	Modification	Default	Payoff	Buyout	Modification	Default
Full Affiliation	1.361***	1.014	1.228	0.383***	2.772***	0.998	1.395***	0.201***
	(3.03)	(0.12)	(0.98)	(-4.61)	(14.18)	(-0.02)	(3.30)	(-10.62)
Partial Affiliation	0.946	0.807*	0.714	0.638***	1.277***	0.887	1.417***	0.799**
	(-0.44)	(-1.92)	(-1.30)	(-3.24)	(3.13)	(-1.44)	(3.44)	(-2.04)
Month 36	1.906***	1.860***	2.064	4.748***	1.381*	1.933***	1.698**	5.238***
	(2.79)	(3.20)	(1.45)	(8.74)	(1.70)	(3.75)	(2.31)	(10.76)
Month 60	3.281	0.000***	0.000***	13.221***	4.541***	3.101*	0.000***	1.351
	(1.33)	(-36.63)	(-22.81)	(2.63)	(3.11)	(1.67)	(-38.11)	(0.28)
Log(Amount)	0.902*	0.883***	1.247**	0.988	0.835***	1.038	1.099**	0.981
	(-1.93)	(-2.81)	(2.35)	(-0.22)	(-7.33)	(1.14)	(2.11)	(-0.42)
Refinance	0.879	0.916	1.335*	1.401***	0.931	1.218**	0.975	1.161
	(-1.43)	(-0.96)	(1.80)	(3.16)	(-0.94)	(2.22)	(-0.22)	(1.32)
Multifamily	0.839	1.275	2.027*	1.350	0.772***	1.455***	3.143***	1.141
	(-1.27)	(1.53)	(1.73)	(1.29)	(-3.42)	(3.14)	(4.39)	(0.75)
Hospitality	0.413***	0.683*	9.137***	1.739**	0.563***	0.689**	14.481***	0.883
	(-3.84)	(-1.76)	(5.20)	(2.01)	(-3.88)	(-1.97)	(9.02)	(-0.45)
Office	0.658***	0.886	2.213*	2.150***	0.611***	0.882	5.684***	2.535***
	(-2.90)	(-0.77)	(1.90)	(3.54)	(-4.57)	(-0.83)	(5.94)	(5.23)
Mixed Use	0.672**	1.025	2.512*	1.824**	0.642**	0.983	4.593***	2.147***
	(-2.14)	(0.13)	(1.95)	(2.28)	(-2.48)	(-0.08)	(4.07)	(3.36)
Retail	0.696**	0.742	2.632**	2.111***	0.946	0.900	7.398***	1.443
	(-2.30)	(-1.58)	(2.03)	(2.94)	(-0.38)	(-0.47)	(5.91)	(1.40)
Northeast	1.131	0.837	1.396	0.971	1.081	1.034	0.996	1.246*
	(0.88)	(-1.31)	(1.52)	(-0.20)	(0.86)	(0.31)	(-0.02)	(1.81)
Midwest	1.248*	0.915	0.943	0.896	1.171	0.890	1.852***	0.937
	(1.70)	(-0.70)	(-0.23)	(-0.69)	(1.60)	(-0.94)	(4.05)	(-0.43)
Southwest	1.354***	0.752***	0.953	0.888	1.112	1.072	1.327**	0.643***
	(2.73)	(-2.66)	(-0.21)	(-0.86)	(1.28)	(0.76)	(2.28)	(-3.41)
Southeast	1.308***	0.926	0.926	0.795*	1.329***	1.107	1.117	0.621***

Continued on next page

Table 11 (continued)

	Static Deals				Managed Deals			
	Payoff	Buyout	Modification	Default	Payoff	Buyout	Modification	Default
	(2.62)	(-0.78)	(-0.37)	(-1.77)	(3.80)	(1.16)	(0.91)	(-3.99)
LTV	0.987***	1.016***	0.991	1.006	0.997**	1.008***	0.993***	1.003
	(-3.36)	(4.39)	(-1.23)	(1.13)	(-2.13)	(4.39)	(-3.21)	(1.30)
KRBA Rated	1.917**	0.472***	1.149	1.103	2.154***	0.481***	2.151***	1.376
	(2.45)	(-4.27)	(0.39)	(0.38)	(6.34)	(-6.08)	(3.79)	(1.63)
DBRS Rated	1.834**	0.479***	0.839	1.103	1.997***	0.439***	2.313***	1.130
	(2.31)	(-4.52)	(-0.49)	(0.40)	(6.02)	(-6.91)	(4.21)	(0.70)
HHI State	0.344	0.258	4.874	7.674*	1.344	1.630	1.220	0.249**
	(-1.18)	(-1.40)	(0.88)	(1.89)	(1.09)	(1.64)	(0.35)	(-2.45)
HHI Property Type	0.854	1.028	0.828	0.583**	0.469***	0.602***	2.319***	1.395
	(-0.74)	(0.14)	(-0.46)	(-1.97)	(-6.14)	(-3.54)	(4.17)	(1.36)
Loan Spread	1.010	1.189***	0.909	0.782***	1.059**	0.975	0.723***	1.111**
	(0.16)	(3.44)	(-0.58)	(-3.17)	(2.23)	(-0.73)	(-5.62)	(2.18)
Exp Appreciation	0.990***	1.001	1.011***	1.000	0.984***	1.005***	1.009***	1.005**
	(-3.62)	(0.31)	(3.11)	(0.07)	(-6.34)	(2.75)	(3.90)	(2.31)
Total Reserves	1.009	0.993	0.998	0.997	1.002	1.005	1.014	0.978***
	(1.62)	(-1.26)	(-0.23)	(-0.40)	(0.34)	(0.77)	(1.63)	(-2.69)
Hard Lockbox	0.993	0.961	0.906	1.020	0.770**	1.276**	1.507***	0.755*
	(-0.06)	(-0.33)	(-0.45)	(0.13)	(-2.37)	(1.97)	(2.60)	(-1.93)
Soft Lockbox	1.119	0.909	0.823	0.820	0.991	1.256**	1.190	0.573***
	(1.08)	(-0.98)	(-0.99)	(-1.60)	(-0.12)	(2.47)	(1.35)	(-3.90)
% Ch CPPI	62.883***	30.948***	0.010***	0.020***	38.258***	3.188***	0.019***	0.020***
	(10.29)	(8.41)	(-4.37)	(-7.06)	(15.33)	(3.91)	(-9.75)	(-9.65)
% Ch Index Rate	0.921***	1.013	0.773***	1.191***	0.947***	0.997	1.044*	1.112***
	(-3.24)	(0.60)	(-3.97)	(6.27)	(-3.78)	(-0.18)	(1.84)	(4.57)
Op. Advisor	0.756***	1.677***	1.231	0.852				
	(-2.85)	(4.54)	(0.92)	(-1.14)				
New Loan					1.100	1.452***	0.935	0.925
					(1.34)	(4.06)	(-0.53)	(-0.54)
Observations	53,789	53,789	53,789	53,789	98,130	98,130	98,130	98,130

Table 12: Terminal Event Conditional on First Event Being Modification or Default

This table shows the distribution of terminal events conditional on the first event experienced by a loan being a modification or default. *Active* loans are still outstanding; *Payoff* loans are repaid in full without signs of distress; *Buyout* loans are repaid while in distress; *REO* indicates real-estate–owned outcomes. Data source: Trepp.

	First Event	
Terminal Event	Modification	Default
Active	442	518
	47.07	45.84
Payoff	95	141
	10.12	12.48
Buyout	395	455
	42.07	40.27
REO	7	16
	0.75	1.42
Total	939	1,130
	100.00	100.00

Appendix A. A Note on CRE CLO Affiliations

Green Street provides names of the major "deal parties" to a CRE CLO securitization. The raw names given are typically the name of the legal entity responsible for carrying out various functions. For our purposes, we need to create a table of normalized names that link affiliates for the various functions. The major deal parties in which we are interested are the ones that provide the collateral for the deal and carry out the investment and servicing functions. These four entities are the sponsors, collateral managers, master servicers, and special servicers.

Our goal is to take the raw names and normalize them for matching. Some names are straightforward; e.g., we can assume that the sponsor Annaly Commercial Real Estate Group is affiliated with the collateral manager Annaly Capital, so we normalize the two parties to Annaly Capital. From these, we were able to confirm that all sponsors were affiliated with all collateral managers.

For affiliations between sponsors and servicers, it could be more complicated, especially for mergers, name changes, and subsidiaries with different names. For this, we used Google's Gemini to ask the question of the form "Is firm X affiliated with firm Y?" From this we read the answer to determine if the firms were affiliated. If we received a negative answer or if we received an answer that did not indicate any promise of an affiliation, we assumed they were unaffiliated. In cases where the answer returned with specifics about the affiliation, we normalized the names to match. For example, we got one answer: "Fortress Investment Group LLC is the investment manager for Drawbridge Special Opportunities Fund." From this we changed the Drawbridge sponsor name to "Fortress Investment" to match it to the corresponding names of the collateral manager and special servicers. Other times we obtained information on name changes or mergers that allowed us to establish affiliations.

To keep a record of our affiliations summarized in Table 3, we kept the Notes below to document our matches for our normalized table.

Notes:

1. RAIT Financial filed for Chapter 11 bankruptcy
2. MF1 is a private lending platform and is a partnership between Berkshire and Limekin Real Estate
3. Resource American and Resource Capital underwent a name change to Exantas Capital Corp
4. Fortress Investment Group LLC is the investment manager for Drawbridge Special Opportunities Fund
5. HGI is affiliated with Harbor Group International
6. Waterfall Asset Management acts as the external manager for Ready Capital
7. Realty Finance Trust's advisor is affiliated with American Realty Capital

8. LFT CRE Ltd is affiliated with Lument
9. LCCM Trust is affiliated with Ladder Capital
10. Latitude Management Real Estate Investors is affiliated with LaSalle Debt Investors
11. Varadero Capital and Bryant Park Commercial Real Estate are affiliated
12. TPG and TRTX Ltd are affiliated
13. OREC is the CRE servicing division under ORIX
14. Granite Point Mortgage Trust (GPMT) and Pine River
15. Capital Management were affiliated from 2017 to 2020
16. Pine River Capital was the external manager of GPMT
17. Annaly Capital Management, Inc. (NLY) is the parent company of NLY Ltd
18. ACAM (which stands for Amherst Capital Management) is considered affiliated with Amherst Capital Management, as ACAM is essentially just the abbreviated name for the company
19. Värde Partners is affiliated with Trimont, as Värde Partners owns and controls Trimont through investment funds they manage; essentially, Trimont is a privately held company owned by Värde Partners
20. Exantas Capital Corp was previously affiliated with C-III Asset Management, as C-III Capital Partners, an affiliate of C-III Asset Management until 2020
21. In 2020 ACRES Capital acquired the management contract of Exantas Capital Corp, essentially making Exantas a subsidiary under ACRES Capital.
22. ACRE is considered affiliated with ACRES Capital as ACRE is typically used as a shorthand reference to Ares Commercial Real Estate
23. Argentic Real Estate Investment has contributed loans to AREIT Trust
24. Grand Avenue CRE Ltd. reports to DoubleLine Capital LP
25. Varadero Capital is affiliated with Bryant Park Commercial Real Estate (BPCRE) and Varadero Capital manages private funds that own BPCRE.

Table A1: Sponsor/Seller Frequency Table
This table reports the frequency and relative frequency of distressed loans by Sponsor/Seller Source: Green Street.

Sponsor/Seller	Frequency	Relative frequency (%)	Cum %
Arbor Realty Trust	15	7.6	7.6
MF1	14	7.1	14.6
Benefit Street Partners	12	6.1	20.7
Bridge Investment Group	12	6.1	26.8
Waterfall Asset Management	12	6.1	32.8
Prime Finance	10	5.1	37.9
Argentic	9	4.5	42.4
ACRES Capital	8	4.0	46.5
FS Investments, Rialto Capital	8	4.0	50.5
RAIT Financial	8	4.0	54.5
Exantas Capital	7	3.5	58.1
LoanCore Capital	7	3.5	61.6
Värde Partners	7	3.5	65.2
Bancorp Bank	6	3.0	68.2
Greystone	6	3.0	71.2
Shelter Growth Capital Partners	5	2.5	73.7
TPG	5	2.5	76.3
Blackstone	4	2.0	78.3
Granite Point Mortgage Trust	4	2.0	80.3
Colony Capital	3	1.5	81.8
Harbor Group International	3	1.5	83.3
KKR	3	1.5	84.8
LaSalle Debt Investors	3	1.5	86.4
Ladder Capital	3	1.5	87.9
M360 Advisors	3	1.5	89.4
BrightSpire Capital	2	1.0	90.4
DoubleLine Capital	2	1.0	91.4
Fortress Investment	2	1.0	92.4
Hunt Cos.	2	1.0	93.4
Starwood Capital	2	1.0	94.4
Varadero Capital	2	1.0	95.5
American Realty Capital	1	0.5	96.0
Amherst	1	0.5	96.5
Annaly Capital	1	0.5	97.0
CrossHarbor Capital Partners	1	0.5	97.5
H.I.G. Capital	1	0.5	98.0
Latitude Management Real Estate Investors	1	0.5	98.5
Lument	1	0.5	99.0
Marathon Asset Management	1	0.5	99.5
ORIX	1	0.5	100.0

Table A2: Primary Servicers

This table lists deal counts and total issuance amounts for the primary servicers of CRE CLOs issued between 2013 and 2024 in our sample. Names are normalized for matching purposes. Source: Green Street.

Master Servicer	Deal Counts	Total Issuance ($ Millions)
Wells Fargo	53	33,893
Situs	41	33,662
KeyBank	32	27,483
Värde Partners	17	11,300
Arbor Realty Trust	15	12,825
Greystone	10	5,364
Midland Loan Services	10	8,784
RAIT Financial	8	1,981
Berkadia	3	1,684
Northmarq Capital	3	1,200
CBRE Loan Services	2	1,940
Exantas Capital	2	1,201
Latitude Management Real Estate Investors	1	466
Lument	1	1,000
Total	198	142,783

Table A3: Special Servicers

This table lists deal counts and total issuance amounts for the special servicers of CRE CLOs issued between 2013 and 2024 in our sample. Names are normalized for matching purposes. Source: Green Street.

Special Servicer	Deal Counts	Total Issuance ($ Millions)
Situs	33	26,540
Wells Fargo	18	11,184
Arbor Realty Trust	17	13,583
Varde Partners	17	10,281
KeyBank	13	8,595
CBRE Loan Services	12	15,322
FS Investments, Rialto Capital	8	6,449
RAIT Financial	8	1,981
Benefit Street Partners	7	6,299
Cohen Financial	7	4,031
Exantas Capital	7	3,045
ACRES Capital	6	3,791
Argentic	6	4,700
Greystone	6	3,042
Midland Loan Services	5	4,177
CT Investment Management	4	4,500
LNR Partners	4	2,974
LaSalle Debt Investors	3	1,200
BrightSpire Capital	2	1,475
Colony Capital	2	1,314
CWCapital Asset Management	2	1,325
Fortress Investment	2	1,715
Hunt Cos.	2	634
MF1	2	1,940
Amherst	1	400
Latitude Management RE Investors	1	466
Lument	1	1,000
Marathon Asset Management	1	470
RED Mortgage Capital	1	350
Total	198	142,783

Table A4: CRE CLO Deal Statistics

This table reports summary statistics for our sample of 198 securitizations, for which we report vintage averages in Table 2. Statistics are weighted by securitized deal balance. Variables are winsorized at the 1% level. Data sources: Trepp and Green Street.

	Obs	Mean	SD	P10	P25	P50	P75	P90
Loans Per Deal	198	29.75	11.11	20.00	22.00	26.00	34.00	45.00
Pool Size ($ M)	198	904.74	433.40	420.02	607.51	857.33	1081.91	1500.00
Cutoff LTV	175	66.55	5.94	60.07	63.26	65.42	69.20	74.96
Effective LTV	175	60.50	6.44	53.83	56.82	59.72	63.42	68.87
AAA Spread (bps)	187	175.09	62.71	119.00	135.00	150.00	200.00	290.00
BBB- Spread (bps)	161	357.71	109.15	260.00	280.00	325.00	400.00	550.00
Managed (%)	198	61.80	48.71	0.00	0.00	100.00	100.00	100.00
Static (%)	198	38.20	48.71	0.00	0.00	0.00	100.00	100.00
State HHI	198	0.14	0.07	0.09	0.11	0.13	0.17	0.21
Asset Class HHI	198	0.59	0.29	0.26	0.34	0.46	0.90	1.00
LTV Bimodal Coeff	197	0.32	0.15	0.18	0.21	0.27	0.42	0.56
New Issuer (%)	198	25.22	43.54	0.00	0.00	0.00	100.00	100.00
AAA Sub. (%)	198	37.65	5.00	31.62	33.75	37.50	40.25	44.00
BBB– Sub. (%)	195	17.83	3.63	14.00	15.50	17.38	19.38	22.02
Master Servicer-Special-Servicer Affiliation (%)								
Full	198	17.28	37.90	0.00	0.00	0.00	0.00	100.00
Partial	198	22.56	41.90	0.00	0.00	0.00	0.00	100.00
Unaffiliated	198	60.17	49.08	0.00	0.00	100.00	100.00	100.00

Table A5: CRE CLO Loan Pool Statistics

This table reports summary statistics for the 6,128 loans included at CRE CLO securitization closing and those added during the subsequent six-month ramp-up period. These statistics reflect those in Table 4, which reports securitization vintage averages. All statistics are weighted by each loan's securitized balance. Variables are winsorized at the 1% level. Data source: Trepp.

	Obs	Mean	SD	P10	P25	P50	P75	P90
Loan Size ($ M)	6,114	27.60	22.06	6.31	11.90	22.37	38.00	54.85
Pari Passu (%)	6,128	3.86	19.27	0.00	0.00	0.00	0.00	0.00
Avg Spread (%)	5,877	3.80	0.82	2.95	3.25	3.65	4.25	4.95
Loan Purpose (%)								
Purchase	6,128	59.30	49.13	0.00	0.00	100.00	100.00	100.00
Refinance	6,128	28.43	45.11	0.00	0.00	0.00	100.00	100.00
Asset Class (%)								
Multifamily	6,128	67.24	46.94	0.00	0.00	100.00	100.00	100.00
Office	6,128	0.12	0.33	0.00	0.00	0.00	0.00	1.00
Retail	6,128	3.45	18.25	0.00	0.00	0.00	0.00	0.00
Industrial	6,128	3.87	19.30	0.00	0.00	0.00	0.00	0.00
Hospitality	6,128	5.06	21.92	0.00	0.00	0.00	0.00	0.00
Mixed-use	6,128	3.44	18.23	0.00	0.00	0.00	0.00	0.00
Other	6,128	3.15	17.47	0.00	0.00	0.00	0.00	0.00
Region (%)								
Northeast	6,128	14.06	34.77	0.00	0.00	0.00	0.00	100.00
Southeast	6,128	30.31	45.96	0.00	0.00	0.00	100.00	100.00
Southwest	6,128	24.35	42.92	0.00	0.00	0.00	0.00	100.00
Midwest	6,128	9.11	28.78	0.00	0.00	0.00	0.00	0.00
West	6,128	18.71	39.00	0.00	0.00	0.00	0.00	100.00

Table A6: CRE CLO Loan Underwriting Statistics

This table reports summary statistics for the 6,128 loans included at CRE CLO securitization closing and those added during the subsequent six-month ramp-up period. These statistics reflect those in Table 5, which reports securitization vintage averages. All statistics are weighted by each loan's securitized balance. Variables are winsorized at the 1% level. Data source: Trepp.

	Obs	Mean	SD	P10	P25	P50	P75	P90
As-Is								
LTV	6,114	65.75	13.71	52.84	60.40	66.70	72.70	78.90
DSCR (NCF)	1,953	1.05	0.78	0.08	0.61	1.14	1.52	1.88
DSCR (NOI)	1,996	1.16	0.73	0.21	0.71	1.19	1.61	1.98
Debt Yield (NCF)	2,054	6.58	15.23	0.21	2.15	4.93	7.47	13.10
Debt Yield (NOI)	2,129	7.26	15.73	0.79	2.66	5.27	8.04	13.76
Occupancy	2,134	82.84	16.98	59.00	77.00	89.00	94.92	97.00
Stabilized								
LTV	5,485	64.75	8.39	53.60	60.20	65.24	70.33	74.61
DSCR (NOI)	4,942	1.75	0.48	1.15	1.40	1.69	2.02	2.36
DSCR (NCF)	5,435	1.64	0.44	1.08	1.33	1.60	1.91	2.21
Debt Yield (NOI)	5,199	13.52	15.80	6.66	7.61	9.54	13.95	22.04
Debt Yield (NCF)	5,195	12.83	15.87	6.52	7.40	9.16	12.88	20.41
Occupancy	5,324	90.59	8.49	80.00	90.00	93.80	95.00	95.50
Lock Box (%)								
Hard	6,114	0.27	0.44	0.00	0.00	0.00	1.00	1.00
Soft	6,114	0.27	0.44	0.00	0.00	0.00	1.00	1.00
Springing	6,114	0.23	0.42	0.00	0.00	0.00	0.00	1.00
Missing	6,114	0.20	0.40	0.00	0.00	0.00	0.00	1.00
Reserves-to-Assets								
Total	6,114	2.53	5.32	0.00	0.00	0.21	2.52	7.51
TI/LC	6,114	0.31	1.31	0.00	0.00	0.00	0.00	0.33
Replacement	6,114	0.25	1.22	0.00	0.00	0.00	0.01	0.26
Other	6,114	1.82	4.13	0.00	0.00	0.00	1.55	5.59
Exp Appreciation	5,479	3.12	11.04	0.00	0.00	0.00	0.00	11.63
Exp Rent Growth	5,581	6.11	55.54	0.00	0.00	0.00	0.00	0.00
Exit Cap Rate	5,524	5.61	1.57	4.11	4.62	5.28	6.31	7.70
Implied Rate	4,758	6.82	8.16	1.31	2.89	4.88	7.94	13.45

Table A7: Probability of Loan Events — Robustness

This table replicates Table 11 under three alternative specifications. Panel A weights observations by loan outstanding balance; Panel B excludes loans contained in *Arbor Realty Trust* CLOs; Panel C restricts the sample to loans backed by multifamily properties only; Panel D drops loans with missing DSCR or DY on their first event date. Reported figures are sub-distribution hazard ratios from Fine–Gray competing-risks models for payoff, buyout, modification, and default. t-statistics based on standard errors clustered at the loan level are shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Data sources: Trepp and Green Street.

Panel A. Weighted by Loan Size

	Static Deals				Managed Deals			
	Payoff	Buyout	Modification	Default	Payoff	Buyout	Modification	Default
Full Affiliation	0.964	1.210	1.115	0.511***	2.660***	1.174	1.830***	0.194***
	(-0.28)	(1.42)	(0.43)	(-2.92)	(10.56)	(1.57)	(4.75)	(-8.84)
Partial Affiliation	0.628***	0.883	0.910	0.649***	1.066	0.867	1.256	0.920
	(-3.16)	(-0.95)	(-0.35)	(-2.68)	(0.64)	(-1.34)	(1.59)	(-0.64)
Observations	53789	53789	53789	53789	98130	98130	98130	98130

Panel B. Excluding Arbor Realty Trust Deals

	Static Deals				Managed Deals			
	Payoff	Buyout	Modification	Default	Payoff	Buyout	Modification	Default
Full Affiliation					2.483***	0.696***	0.638**	0.578***
					(9.50)	(-2.88)	(-2.05)	(-3.40)
Partial Affiliation					1.195**	0.926	1.470***	0.807**
					(2.32)	(-0.89)	(3.93)	(-1.96)
Observations					78343	78343	78343	78343

Panel C. Multifamily Loans Only

	Static Deals				Managed Deals			
	Payoff	Buyout	Modification	Default	Payoff	Buyout	Modification	Default
Full Affiliation	1.296*	1.136	0.375*	0.559*	2.540***	1.003	2.611***	0.155***
	(1.67)	(0.80)	(-1.80)	(-1.76)	(10.00)	(0.04)	(7.32)	(-9.53)
Partial Affiliation	0.764	1.029	0.650	0.507***	1.360***	0.763***	2.625***	0.754*
	(-1.52)	(0.19)	(-1.18)	(-3.05)	(2.99)	(-2.65)	(6.58)	(-1.77)
Observations	28721	28721	28721	28721	64210	64210	64210	64210

Panel D. Dropping Loans with Missing DSCR or DY

	Static Deals				Managed Deals			
	Payoff	Buyout	Modification	Default	Payoff	Buyout	Modification	Default
Full Affiliation	1.526***	1.021	1.642**	0.472***	2.583***	1.320***	1.442***	0.222***
	(2.70)	(0.17)	(2.18)	(-3.62)	(9.07)	(3.11)	(3.54)	(-9.26)
Partial Affiliation	0.880	0.647***	0.716	0.599***	1.429***	0.847*	1.515***	0.840
	(-0.74)	(-3.35)	(-1.02)	(-3.22)	(3.38)	(-1.80)	(3.94)	(-1.41)
Observations	43550	43550	43550	43550	77419	77419	77419	77419

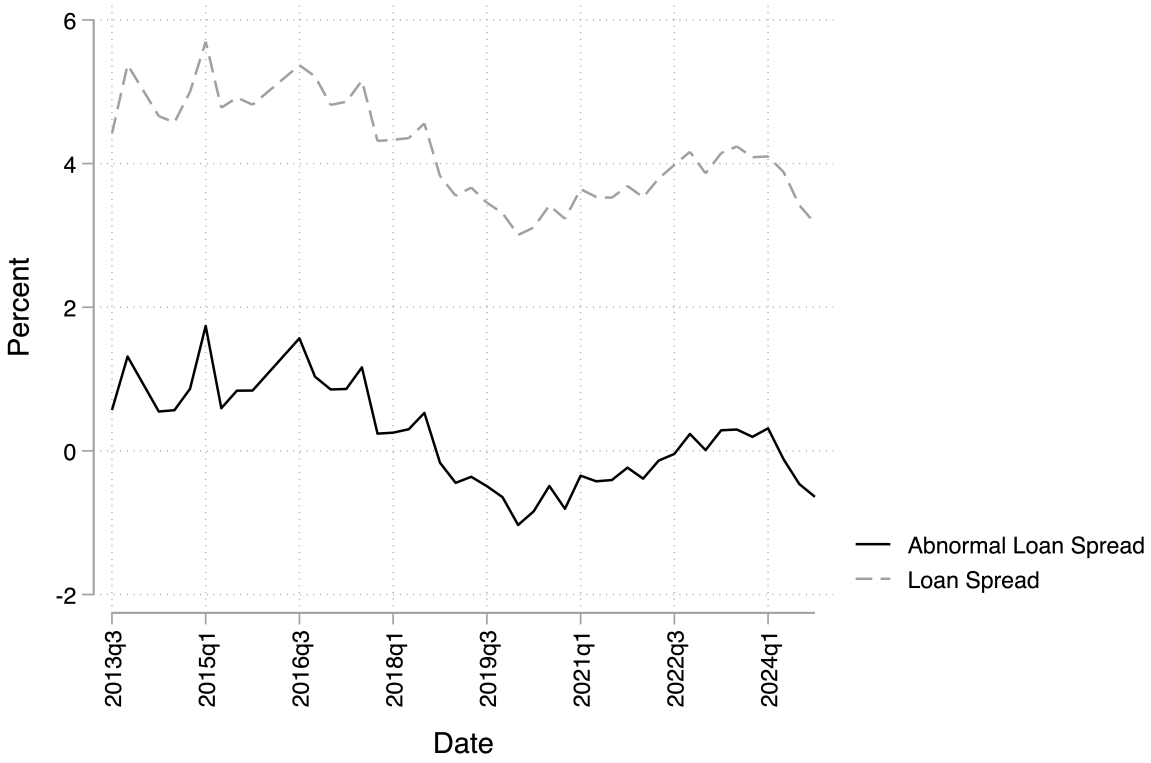


Fig. A1. **Risk-Adjusted Average Loan Spreads by Quarter.** This figure presents average loan spreads by vintage by quarter. Abnormal loan spreads are calculated as the residual from a regression of loan spreads on As-Is LTV, indicators for hard and soft lockbox, total reserves to assets, loan and property type dummies, and expected appreciation. All averages are weighted by loan amount. Data source: Trepp.

Table A8: Observable Differences and Pricing by Sponsor Affiliation
Panel A reports weighted OLS estimates of the relationship between sponsor–servicer affiliation and a set of deal-level characteristics. Each column shows a separate regression of the observable named in the column header on indicators for Partial affiliation and Full affiliation; unaffiliated deals are the omitted category. Regressions are weighted by deal balance and include securitization-year fixed effects. Additional controls include the log of the number of loans in the pool, an indicator for static pools, the weighted average securitization LTV, and the BBB- subordination percentage. Panel B repeats the exercise for loan-level observables for the original loan sample at securitization. Regressions are weighted by loan face value and include securitization-year fixed effects. Additional controls include the log of loan amount, the as-is LTV, an indicator for springing lock box, total reserves to assets, expected appreciation, expected rent growth, and exit cap rate. Panel C looks at managed deals and loans added after securitization and ramp-up. Here affiliation is interacted with the current percentage of loans in the deal that carry the bad-loan flag when the new loan is added to the pool. Additional controls include the log of loan amount, the as-is LTV, expected rent growth, and exit cap rate (other additional controls used in Panel B were dropped due to missing observations.). For all panels, t-statistics based on standard errors clustered by securitization year and are shown in parentheses. Statistical significance: $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Data sources: Trepp and Green Street.

Panel A. Deal Pricing

	AAA Spread	BBB– Spread	AAA Spread	BBB– Spread
Full affiliation	1.577	-3.504	5.077	6.234
	(0.26)	(-0.41)	(1.50)	(0.75)
Partial affiliation	15.114*	11.992	19.206	11.616
	(1.98)	(1.57)	(1.78)	(1.08)
Securitization Year FE	Yes	Yes	Yes	Yes
Add. Controls	No	No	Yes	Yes
Observations	186	161	166	144
R^2	0.65	0.55	0.66	0.60

Panel B. Observable Differences and Pricing in Original Loans

	As-is LTV	Spring. Lockbox	Total Reserves	Expected App.	Exp. Rent Gr.	Exit Cap Rate	Loan Spread	Loan Spread
Full affiliation	4.195***	0.007	0.136	−1.244*	4.891**	0.265	21.848**	23.151***
	(3.97)	(0.18)	(0.41)	(-1.92)	(2.20)	(1.29)	(2.81)	(3.63)
Partial affiliation	0.878	−0.189**	0.439*	−0.318	1.022	0.247	16.659*	13.441*
	(1.22)	(-2.80)	(1.85)	(-0.33)	(0.42)	(1.13)	(2.05)	(2.12)
Securitization Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Add. Controls	No	No	No	No	No	No	No	Yes
Observations	6114	6114	6114	5479	5581	5524	5872	5072
R^2	0.04	0.07	0.02	0.07	0.01	0.18	0.26	0.40

Panel C. Observable Differences and Pricing in New Loans

	As-is LTV	Exp. Rent Gr.	Exit Cap Rate	Loan Spread	Loan Spread
% Bad Loans	14.845*	31.059	−0.075	22.577	40.719
	(2.00)	(0.56)	(-0.04)	(0.63)	(0.91)
Full affiliation	22.216	3.565	1.596*	65.038	42.074
	(1.51)	(0.06)	(2.03)	(1.75)	(0.71)
Full affil.×% Bad	10.674	99.367*	−0.268	−57.660	−53.738
	(0.51)	(2.13)	(-0.17)	(-1.03)	(-0.62)
Partial affiliation	32.156***	−11.976	0.362	5.375	−43.947
	(5.31)	(-0.26)	(0.53)	(0.15)	(-1.44)
Partial affil.×% Bad	−26.654*	−36.380	0.407	13.071	38.085
	(-2.08)	(-0.91)	(0.26)	(0.17)	(1.33)
Observations	1952	629	643	1917	595
R^2	0.23	0.04	0.13	0.09	0.13

Table A9: Probability of Loan Events Conditional on Past Deal Performance
This table re-estimates the Fine-Gray competing risks models presented in Table 11 with modifications. Here we restrict the sample to only managed deals and interact our affiliation dummies with a dummy that takes on a value of 1 when the percentage of loans with a bad loan flag within a deal exceeds the sample average of 31% bad loans (**1**[Bad Loans]). t-statistics based on standard errors clustered at the loan level are shown in parentheses. Statistical significance is denoted as follows: $^{*} < 0.10$, $^{**} < 0.05$, $^{***} < 0.01$. Data sources: Trepp and Green Street.

	Managed Deals			
	Payoff	Buyout	Modification	Default
Full Affiliation	2.314***	0.548**	0.425	0.625
	(11.23)	(-2.01)	(-1.57)	(-1.33)
Full Aff. ×**1**[Bad Loans]	0.490***	3.163***	3.820**	0.342***
	(-9.69)	(3.72)	(2.45)	(-2.70)
Partial Affiliation	1.453***	0.933	0.561	1.013
	(4.92)	(-0.20)	(-1.28)	(0.03)
Part Aff. ×**1**[Bad Loans]	0.763***	1.067	2.785**	0.782
	(-3.15)	(0.19)	(2.23)	(-0.62)
1[Bad Loans]	0.000***	27.105***	16.909***	16.370***
	(-473.81)	(16.59)	(13.85)	(14.05)
Observations	98130	98130	98130	98130

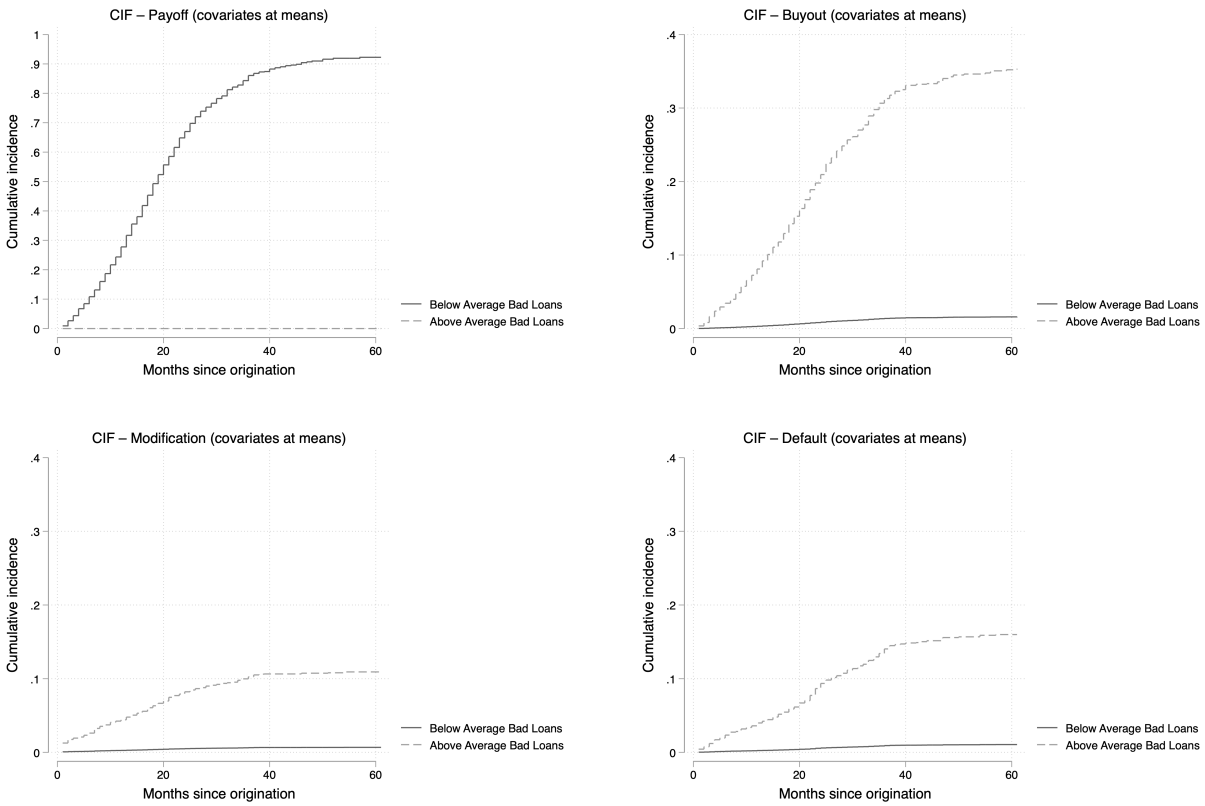


Fig. A2. **Managed Deal Cumulative Incidence Functions by Affiliation and Past Deal Performance.** This figure presents cumulative incidence functions (CIFs) for loans in managed deals, conditional on full affiliation between the sponsor/collateral managers and both their master and special servicers, conditional on deals having above or below the median percentages of bad loans. CIFs are derived from estimates in Table A9. Data source: Trepp.

Table A10: Probability of Loan Events This table reports estimates from a probit model matching the general specification of Table 11. The dependent variable equals one if a loan experiences the event as its first event and is zero otherwise. Variables are measured at securitization. Coefficients report marginal effects. Standard errors are clustered at the loan level. Statistical significance is denoted as follows: * < 0.10, ** < 0.05, *** < 0.01. Data sources: Trepp and Green Street.

	Static Deals				Managed Deals			
	Payoff	Buyout	Modification	Default	Payoff	Buyout	Modification	Default
Full Affiliation	0.107***	0.022	0.012	-0.134***	0.212***	0.010	0.035***	-0.141***
	(0.026)	(0.029)	(0.015)	(0.029)	(0.015)	(0.016)	(0.012)	(0.013)
Partial Affiliation	-0.006	-0.053**	-0.013	-0.067***	0.026	-0.043***	0.037***	-0.027**
	(0.024)	(0.026)	(0.016)	(0.022)	(0.016)	(0.016)	(0.012)	(0.011)
Log(Amount)	-0.023**	-0.028***	0.013**	-0.013	-0.046***	0.004	0.011**	-0.003
	(0.010)	(0.010)	(0.006)	(0.009)	(0.006)	(0.006)	(0.005)	(0.004)
Refinance	-0.048**	-0.031	0.018	0.051***	-0.039**	0.019	-0.007	0.005
	(0.019)	(0.021)	(0.011)	(0.017)	(0.017)	(0.017)	(0.013)	(0.012)
Multifamily	-0.044	0.075**	0.052**	0.066*	-0.086***	0.060***	0.097***	0.003
	(0.032)	(0.036)	(0.025)	(0.034)	(0.019)	(0.021)	(0.023)	(0.016)
Hospitality	-0.172***	-0.020	0.153***	0.130***	-0.141***	-0.066*	0.287***	-0.010
	(0.047)	(0.049)	(0.026)	(0.042)	(0.032)	(0.034)	(0.029)	(0.025)
Office	-0.073**	0.017	0.069***	0.157***	-0.152***	-0.028	0.170***	0.097***
	(0.034)	(0.037)	(0.025)	(0.032)	(0.025)	(0.027)	(0.027)	(0.018)
Mixed Use	-0.090**	0.054	0.072**	0.125***	-0.118***	-0.015	0.149***	0.077***
	(0.043)	(0.047)	(0.029)	(0.041)	(0.040)	(0.039)	(0.037)	(0.024)
Retail	-0.067*	-0.031	0.067**	0.153***	-0.052	-0.028	0.198***	0.027
	(0.040)	(0.045)	(0.029)	(0.039)	(0.035)	(0.040)	(0.034)	(0.025)
Northeast	0.022	-0.046	0.017	-0.007	-0.020	-0.002	-0.000	0.023*
	(0.029)	(0.031)	(0.016)	(0.024)	(0.020)	(0.020)	(0.017)	(0.013)
Midwest	0.055*	-0.016	-0.009	-0.000	-0.002	-0.028	0.074***	-0.003
	(0.029)	(0.031)	(0.018)	(0.026)	(0.023)	(0.023)	(0.018)	(0.016)
Southwest	0.069***	-0.063**	-0.011	-0.018	-0.020	0.009	0.032**	-0.043***
	(0.024)	(0.026)	(0.015)	(0.022)	(0.018)	(0.018)	(0.014)	(0.013)
Southeast	0.065***	-0.022	-0.009	-0.027	0.033**	0.009	0.012	-0.050***
	(0.023)	(0.024)	(0.014)	(0.020)	(0.017)	(0.017)	(0.014)	(0.012)
LTV	-0.002***	0.005***	-0.001	0.001	0.000	0.002***	-0.001***	0.000*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
KRBA Rated	0.192***	-0.064	0.020	0.067*	0.189***	-0.072***	0.135***	0.078***
	(0.046)	(0.039)	(0.023)	(0.035)	(0.026)	(0.024)	(0.023)	(0.020)
DBRS Rated	0.198***	-0.051	0.010	0.079**	0.190***	-0.089***	0.138***	0.057***
	(0.045)	(0.038)	(0.022)	(0.034)	(0.025)	(0.022)	(0.022)	(0.018)
HHI State	-0.335	-0.232	0.020	0.398**	0.051	0.106	0.015	-0.159***
	(0.208)	(0.229)	(0.118)	(0.177)	(0.071)	(0.072)	(0.064)	(0.058)
HHI Property Type	-0.040	-0.022	-0.032	-0.097**	-0.220***	-0.158***	0.075***	0.011
	(0.045)	(0.048)	(0.028)	(0.041)	(0.026)	(0.026)	(0.022)	(0.022)
Loan Spread	0.003	0.037***	-0.013	-0.046***	0.016**	-0.011	-0.037***	0.007
	(0.012)	(0.013)	(0.009)	(0.011)	(0.007)	(0.007)	(0.007)	(0.005)
Exp Appreciation	-0.003***	-0.000	0.001***	-0.000	-0.004***	0.001**	0.001***	0.000*
	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
Total Reserves	0.002*	-0.002	-0.000	-0.001	0.000	0.001	0.002	-0.002**

Continued on next page

Table A10 (continued)

	Static Deals				Managed Deals			
	Payoff	Buyout	Modification	Default	Payoff	Buyout	Modification	Default
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Hard Lockbox	-0.006	-0.011	-0.009	0.003	-0.046**	0.040*	0.050***	-0.031**
	(0.026)	(0.028)	(0.015)	(0.025)	(0.023)	(0.023)	(0.018)	(0.015)
Soft Lockbox	0.008	-0.036	-0.020	-0.040**	0.023	0.041**	0.018	-0.056***
	(0.022)	(0.023)	(0.013)	(0.019)	(0.018)	(0.018)	(0.015)	(0.014)
% Ch CPPI	0.853***	0.865***	-0.366***	-0.565***	0.923***	0.312***	-0.346***	-0.328***
	(0.088)	(0.097)	(0.062)	(0.083)	(0.052)	(0.055)	(0.046)	(0.040)
% Ch Index Rate	-0.014***	0.003	-0.017***	0.029***	-0.006**	0.002	0.005**	0.012***
	(0.005)	(0.005)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.002)
Op. Advisor	-0.086***	0.103***	-0.013	-0.031				
	(0.024)	(0.028)	(0.016)	(0.022)				
New Loan					-0.033*	0.042**	-0.021	-0.016
					(0.018)	(0.018)	(0.014)	(0.014)
Observations	2692	2689	2689	2692	5399	5399	5399	5399

Table A11: CRE CLO Ratings Actions, March 2020–August 29, 2025
This table summarizes all rating actions on active CRE CLO deals recorded by rating agencies between March 2020 and August 29, 2025. Bonds are identified by original rating. Source: Bank of America Report CMBS Commentary.

Original Rating	N	Upgraded	Affirmed	Downgraded	Watch
AAA	271	0	271	0	0
AA	144	34	107	0	3
A	142	34	105	0	3
BBB	272	41	216	4	11
BB	187	20	124	10	33
B	154	8	106	16	24
Totals	1,170	137	929	30	74
% Totals		11.7	79.4	2.6	6.3